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Human Resource Management Practices and Wage Dispersion in U.S. Establishments

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Abstract

This paper explores the relationship between the presence of employee involvement workplace practices and wage dispersion within firms. Using the representative sample of US establishments from the National Employer Survey conducted in 1994 and 1997, the paper explores the links between employee involvement workplace practices adoption and intensity of use (measured by the percentage of a firm's workers who operate under a given practice) and wage inequality within companies using OLS as well as quantile regressions.

The results suggest that adoption of employee involvement workplace practices is associated with greater wage dispersion. Compared to establishments not using any of the involvement practices, firms that adopt a partial system or full system of practices, including regular problem-solving meetings and/or self-managed team and/or job rotation, have significantly greater wage dispersion. On the other hand, firms that complement the practices with training for production workers (on teamwork or problem-solving meetings) have lower dispersion than those who do not complement with training. The results based on employee involvement intensity of use show evidence of compression effects associated with self-managed teamwork in the manufacturing sector at the 25th percentile or for low wage dispersion firms. There is also evidence of wage compression effects associated with problem-solving meetings in the non manufacturing sector for high wage dispersion firms.

1 Introduction

Starting in the 1980s, there has been an increasing interest in the use of what have commonly been called "innovative" or "high- performance" workplace practices in the United States. The interest grew mainly after observing the success of Japanese firms using management practices such as Total Quality Management (TQM), self-managed teams and job rotation. With the recent availability of plant-level data on human resources and workplace organization practices, researchers have found evidence that these practices deserve their label "high-performance" in that they appear to increase firm performance. [1]

Although improvement in firm productivity has been the main focus of analysis, a related aspect concerns the effect of these workplace practices on wage outcomes. In particular, practices such as problem-solving meetings, self-managed teamwork or job rotation, which are aimed at increasing employee involvement in the firm's production and business objectives, have significant effects on the responsibilities of workers at the lower end of the firm's job ladder. This leads to the following somewhat overlooked questions: What is the relationship between employee involvement workplace practices and within-firm wage dispersion? Is wage dispersion affected by adoption of such practices? Does the intensity with which the practices are used (measured by the firm's percentage of workers under the given practice) affect wage dispersion?

This paper explores the relationship between employee involvement workplace practice adoption and wage dispersion within firms using data from the National Employer Survey (NES), which consists of two nationally representative samples of U.S. private establishments interviewed in 1993 and 1996. I analyze the impact of adopting these employee involvement workplace practices on the ratio of average wages of managerial workers to those of production workers. I also examine the robustness of this relationship to alternate definitions of adoption. Importantly, following recent theoretical and empirical work emphasizing the importance of complementarities between practices, I allow for different effects on wages in firms that implement a system involving several of these practices relative to firms which adopt individual practices. Finally, the effect of employee involvement practices on wage dispersion may differ for firms above or below average wage dispersion. I employ quantile regressions to examine the impact of employee involvement workplace practice adoption at different percentiles of the distribution of within firms wage dispersion.

A relationship between the implementation of employee involvement workplace practices and wage dispersion can be motivated theoretically from two perspectives: a productivity perspective and an incentives perspective. According to the productivity approach, workplace practices can be associated with either lower or greater wage dispersion. Greater decentralization in decision making increases

[1] For a review of the empirical literature on human resources workplace practices and their effect on firm performance, see Ichniowski, Kochan, Levine, Olson and Strauss (1996).

the demand for skilled workers (Breshnahan, Brynjolfsson and Hitt (2002)) requiring workers at the bottom to be more productive and therefore causing their wages to rise. At the same time, changes in work organization may also increase the productivity requirements of managerial jobs and therefore managerial wages. The paper employs a production function framework incorporating aspects of both of these approaches to derive an estimating equation. According to the incentive approach, firms whose goal is to maximize the effectiveness of workers cooperation and cohesiveness may do so by reducing the dispersion of wages within the company (Lazear (1989), Levine (1991)). As a result, workplace practices that increase the degree of employee involvement in the firm's production and business strategies should be associated with lower wage dispersion.

Despite both a vast empirical literature studying employee involvement practices in the workplace and the theoretical work discussed above, very few studies have focused on the effect of these practices on wage outcomes. Helper, Levine and Bendoly (2002) investigate the effect of employee involvement on pay in the auto-supply industry in Canada and the US. They find evidence that the practices raise the wages of blue-collar workers by 3-5%. Black and Lynch (2000) and Cappelli and Carter (2000) analyze the effect of workplace organization practices on wage outcomes using a nationally representative sample of US firms. More precisely, they look at the impact of various workplace practices on wages for different categories of workers within the firm (managers, supervisors, clerical workers, technicians and production workers). They find that the practices have different impact on the wages of each type of workers. Using the same data, Black, Lynch and Kryvelyova (2003) analyze the effect of workplace practices on worker outcomes in terms of wages and employment. Their analysis confirm the results on wage outcomes found in their previous study. They also include an analysis of the workplace practices on wage inequality using the ratio of non production to production workers as a measure of wage dispersion. Given that wage inequality is not the main focus of their paper, they do not examine issues of wage dispersion in great depth.

The analysis in this paper uses data from the National Employer Survey (NES).[2] This survey consists of two nationally representative samples of U.S. private establishments interviewed in 1993 and 1996. The surveys constitute a unique source of information for the analysis hereafter in that they provide detailed information on employers' human resource management practices such as recruitment strategies, organization of the workplace and training provision and on average characteristics of its workforce (where the information is available) for the different categories of workers (managers, supervisors, clerical workers, technicians and production or front-line workers). In addition, they report information on a company's equipment and technology characteristics.[3]

[2]The data are the same data used in Black and Lynch (2000), Cappelli and Carter (2000), and Black, Lynch and Kryvelyova (2003).

[3]See Cappelli (2001) for a detailed description of the design and variables provided in the two surveys.

This paper focuses on a number of issues which have been de-emphasized and neglected in previous studies using the NES data. First, the impact of workplace organization practices on wage outcomes is assessed using the average wage ratio of managers and production workers rather than performing individual analysis of workers' wages separately for each category of workers. Apart from providing information on wage dispersion, the use of a wage ratio helps control for unmeasured (by the econometrician) firm-specific wage effects that may bias cross-section estimations when wage equations are estimated separately for each category of workers. This firm-effect drops out from the wage ratio.

Second, the paper uses different approaches to measure the effect of employee involvement workplace practices on wage dispersion. There may be variations in wage dispersion across establishments between workplace practices adopters and non adopters. I therefore analyze the effects of workplace practices adoption, where firms are counted as adopters if a given proportion of their workers operate under a given workplace practice. Wage dispersion may also be affected by the intensity with which the practices are used. In this case, wage dispersion is a function of the fraction of workers covered by a given workplace practice.

Third, the paper analyzes the effect of workplace organization practices on within firm wage dispersion at the mean as well as at different percentiles of the distribution of wage dispersion across establishments. This approach allows for differential effects of the workplace practices on wage dispersion for higher and lower wage dispersion firms. To do so, I employ quantile regressions of the wage ratio on employee involvement workplace practices.

Finally, the practices are not only analyzed individually but also as combinations or systems of practices. Theoretical work by Holmstrom and Milgrom (1994) and Milgrom and Roberts (1995)emphasize the importance of analyzing a firm's organizational decisions as part of a *system* of human resource management policies. Productivity gains are obtained from exploiting complementarities in practices and changes in only one practice bring little benefit to a firm's performance. For example, Milgrom and Roberts (1995) show that teamwork will be more effective in combination with job flexibility, training and communication. This is confirmed by empirical studies showing evidence of the importance of bundles of practices (Arthur (1992), MacDuffie (1995), Ichniowski, Shaw and Prenushi (1997)).

The paper is organized as follows. Section 2 presents the analytical framework summarizing the relationship between wage dispersion and workplace organization from the different perspectives of wage determination. Section 3 describes the data. Starting with the variables common to the two surveys, measures of workplace practices are analyzed as workers' percentage and as dummy variables. Section 4 is divided into two part. The first part describes the results of the analysis based on employee involvement practices adoption. The second part presents the results of OLS and quantile estimations of the effect of workplace practices on the manager-production workers wage ratio in terms employee

involvement practices intensity. Section 5 concludes.

2 Framework of Analysis

A relationship between workplace organization practices and wage dispersion can be motivated using two different perspectives of wage determination: incentives or productivity. Both approaches provide a rationale as to why there might be a link between workplace organization practices and within firm wage dispersion. This section is divided into two parts. The first part describes the ways in which each approach motivates the link between workplace organization practices and wage dispersion. The second part presents an empirical framework, consistent with either of these two approaches, that will serve as a basis for the estimation part and the interpretation of the results.

2.1 Analytical Framework

According to the productivity approach, employee involvement workplace practices enhance worker productivity. As a result, workers' wages may be positively correlated with these practices. Moreover, in the same spirit as in Breshnahan, Brynjolfsson and Hitt (1999), workplace organization practices constitute an innovation that is complementary to product innovation and IT investments. These factors taken together would explain the skill-biased technical changes that operated to increase the relative demand for skilled workers in the 80's. The authors find evidence of complementarity between workplace practices adoption, investment in IT and workers skills. Wage dispersion within and across establishments may have been affected by the adoption of new workplace organization practices.

The approach based on incentives or worker motivation and its implications for the relationship between workplace organization and wage dispersion borrows from different literatures. On the one hand, research in organizational psychology provides a broad literature on the role of pay equity as a factor affecting employee motivation (Vroom (1964) , Lawler (1971)). An implication of this relationship would be that for the implementation of the practices to be effective in increasing firm performance, wage compression may be a necessary tool to increase worker motivation. Economists have also provided a rationale for the importance of social relations in the workplace and the use of pay compression to maximize firm performance (Milgrom and Roberts (1988) and Lazear (1989)). Both analysis show that inducing too much competition in the workplace may lead to output-reducing behavior such as influence-seeking activity or sabotage of a co-worker's productivity, for the purpose of obtaining a career advantage. With a high amount of interdependence among co-workers, the loss of productivity resulting from such behaviors can be minimized by reducing wage differentials. Levine (1991) further develops the analysis of the links between workplace organization and wage dispersion by providing a model in

which firms, seeking to increase group cohesiveness, may find it profitable to do so by paying efficiency wages to the low end of the firm's wage distribution therefore reducing wage dispersion.

Each approach predicts different outcomes for the relationship between workplace practices and wage dispersion. The cohesiveness or motivational approach predicts that workplace practices toward more employee involvement should be associated with wage compression. The productivity or skill-biased technical change approach can predict either lower or greater wage dispersion. One expects that an increase in the demand for skilled workers following adoption of the practices leads to greater demands in the task requirements for production workers and therefore greater wages. On the other hand, it also leads to greater demands on the managerial part and therefore greater compensation for managers than for production workers. Overall, whether workplace organization practices are associated with greater or lower wage dispersion is an empirical question.

Evidence of increased wage dispersion following adoption of employee involvement practices would favor the productivity hypothesis and the idea that managers' productivity is increased by more than production workers' productivity by the practices. Evidence of wage compression may favor either the motivational hypothesis or the productivity hypothesis if employee involvement practices increase front-line workers' productivity more than managers' productivity.

Note that wage dispersion, as a prediction of the productivity hypothesis, can also be motivated based on productivity loss rather than productivity gains associated with workplace practices adoption. Indeed, it is likely that, shortly after adoption, productivity falls as changes in the organization of the workplace involve adjustment costs. Those costs may be greater for production workers leading to lower productivity and wages and therefore greater wage dispersion. To distinguish the two possibilities one needs information on the timing of adoption and whether complementary training was adopted. Information on training is available in the data and will be exploited in the estimation part.

2.2 Empirical Framework

According to the productivity hypothesis, wages reflect the value of workers' marginal productivity. The idea that workplace practices adoption follows from on-going skill-biased technical changes can be represented in a production function framework as follows.

Assume a competitive economic environment in which firms' production function depends on capital and equipment, summarized in the variable K, and on two types of labor inputs, managerial L_M and production L_F. It is assumed that workplace organization practices (summarized in the index P) affect production through their impact on labor efficiency units. Define $\theta_M(P)$ and $\theta_F(P)$ as the amount of efficiency units associated with each type of labor. With Y as the aggregate output produced, the production function can be defined as:

$$Y = F(K, \theta_M(P)L_M, \theta_F(P)L_F)$$

Firms are profit maximizers and given wage levels w_M and w_F for managers and front-line workers respectively, the first order conditions defining the optimal choice of labor inputs provide the equality condition between wages and marginal productivities for each category of workers as follows:

$$\frac{\partial Y}{\partial L_M} = w_M \quad (1)$$

$$\frac{\partial Y}{\partial L_F} = w_F \quad (2)$$

Assuming a Cobb Douglas production function with constant returns to scale [4], the production function is given by:

$$F(K, \theta_M(P)L_M, \theta_F(P)L_F) = K^{\alpha}(\theta_M(P)L_M)^{\beta_M}(\theta_F(P)L_F)^{\beta_F}$$

The system of first order condition (3) becomes:

$$\frac{\beta_M}{\theta_M(P)L_M}F(K, \theta_M(P)L_M, \theta_F(P)L_F) = w_M \quad (3)$$

$$\frac{\beta_F}{\theta_F(P)L_F}F(K, \theta_M(P)L_M, \theta_F(P)L_F) = w_F \quad (4)$$

The wage ratio between manager and front-line workers is therefore given by the following equation:

$$\frac{w_M}{w_F} = \frac{\beta_M\ \theta_F(P)L_F}{\beta_F\ \theta_M(P)L_M} \quad (5)$$

Taking the log of both sides of this equation provides the empirical equation to be estimated:

$$log(\frac{w_M}{w_F}) = log(\frac{\beta_M}{\beta_F}) + log(\frac{L_F}{L_M}) + log(\frac{\theta_F(P)}{\theta_M(P)}) \quad (6)$$

Following the literature on skill-biased technological change, it is assumed that the invention associated with workplace practices toward more employee involvement represents a discrete and exogenous change in technological opportunities. Some firms have adopted the new workplace practices ($P > 0$, $\theta(P) > 1$) while others haven't ($P = 0$, $\theta(0) = 1$).

The last term of equation (6) represents the effect of the use of workplace practices on wage dispersion. The identification of this term will be based on the following reasoning. Among firms not implementing the practices, the term vanishes because $\theta_M(0) = \theta_F(0) = 1$. The term will be non

[4] The use of a Cobb Douglas production function follows the empirical literature on the effect of workplace practices on firm performance. In particular, Black and Lynch (1997) tested the hypothesis of constant returns to scale based on the NES data and could not reject it.

zero whenever $\theta_M(P) \neq \theta_F(P)$ for firms adopters. This term can have a positive or negative impact depending upon whether workplace practices increases managerial workers' productivity more or less than production workers.

Now consider the cohesiveness hypothesis proposed in Levine (1991), whereby production depends upon worker cohesiveness $C(.)$ which is a function of the firm's wage dispersion:

$$Y = C(w_F/w_M)F(K, L_M, L_F)$$

where C is such that $C' > 0$ and $C'' < 0$. Given these assumptions, the first-order condition for an interior solution for the firm is to set the elasticity of the cohesiveness function C with respect to wage equal to the elasticity of F with respect to labor.

$$\frac{\delta C}{\delta w}\frac{w}{C} = \frac{\delta F}{\delta L}\frac{L}{F} \tag{7}$$

Although the main derivations of the model are carried out under the assumption that the demand for higher skilled workers is fixed, the condition above is valid for both types of labor. Using this condition and the Cobb-Douglas type of production function described above allows one to derive a wage ratio condition:

$$\frac{w_M}{w_F} = \frac{\beta_M}{\beta_F}\frac{C_{w_F}}{C_{w_M}} \tag{8}$$

Where C_{w_F} and C_{w_M} are the derivatives of the cohesiveness function with respect to wages for production workers and managers respectively. This condition can be tested if the ratio of marginal cohesiveness with respect to wages is assumed constant. Assume for example that $C(w_F, w_M) = e^{w_F - w_M}$ and $w_F = \lambda\, w_M$. This function is positive and increasing in w_F and in w_F/w_M. The parameter λ describing the degree of wage compression is such that $0 < \lambda \leq 1$. Cohesiveness increases with λ while the ratio $\frac{C_{w_F}}{C_{w_M}}$, equal to $1/\lambda$, decreases with λ.

One can introduce the role of workplace practices in the firm's decision to reduce wage dispersion by assuming that workplace practices toward greater employee involvement affect cohesiveness through the parameter θ. Assume P is an index of workplace organization practices, then $\lambda(P)$ is such that $\lambda(P) > \lambda(0)$ or in other words, that wage compression is greater among workplace practices adopters.

$$log(\frac{w_M}{w_F}) = log(\frac{\beta_M}{\beta_F}) + log(\frac{1}{\lambda(P)}) \tag{9}$$

The two perspectives of the relationship between workplace organization and wage dispersion described in equations (6) and (9) can be estimated using the following equation:

$$log(\frac{w_M}{w_F}) = \alpha + \beta log(\frac{L_F}{L_M}) + \gamma P + \epsilon \tag{10}$$

Where ϵ is an i.i.d. random noise satisfying the classical properties of a white noise. If workplace practices are associated with greater (lower) wage dispersion the estimated γ will be positive or (negative).

In order to better approximate L_F and L_M, variables related to average worker characteristics for managers and production workers will be added to capture differences in worker quality. Firm characteristics such as size, industry and its proportion of unionized workers will be included as controls for differences in companies usually observed in the empirical literature to affect wage outcomes and wage dispersion. The value of capital and equipment are also added as controls, for the same reasons.

3 The Data

This section introduces the dataset used in this paper and discusses issues such as choice of variables related to workplace practices and measurement method for the analysis. Section 3.1 describes the two surveys used for the analysis. Section 3.2 summarizes the different workplace organization and employee involvement variables and discusses measurement issues in analyzing the effect of adoption of the practices (intensity of adoption versus adoption against non adoption). Since the data come from establishment-level surveys, information on workers is limited. Section 3.3 discusses this point.

3.1 The NES Surveys

The data come from the National Employer Survey (NES), an establishment-level survey of employment practices conducted by the Bureau of the Census for the National Center on Education Quality of the Workforce (EQW). The survey was first administered in 1994 to a nationally representative sample of private establishments with more than 20 employees. It was repeated again in 1997 using the same sampling frame as in 1994, based on the Bureau of the Census SSEL file. Public sector employers, not-for-profit institutions and corporate headquarters were excluded from the sample. The questions apply to firm outcomes during the year preceding the survey year.

These surveys provide detailed information on employers human resource management practices such as recruitment strategies, organization of the workplace and training investments. They also report information on a company's equipment and technology and on the average characteristics of its workforce. The workforce information is available for different categories of workers: managers, supervisors, clerks, technicians and production or front-line workers.

The questionnaires for the two surveys are not identical. The NES 1993 has a detailed section related to training investments and whereas NES 1996 has additional questions about school-to-work transition and community involvement. On the other hand, there is a common set of core questions on

firms and workers characteristics as well as on the organization of the workplace. In particular, there is information on the value of the firm's capital stock, the age of its equipment, the amount spent on new equipment during the current year, labor and other costs, the establishment's industry and size and whether the establishment is part of a multi-establishment company.

The information on workforce characteristics include the percentage of workers in different categories (front-line workers, clerical workers, technicians, supervisors, and managers), the average education for each of the category, the proportion of women and minorities, the percentage of workers hired during the current year and whether the employees are represented by a union or covered by collective bargaining agreements.

Information on wages comes from a question on the average pay for each category of full-time workers in the establishment and is reported in one of the following ways: hourly, weekly, monthly or annual. I use hourly wages and since average hours per week for each type of workers are asked in a subsequent question, I compute average hourly pay for each case where pay were not reported on an hourly basis. Note that in the NES 1993, average weekly hours worked are not asked about for managers. Since the NES questions only concern full-time workers, I computed hourly pay for managers based on a 40 hours week of work. [5]

Questions related to the organization of the workplace are identical in the two surveys with only one exception. The NES 1993 asked whether the establishment has adopted a Total Quality Management program, but this question is not asked in the NES 1996. In place, it is asked whether the establishment has undergone re-engineering. Since TQM can be viewed as a form of re-engineering of the workplace, both questions provide similar information and will be considered in the analysis hereafter. The final samples, with non missing observations on all variables, contain information for 816 establishments in 1993 and 765 in 1996.

3.2 Workplace Organization and Employee Involvement Practices

The NES contains detailed information on the practices related to the level of employee involvement, workplace organization, and the use of stock option or profit sharing. This section presents summary statistics for these variables (table 1) and analyzes the question of adoption versus intensity of use of employee involvement practices (table 2).

Table 1 presents the means of the different variables on workplace practices for the year 1993 and 1996. Considering first the year 1993 for all sectors (first column), one can see that among the three practices related to employee involvement, job-related meetings is the practice that applied the most

[5] Note also that for for workers reporting annual pay, I computed hourly pay dividing by weekly hours times 51 weeks of work per year.

intensively in establishments with, on average over all establishments, 52.3 % of the non-managerial and non-supervisory workers under this practice. Job rotation and self-directed teamwork, when adopted by firms, is used on average by 12.1% and 13.7% of the workforce respectively.

Comparing these results with the year 1996 for all sectors (column 4), one can see an increase in the percentage of non-managerial and non- supervisory workers using each of the three involvement practices. Looking at the practices by manufacturing and non manufacturing sectors, one observes that a greater proportion of workers are engaged in job rotation in manufacturing establishments whereas for non manufacturing businesses, meetings and teamwork are more common. The workers percentage has increased between 1993 and 1996 in both sectors for all three practices.

Among the variables describing the organization of the workplace, the number of management levels and the number of workers per supervisor in the company reflect the degree of hierarchy and levels of authority in the organization. Over all sectors these two measures decreased between 1993 and 1996, suggesting a change in the type of internal organization of the establishments during the two years.

The variables regarding the use of benchmarking, TQM or re- engineering do not change much during the two years. The most striking feature from the table is that the proportion investing in training for working in teams has almost doubled between the two years. At the same time, the proportion of establishments using profit sharing or stock option as part of the compensation system declined by almost half.

It is interesting to see that very few establishments use all of the preceding practices all together (3% in 1993 and 2% in 1996) but at the same time, very few companies do not use any of them (2% in 1993 and 1% in 1996).

Table 2 describes the preceding workplace and organization practices but this time, showing the frequencies rather than analyzing the intensity of use. I built two types of dummy variables shown in the two columns of the table for each year: one to indicate that the establishment uses at least the given practice and the other to indicate that the given practice is the only practice used by the establishment.

Looking at the column "At least", one can clearly see that meetings is the practice adopted by the majority of firms (86% in 1993 and 84% in 1996). Moreover, although teamwork and job rotation are not used by a large percentage of workers, between 40 and 50% of the establishments use them. From the column "Only", the very low percentages demonstrate that the practices tend to be used as bundles rather than individually.

Overall comparing 1993 and 1996, tables 1 and 2 reflect the findings from previous studies using the NES data as well as similar cross-industry data on workplace practices (Osterman (2000)): according to table 2, there has been an increase in the adoption of individual practices but the proportion of firms adopting the full set of practices (employee involvement as well as other workplace practices and pay

related practices) remains fairly small (4% from table 1).

Given the previous results, I selected the three employee involvement practices mainly used and computed a set of dummy variables describing the eight possible combinations of one, two and three of the practices including non adoption. The bottom half of table 2 shows the frequencies for the different possible bundles. One can see that for some of the bundles like teamwork only (T) or teamwork and job rotation (TJ) the frequencies are very low especially when the sample is divided into manufacturing and non manufacturing. Given that the analysis hereafter will use each sample separately, a broader definition of bundles will be more appropriate.

A broader definition of bundles can be used by using a criteria based on the number of practices adopted. The full system is defined as a system where the three practices are adopted, the partial system is defined as having one or two of the practices adopted. The last system is the null system where none of the employee involvement practices are adopted. The frequencies associated with these systems are shown at the bottom of the table. One can see that 24% of the firms adopted the full system in 1993 and 31% in 1996. The percentage of firms under the null system did not change over the two years while the proportion of firms under the partial system decreased from 69% in 1994 to 63% in 1996. The remainder of the analysis will focus on these systems, controlling for the other types of workplace practices variables. Note that the variables indicating adoption of a practice or system of practices have been created using a broad definition of adoption. If at least 1% of the workers in the firm operate under the given practice, the establishment is considered to have adopted the practice. Since the sample includes large and medium sized establishments, 1% may represent a reasonable minimum [6]

Appendix B shows the means of all the variables used in the analysis hereafter by type of system used (as defined above) for both years. Comparing the columns of the tables associated with the full system to those with the null system for both years allows one to emphasize possible differences in the average profiles of adopters and non adopters. For both years, firms that adopted the full system have on average more educated managers and front-line workers. In terms of average wage dispersion, the ratio of average wages for managers and production workers is greater under the full system relative to the null system suggesting greater wage dispersion in establishments that adopted the full system. Comparing average wages of managers and front-line workers separately, one can see that production workers tend to have slightly higher wages in establishments that did not adopt a system of employee involvement practices.

In summary, from the descriptive analysis, a comparison of non adopters to all-practices adopters shows substantial differences. In particular, wage dispersion is higher in firms adopting all of the

[6] Appendix A.1 discusses this point and shows the average percentage of (non-managerial and non-supervisory) workers under the given bundles of practices defined at the 1% level.

practices relative to non adopters. Since differences in firm and workforce characteristics are also substantial, the effect of the practices on wage dispersion will be more rigourously established using OLS regressions in which proper controls for firms and workers characteristics are included. Before presenting the regression analysis results, the next section discusses limitations of the NES data.

3.3 Data limitations

As it is a plant-level dataset, the NES does not have detailed variables on establishment's workforce characteristics. In particular, workers' average experience or tenure are not available. These variables affect individual wages and may explain a substantial part of the manager-production workers wage differentials. Given that the paper focuses on the analysis of variations in the manager/production worker wage ratio across establishments, it is important to first verify whether or not the lack of control for average experience modifies the cross-establishment variations in wage differentials. Using information on workers potential experience from the CPS in the years 1993 and 1996, the manager/production worker wage ratio is estimated across industries and firms of different sizes. The inclusion of workers experience does not significantly affect the estimated ratio (see Appendix A.2 for details).

A second important limitation of these data set is that there is no information on the date the firm started to adopt the practice. It is therefore difficult to identify properly the effects that would be specifically related to the timing of adoption (learning effects at adoption as well as differences in experience with the given practices). The analysis in this paper is based on the assumption that all firms that adopted the practices, have done so during the same period within the last 25 years.

Finally, although the NES 1996 sample has a longitudinal component of about 900 companies that also participated in the survey of the NES 1993, the longitudinal link is not publicly available. On the other hand, previous studies using the NES that have exploited the longitudinal aspect of the NES have not found much differences in the results when using OLS or fixed-effect estimations (Black and Lynch (1997) and (2000)). Using the longitudinal format of the NES may not constitute an improvement in the quality of the results if the number of workplace practices switchers is very small which is likely to be the case given the years analyzed (mid-90s) and the short period of time between the two years.

As a result, the analysis hereafter uses the cross-sectional aspect of the data to identify the effect of the practices through inter-establishment variations. The methodology however does not take into account effects due to firm-specific unobserved heterogeneity. On that last point, the analysis in this paper based on wage ratios rather than wage levels has the advantage of controlling for a given type of firm-specific unobserved heterogeneity. Indeed, if the unobserved heterogeneity term is constant over time and affects similarly the wages of all categories of workers, it will drop out of the wage ratio equation.

4 Results

The goal in this paper is to explore the relationship between workplace organization changes and wage dispersion by asking the following questions: Is there a link between employee involvement workplace practices and within-firm wage dispersion? Is wage dispersion affected by adoption of such practices? Is wage dispersion affected by the intensity with which the practices are used (measured by the firm's percentage of workers under the given practice)?

This section presents the results of estimations of equation (10) where the log of the manager/production worker ratio is regressed on employee involvement workplace practices controlling for firm technology, workforce characteristics and workplace organization. The first part of the analysis focuses on workplace practices adoption. Systems of employee involvement practices, like the ones discussed in the previous section, are used to explain cross-establishment variation in wage dispersion among adopters and non adopters. The second part of the analysis looks at the effect of the intensity of use of employee involvement practices on wage dispersion.

Note that given the lack of information on average hours worked for managers in the NES 1993 and the resulting imprecision in the measurement of the hourly wage ratio, the analysis hereafter focuses on the NES 1996. The results from estimations based on the NES 1993 are shown for illustration and any differences in the results should be interpreted with caution.

4.1 Wage Dispersion and Employee Involvement Practices Adoption

This section investigates the impact of firms adoption of employee involvement practices on wage dispersion analyzing cross-establishments variations in the log of the wage ratio for managers and production workers between adopters and non adopters. From the analysis in section 3 (and in particular based on table 2), there are substantial variations in adoption rate depending upon the ways the employee involvement practices on problem-solving meetings, self-managed teamwork and job rotation are grouped into bundles. The analysis hereafter uses the definition of a bundle based on the number of employee involvement practices adopted as defined in section 3. The analysis is based on regressions of the log of managers/production workers wage ratio on dummies indicating whether the firm adopted the full set of practices, a partial system based on one or two practices or none of the practices. Results are presented in table 5 and 6 for both NES surveys. The regressions are performed without constant terms so the coefficients associated with each of the systems corresponds to the estimated log ratio of the wages of managers and front-line workers, or the managerial premium under each system.

Each column summarizes the results for different specifications of the regression equation. The column labelled specification I corresponds to the base case where only workforce characteristics are

included. Specification II shows the results when specification I is augmented by technology controls and specification III adds workplace organization controls. In specification IV, the employee involvement system dummies are interacted with the variable indicating whether production workers received training about problem-solving meetings and teamwork during the last three years. Specification V adds a dummy for the use of profit sharing or stock options. The results for each specification are summarized into two columns showing the estimated coefficients and the value of the χ^2 statistic from a test of equality between the estimated log wage ratios. Finally, each table is further divided into two panels each showing the results from the regressions applied to the samples of manufacturing (upper panel) and non manufacturing firms (lower panel).

The first two columns of table 5 show the estimated managerial wage premia associated to each system (null, partial and full) with controls for workforce characteristics. Notice that compared to the raw averages presented in appendix B, the inclusion of workforce characteristics reduces substantially the estimated gap with an estimated 33% managerial premium in the manufacturing sector among establishment that did not adopt employee involvement practices and 34% in the non manufacturing sector. The estimated premia varies across systems and specifications and remain strongly significant. Note that it is not always the case on the non manufacturing sector but this may be explained by the much smaller sample size of non manufacturing firms.

To better illustrate the differences in the wage premia across systems, figures 1 and 2 below graph the estimated managerial wage premia by type of employee involvement system adopted for the year 1996 for the manufacturing and non manufacturing sectors respectively. From figure 1 describing the manufacturing sector case, one can see that the systems of partial use of the involvement practices (when only one or two of the three practices is used) and the full systems are both associated with greater wage dispersion relative to the null system (none of the practices adopted) The additional controls do not change these results.

Going back to table 5 for the manufacturing sector, one can see that the differences in the premia are significant between the null system and the partial system as well as the full system. Indeed, for the difference between the null system and the partial system, the value of the statistics in specifications IV or V (which controls for stock option and profit sharing) are equal to 6.44 and 6.59 which implies that equality in the estimated wage premia between establishments with no system and those with a partial system is rejected at the 99% confidence level.

Figure 2 illustrates the non manufacturing case. The results are similar to the manufacturing sector in that adoption of an employee involvement system (whether full or partial) is associated with greater wage dispersion. The statistics of the tests of equality between wage premia across systems in the second panel of table 5 show that there are significant differences between the managerial wage premia under

Figure 1: Wage Dispersion and Workplace Practices Adoption - NES 1996

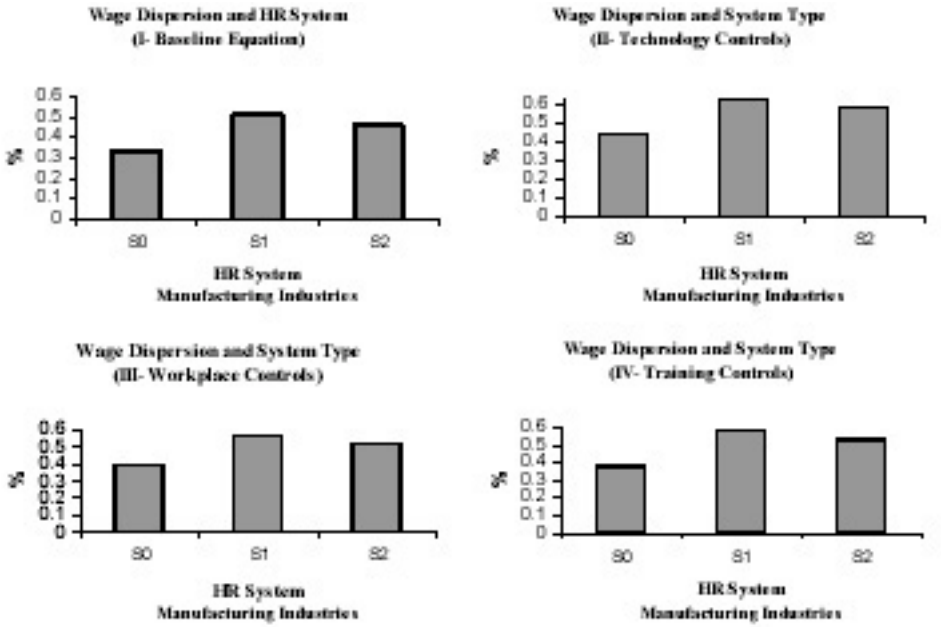


Figure 2: Wage Dispersion and Workplace Practices Adoption - NES 1996

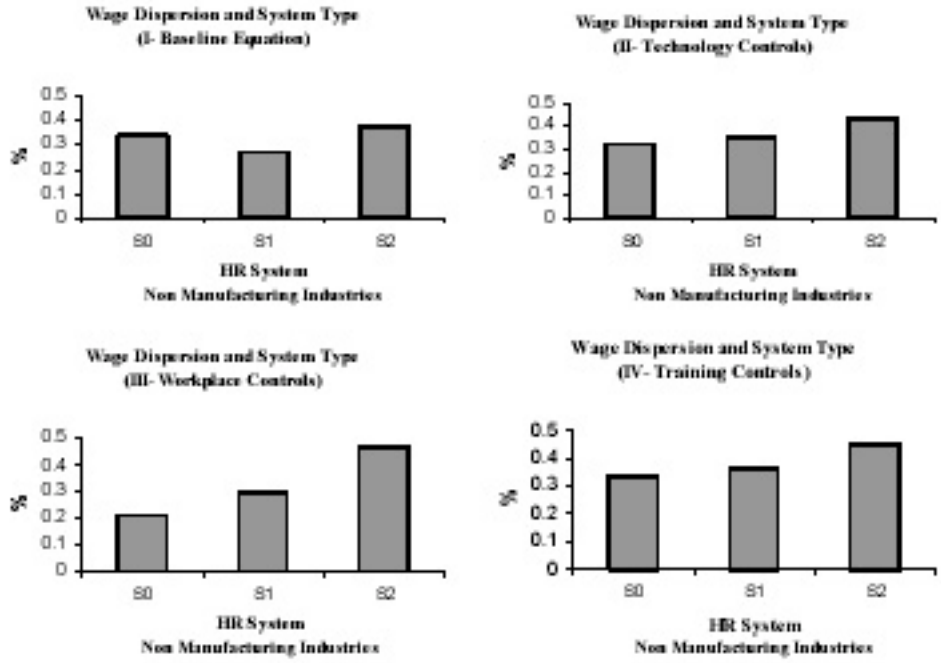
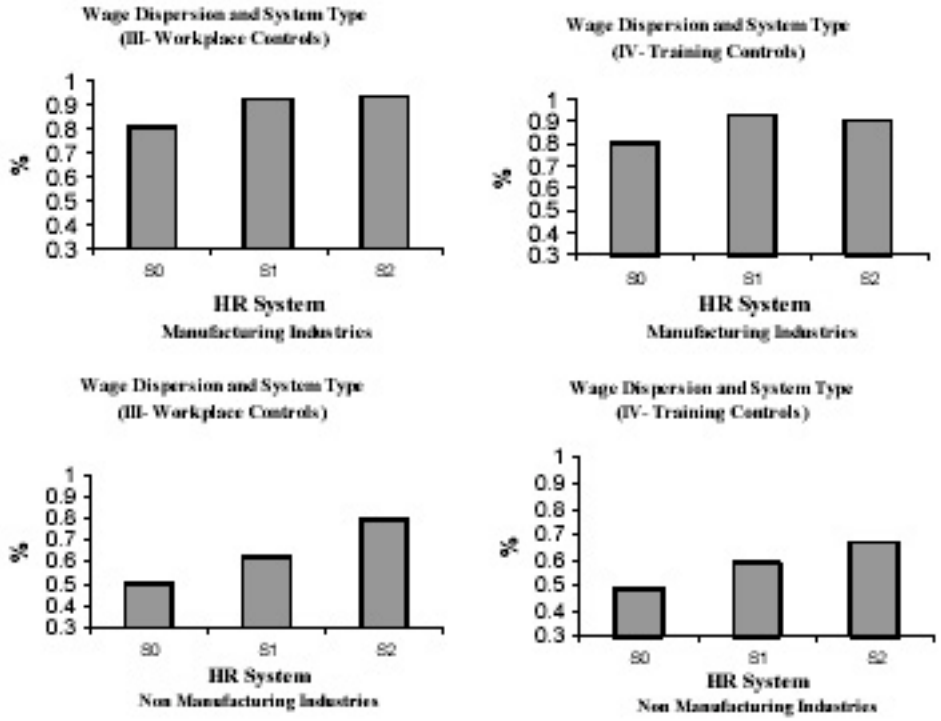


Figure 3: Wage Dispersion and Workplace Practices Adoption - NES 1993



no system and the one under the full system with values equal to 2.20 and 2.24 (in specification IV and V respectively) which implies that equality is rejected at the 87% confidence level. These results are weaker than the one found in the manufacturing case but recall that the sample size is much smaller which reduces the precision with which the coefficients are estimated.

Finally, specification IV of table 5 shows the interactions between training for production workers [7] and the system dummies. It is interesting to see that firms that complement the employee involvement system (either the partial or the full system) with training for production workers have lower wage dispersion relative to firms who don't complement the system with training. The difference is strongly significant in the non manufacturing sector where the reduction in the managerial wage premia for establishments under the full system is estimated to be of 0.234 percentage point. As a result the estimated wage premia for firms under the system which also adopted complementary training comes down to about 27%.

The results from the NES 1993 dataset are summarized in figure 3 and table 6 for both sectors. From figure 3 one can see that the variations in the estimated managerial wage premia are similar to those in the NES 1996. In both manufacturing and non manufacturing sectors, the estimated managerial premium for establishments that did not adopt a system is smaller than the premium at establishments

[7] The training relates specifically to problem-solving meetings and teamwork.

that adopted either the partial or the full system. Note that the estimated premium are greater in magnitude, especially in the manufacturing case. Given that hourly wages for managers are approximated using an average of 40 hours per week, the approximation tends to overestimate average hourly wages for managers. The bias seems to be even stronger in the manufacturing sector. From table 6 one can see that the differences in the wage premia are significant though the tests show lower level of confidence than with the NES 1996.

Overall the results are similar for both years and both sectors in terms of the positively significant link between employee involvement practices and wage dispersion. There is evidence of lower dispersion in establishments that complement the practices with training compared to those who do not. The evidence is significant in the non manufacturing case in the NES 1996.

To further investigate the effect of employee involvement workplace practices on wage dispersion, the next sub-section analyzes cross-establishment variations in wage dispersion in terms of practices intensity of use, measured by the percentage of workers operating under the given practice.

4.2 Wage Dispersion and Employee Involvement Practices Intensity

The objectives in this sub-section are twofold. The analysis first replicates the approach taken in previous studies on workplace practices using the NES data. In these studies[8], employee involvement practices like problem-solving meetings, teamwork and job rotation are analyzed as percentage of non managerial and non supervisory workers currently under a given practice. This measure allows one to analyze the importance of intensity of use of such practices. In a first step, the analysis investigates the impact of factors related to workforce, technology and workplace characteristics on within firm wage dispersion. The impact of employee involvement is then analyzed after controlling for cross-establishments variations in workforce, technology and workplace factors. A second objective is to investigate the possibility that the effect of the practices on wage dispersion varies between firms with low wage or high wage dispersion and present the results of an analysis based on quantile regressions.

The results on the impact of the employee involvement practices, in terms of percentage of workers, on the log of the wage ratio are presented in tables 5 and 6 for the NES 1996 and NES 1993 respectively. In each table, the three first columns describe three different specifications. The first column corresponds to the base specification in which the log of the wage ratio is regressed on establishment's workforce and technology characteristics. The next column describes the result of the same regression where workplace variables have been added. The third column corresponds to the previous regression and the inclusion of the three employee involvement practices. The last two columns consider the third specification over the sample of manufacturing and non manufacturing establishments.

[8]Black and Lynch (2000), Cappelli and Neumark (2001) and Cappelli and Carter (2000).

The results from the NES 1996 in table 5 show that most of the workforce characteristics have a significant impact on wage dispersion and that except for costs, none the technology characteristics have an impact.[9] Education of production workers significantly reduces the managers- production workers wage ratio. A greater proportion of women and minorities is associated with greater wage dispersion. These results are consistent with those found in Black and Lynch (2000) also based on the NES 1996.

Not surprisingly, establishment that have a unionized workforce have lower wage dispersion. The wage compression effect is however not significant in the manufacturing sector. Given that the proportion of unionized firms in the manufacturing sector is not insignificant (in this sample about 35% of manufacturing firms have a unionized workforce), this absence of compression effect suggests that spillover effects might be important.

In the next part of the table, the results show the effect of the variables describing computer use, workplace organization and employee involvement practices. The percentage of managers using computer does not have a significant impact on wage dispersion suggesting that it may affect both categories of workers similarly.[10] The percentage of non-managers using a computer has a significant positive impact on wage dispersion suggesting a differential impact on the wages of managers and front-line workers.

This result may be surprising given the common finding on the positive impact of computer use on wages. One would expect the wages of front-line workers to be positively affected and therefore wage dispersion to reduce. Given that the variable on computer use includes all non-managerial workers, it may either not directly influence wages for front-line workers or influence it positively but in a smaller extent than the wages of managers. One may also suspect that computer use captures greater managerial ability which translates into greater dispersion due to greater wages for managers although the fact that the percentage of managers using computer does affect wage dispersion rules out this last conjecture. firms that are associated

Among the workplace organization variables, neither benchmarking, nor re-engineering have an impact on wage dispersion. Although surprising, this result is similar to Black and Lynch (2000) and Cappelli and Carter (2000) who find positive impacts of the same magnitude on the wages of both managers and production workers for re-engineering and no significant impact for benchmarking. Contrary to these two studies, the number of managerial levels significantly affect wage dispersion in the manufacturing sector. One expects that greater hierarchical levels would be associated with greater differences in pay.

[9]The information on costs relates to energy costs, raw materials, goods and services purchased in the course of doing business. This variable is the only technology related variable that is significant and is associated with greater wage dispersion. This result suggests that firms may pass some of their costs onto production workers reducing their wages.

[10]Note that the effect remains insignificant when one does not include the variable on computer use for non-managerial workers.

Among the three employee involvement practices defined by the percentage of workers participating in regular problem-solving meetings, teamwork and job rotation, teamwork has a strong positive impact on wage dispersion in the non manufacturing sector. On the other hand, given that the sample is very small, this result may not be representative of the non manufacturing sector.

Table 6 presents the results based on the NES 1993 and one can see that they are similar to those from the NES 1996 in that the workforce characteristics variables are the one affecting wage dispersion while almost none of the technology variables and workplace organization variables have a significant impact.

Note that in the NES 1993, among the workplace organization variables that may potentially affect wage dispersion, it is the span of control represented by the number of workers per supervisors rather than the hierarchical levels that has a significant positive impact on wage dispersion. This result suggest that less supervision (or more workers per supervisors) would be associated with greater wages for managers conditional on production workers' wages. This could be interpreted as compensating differentials to managers for taking on supervisory responsibilities. As with the NES 1996, teamwork is associated with greater wage dispersion in the non manufacturing sector. In addition, problem-solving meetings is weakly significant and also positively associated with greater wage dispersion in the non manufacturing sector.

Overall, the results show that wage dispersion do not seem to be significantly affected by employee involvement workplace practices as measured by the firm's percentage of workers under the given practice. However, it is possible that the practices have an impact on wage dispersion for firms above or below average wage dispersion. In other words, the effect of employee involvement practices on firms wage dispersion may differ at different percentiles of the distribution of wage ratios. I now consider an analysis of the practices intensity based on quantile regressions of the log of the manager/production worker wage ratio.

The results of the quantile regressions are shown in table 7 for both the NES 1996 and NES 1993. Interestingly, an analysis at different part of the wage ratio distribution across establishments show some evidence of differential effects. Indeed, whereas the effects of the practices were very small and non significant when estimated at the mean of the wage ratio distribution in the NES 1996 (table 5), they are significant at the 25th percentile or for low wage dispersion firms. Moreover, the practices do not have the same effects on wage dispersion. Whereas problem-solving meetings and job rotation are associated with an increase in wage dispersion, self-managed teamwork reduces the dispersion.

In the non manufacturing case, the results based on the NES 1996 show that the effects of the practices, similar in signs as those found at the mean of the wage ratio distribution (from table 5), are significant at the 90th percentile or for high wage dispersion firms.

Note that the effects in the manufacturing case differ from the non manufacturing case. Problem-solving meetings are associated with lower dispersion and teamwork with greater wage dispersion which are opposite to the effects found in the manufacturing case. On the other hand, the effects are similar in signs between the two sectors when one compares them at the same percentiles of the wage ratio distribution. Indeed, at the 25th percentile, problem-solving meetings and job rotation are associated with greater dispersion while teamwork compresses the distribution in both sectors. In particular, the positive effect of problem-solving meetings on wage dispersion among low dispersion firms at the 25th percentile is significant in the non manufacturing sector in the NES 1993 dataset.

In summary, the results suggest that employee involvement practices affect the wage dispersion of low wage dispersion firms in the manufacturing sector. More precisely, problem-solving meetings and job rotation are associated with greater dispersion and teamwork is associated with wage compression the low wage dispersion firms. In the non manufacturing sector, problem-solving meetings are associated with lower wage dispersion for high wage dispersion firms.

5 Conclusion

In this paper, I explored the link between workplace organization practices and wage dispersion within firms. Using two samples of nationally representative U.S. establishments for the years 1993 and 1996 I estimated the effect of employee involvement workplace practices adoption and intensity of use (as measured by the percentage of workers under the given practice in the company) on within firm wage dispersion measured by the ratio of average wages for managers and production workers. I also analyze the possibility that involvement practices affect firms differently depending upon whether they are at the low or high end of the distribution of the manager/production workers wage ratios.

The results suggest that adoption of employee involvement workplace practices is associated with greater wage dispersion. Compared to establishments not using any of the involvement practices, firms that adopt a partial system or full system of practices, including regular problem-solving meetings and/or self-managed team and/or job rotation, have significantly greater wage dispersion. On the other hand, firms that complement the practices with training for production workers (on teamwork or problem-solving meetings) have lower dispersion than those who do not complement with training.

The results based on employee involvement intensity of use show evidence of compression effects associated with self-managed teamwork in the manufacturing sector at the 25th percentile or for low wage dispersion firms. There is also evidence of wage compression effects associated with problem-solving meetings in the non manufacturing sector for high wage dispersion firms.

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Table 1: Workplace Organization and Practices, Means[a] for NES 1993 and 1996

Year	**1993**			**1996**		
Variables	All	Manuf.	Non Man.	All	Manuf.	Non Man.
Involvement						
Meeting (% wkrs)	52.35	38.88	58.44	61.88	57.23	63.46
	(1.51)	(1.83)	(2.53)	(1.46)	(1.81)	(2.58)
Team (% wkrs)	12.13	10.38	12.92	19.07	18.95	19.11
	(0.87)	(1.04)	(1.52)	(1.12)	(1.38)	(1.98)
Job Rot. (% wkrs)	13.70	15.90	12.70	16.45	25.36	13.40
	(0.92)	(1.25)	(1.49)	(0.97)	(1.47)	(1.51)
Workplace						
# Management Lvls	2.06	1.95	2.11	1.73	2.15	1.58
	(0.05)	(0.05)	(0.10)	(0.10)	(0.20)	(0.09)
# Wkrs/Supervisor	15.28	15.54	15.16	12.62	13.98	12.16
	(0.68)	(0.88)	(1.14)	(0.45)	(0.61)	(0.76)
Benchmarking	0.28	0.24	0.30	0.33	0.28	0.34
	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)	(0.03)
TQM/Re-engineering	0.35	0.40	0.29	0.32	0.29	
	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)	(0.03)
Training Team	0.53	0.50	0.54	0.70	0.65	0.72
	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)	(0.03)
Pay						
Stock Opt.-Prof. Sha.	0.77	0.74	0.79	0.46	0.51	0.44
	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)
All Practices	0.06	0.03	0.08	0.04	0.04	0.04
	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)
No Practices	0.02	0.04	0.01	0.01	0.03	0.00
	(0.00)	(0.01)	(0.01)	(0.00)	(0.01)	(0.00)
ComputerUse						
% Managers	0.74	0.70	0.76	82.42	82.98	82.23
	(0.01)	(0.01)	(0.02)	(1.14)	(1.19)	(2.14)
% Others	0.41	0.25	0.48	61.00	33.86	70.25
	(0.01)	(0.01)	(0.02)	(1.42)	(1.35)	(2.44)
N	816	537	279	765	527	238

a-Standard errors in parenthesis.

Table 2: Practices Variables and Bundles, NES 1993 and NES 1996

Individual Practice Frequencies

Year	**1993**		**1996**	
Variables	At least	Only	At least	Only
Involvement				
Meetings	0.844	0.021	0.884	0.002
Team	0.368	0.000	0.420	0.000
Job Rotation	0.452	0.010	0.487	0.002
Workplace				
Benchmarking	0.277	0.006	0.325	0.001
TQM/Reengineering	0.353	0.003	0.293	0.000
Training	0.525	0.021	0.704	0.000
Pay				
Stock Opt.-Prof. Sha.	0.774	0.045	0.455	0.001
N	816	816	765	765

Practice Bundle Frequencies

Year	**1993**			**1996**		
Variables	All	Manuf.	Non Man.	All	Manuf.	Non Man.
Wkr $\geq$ 1 %						
One Practice						
Meetings (M)	0.298	0.315	0.290	0.270	0.214	0.290
Team (T)	0.008	0.000	0.011	0.022	0.015	0.024
Job Rotation (J)	0.034	0.052	0.026	0.013	0.015	0.013
Two Practices						
MT	0.140	0.091	0.162	0.151	0.133	0.157
MJ	0.198	0.191	0.201	0.224	0.257	0.214
TJ	0.011	0.028	0.004	0.011	0.019	0.009
All/No Practices						
MTJ	0.208	0.173	0.223	0.238	0.279	0.224
NOMTJ	0.103	0.150	0.082	0.070	0.069	0.071
System						
No EI	0.078	0.088	0.061	0.061	0.060	0.063
Partial EI	0.682	0.662	0.717	0.630	0.585	0.730
Full EI	0.239	0.248	0.221	0.307	0.353	0.205
N	811	533	278	756	519	237

Table 3: Systems of Employee Involvement Practices and Wage Dispersion[a], NES 1996

Specification[b]	I Coef.	χ^2-test $s_i = s_{i-1}$	II Coef.	χ^2-test $s_i = s_{i-1}$	III Coef.	χ^2-test $s_i = s_{i-1}$	IV Coef.	χ^2-test $s_i = s_{i-1}$	V Coef.	χ^2-test $s_i = s_{i-1}$
Firm Technology	No		Yes		Yes		Yes		Yes	
Workplace	No		No		Yes		Yes		Yes	
Stock Option/ Profit Sharing	No		No		No		No		Yes	
				Manufacturing Sector						
System S_0 (No Employee Involvement Practices)	0.334**		0.437**		0.396**		0.379***		0.385**	
	(0.141)		(0.180)		(0.191)		(0.193)		(0.192)	
System S_1 (Meetings or Job Rotation, or Teamwork	0.510***	5.99	0.617***	5.06	0.568***	4.61	0.585***	6.44	0.592***	6.59
used as individual practices or in pairs)	(0.117)	(0.01)	(0.146)	(0.16)	(0.159)	(0.03)	(0.165)	(0.01)	(0.164)	(0.01)
System S_2 (Meetings *and* Job Rotation *and* Teamwork)	0.462***	1.20	0.580***	0.76	0.522***	1.04	0.530***	0.16	0.563***	0.21
	(0.123)	(0.27)	(0.147)	(0.39)	(0.160)	(0.30)	(0.157)	(0.66)	(0.155)	(0.65)
χ^2-test $S_0 = S_2$		2.74		3.04		2.41		4.02		3.82
(p-value)		(0.09)		(0.08)		(0.12)		(0.04)		(0.05)
System S_1' (S_1 *and* Ft-lines Training)							-0.065		-0.061	
							(0.048)		(0.048)	
System S_2' (S_2 *and* Ft-lines Training)							-0.081		-0.079	
							(0.073)		(0.075)	
N=533										
				Non Manufacturing Sector						
System S_0 (No Employee Involvement Practices)	0.341*		0.323		0.332		0.210		0.211	
	(0.197)		(0.220)		(0.239)		(0.232)		(0.215)	
System S_1 (Meetings or Job Rotation, or Teamwork	0.274	0.35	0.354**	0.06	0.358*	0.04	0.296	0.46	0.298	0.44
used as individual practices or in pairs)	(0.177)	(0.55)	(0.179)	(0.71)	(0.213)	(0.81)	(0.210)	(0.49)	(0.204)	(0.50)
System S_2 (Meetings *and* Job Rotation *and* Teamwork)	0.376**	2.43	0.433**	1.30	0.447*	1.63	0.464**	1.84	0.478**	1.86
	(0.187)	(0.12)	(0.197)	(0.30)	(0.243)	(0.20)	(0.246)	(0.17)	(0.231)	(0.17)
χ^2-test $S_0 = S_2$		0.11		0.75		0.69		2.20		2.24
(p-value)		(0.74)		(0.80)		(0.40)		(0.13)		(0.13)
System S_1' (S_1 *and* Ft-lines Training)							-0.176**		-0.147*	
							(0.069)		(0.088)	
System S_2' (S_2 *and* Ft-lines Training)							-0.234**		-0.223**	
							(0.149)		(0.138)	
N=191										

a-The dependent variable is the log of the average wage ratio for managers and production workers. Standard errors computed using the White correction.
b-Includes the value of the firm's capital stock, new equipment, labor and other costs, equipment age, industry, firm-size and union dummies.

Table 4: Systems of Employee Involvement Practices and Wage Dispersion[a], NES 1993

Specification[b]	I Coef.	χ^2-test $s_i = s_{i-1}$	II Coef.	χ^2-test $s_i = s_{i-1}$	III Coef.	χ^2-test $s_i = s_{i-1}$	IV Coef.	χ^2-test $s_i = s_{i-1}$	V Coef.	χ^2-test $s_i = s_{i-1}$
Firm Technology	No		Yes		Yes		Yes		Yes	
Workplace	No		No		Yes		Yes		Yes	
Stock Option/ Profit Sharing	No		No		No		No		Yes	
				Manufacturing Sector						
System S_0 (No Employee Involvement Practices)	0.605***		0.851***		0.805***		0.807***		0.840***	
	(0.234)		(0.226)		(0.233)		(0.232)		(0.232)	
System S_1 (Meetings or Job Rotation, or Teamwork used as individual practices or in pairs)	0.650***	0.43	0.939***	1.39	0.924***	2.34	0.928***	2.37	0.971***	2.57
	(0.215)	(0.76)	(0.213)	(0.23)	(0.226)	(0.12)	(0.230)	(0.12)	(0.233)	(0.10)
System S_2 (Meetings *and* Job Rotation *and* Teamwork)	0.656***	0.01	0.989***	0.68	0.938***	0.05	0.906***	0.02	0.961***	0.00
	(0.230)	(0.91)	(0.229)	(0.40)	(0.242)	(0.81)	(0.282)	(0.88)	(0.284)	(0.96)
χ^2-test $S_0 = S_2$		0.44		2.56		2.35		0.42		0.63
(p-value)		(0.50)		(0.11)		(0.12)		(0.50)		(0.41)
System S_1' (S_1 *and* Ft-lines Training)							0.000		-0.001	
							(0.073)		(0.072)	
System S_2' (S_2 *and* Ft-lines Training)							0.046		-0.039	
							(0.159)		(0.158)	
N=477 obs.										
				Non Manufacturing Sector						
System S_0 (No Employee Involvement Practices)	0.629***		0.478**		0.486**		0.501**		0.426	
	(0.239)		(0.229)		(0.231)		(0.236)		(0.276)	
System S_1 (Meetings or Job Rotation, or Teamwork used as individual practices or in pairs)	0.739***	0.54	0.602***	0.74	0.587***	0.52	0.620***	0.61	0.554*	0.74
	(0.221)	(0.46)	(0.226)	(0.39)	(0.226)	(0.47)	(0.240)	(0.45)	(0.297)	(0.39)
System S_2 (Meetings *and* Job Rotation *and* Teamwork)	0.787***	0.39	0.708***	1.94	0.671***	1.28	0.794***	2.58	0.715**	2.03
	(0.229)	(0.53)	(0.235)	(0.16)	(0.243)	(0.25)	(0.273)	(0.10)	(0.341)	(0.15)
χ^2-test $S_0 = S_2$		0.99		1.99		1.35		2.68		2.50
(p-value)		(0.31)		(0.15)		(0.24)		(0.10)		(0.11)
System S_1' (S_1 *and* Ft-lines Training)							-0.010		-0.017	
							(0.070)		(0.073)	
System S_2' (S_2 *and* Ft-lines Training)							-0.136		-0.131	
							(0.120)		(0.121)	
N=236 obs.										

a-The dependent variable is the log of the average wage ratio for managers and production workers. Standard errors computed using the White correction.
b-Includes the value of the firm's capital stock, new equipment, labor and other costs, equipment age, industry, firm-size and union dummies.

Table 5: Workplace Organization and Practices and Wage Dispersion[a] - NES 1996

Specifications[b]	(1)	(2)	(3)	(3) Manuf.	(3) Non Man.
Workforce					
Education Managers	0.016	0.014	0.015	0.009	0.018
	(0.016)	(0.015)	(0.015)	(0.013)	(0.025)
Education Ft-Lines	-0.069**	-0.062**	-0.069**	-0.060*	-0.065
	(0.031)	(0.031)	(0.030)	(0.036)	(0.043)
% Women	0.474***	0.488***	0.473***	0.086	0.643***
	(0.099)	(0.105)	(0.110)	(0.132)	(0.162)
% Minorities	0.190**	0.253***	0.247***	0.319***	0.199*
	(0.081)	(0.078)	(0.076)	(0.077)	(0.184)
% New Hired	0.038	0.120	0.125	0.327**	0.117
	(0.127)	(0.122)	(0.121)	(0.160)	(0.184)
Union Dummy	-0.154***	-0.110**	-0.112**	-0.003	-0.230***
	(0.052)	(0.051)	(0.050)	(0.056)	(0.071)
% Managers	-0.313	-0.261	-0.293	-0.175	-0.459*
	(0.204)	(0.190)	(0.190)	(0.239)	(0.280)
% Ft-Lines	-0.110	0.066	0.064	-0.064	0.116
	(0.117))	(0.108)	(0.105)	(0.192)	(0.143)
Technology					
% Equipment $<$ 1 yr	0.031	0.105	0.062	0.105	0.144
	(0.131)	(0.139)	(0.136)	(0.209)	(0.204)
% Equipment 5-10 yr	0.009	0.079	0.058	-0.125	0.057
	(0.094)	(0.091)	(0.091)	(0.123)	(0.155)
% Equipment $>$ 11 yr	0.048	0.025	0.012	-0.210*	0.056
	(0.113)	(0.117)	(0.117)	(0.112)	(0.196)
Capital Stock	-0.017	-0.015	-0.012	-0.003	-0.002
$ value, in log	(0.015)	(0.014)	(0.015)	(0.018)	(0.020)
New Equipt	-0.015	-0.022	-0.021	-0.028	-0.021
$ value, in log	(0.018)	(0.016)	(0.016)	(0.021)	(0.022)
Labor Cost	0.032	0.000	-0.003	-0.037	0.024
$ value, in log	(0.024)	(0.023)	(0.023)	(0.028)	(0.035)
Other Costs	0.029*	0.039**	0.039**	0.023	0.039*
$ value, in log	(0.016)	(0.016)	(0.015)	(0.021)	(0.022)

a-The dependent variable is the log of the ratio of average wages of managers and production workers.

b-Also include industry and firm-size dummies. Standard errors computed using the White correction. 1% significance level: ***. 5% significance level: **. 10% significance level: *.

Table 5: Workplace Organization and Practices and Wage Dispersion[a] - NES 1996
(Continued)

Specifications[b]	(1)	(2)	(3)	(3) Manuf.	(3) Non Man.
Computer Use					
% Managers		-0.101	-0.104	-0.049	-0.119
		(0.083)	(0.082)	(0.097)	(0.115)
% Others		0.137*	0.128*	0.153**	0.079
		(0.073)	(0.071)	(0.075)	(0.093)
Workplace Organization					
# Management Levels		0.007*	0.006*	0.005***	0.015
		(0.004)	(0.004)	(0.001)	(0.018)
# Wkrs/Supervisor		0.000	-0.000	0.000	-0.000
		(0.001)	(0.001)	(0.001)	(0.002)
Benchmarking		0.051	0.051	-0.020	0.140*
		(0.047)	(0.050)	(0.048)	(0.075)
Re-engineering		-0.023	-0.100*	0.021	0.006
		(0.049)	(0.050)	(0.041)	(0.081)
Ft-lines Team/meetings Training		-0.066	-0.073	-0.055	-0.085
		(0.049)	(0.051)	(0.047)	(0.070)
Pay					
Stock Option-Profit Sharing		-0.060	-0.056	-0.008	-0.065
		(0.058)	(0.056)	(0.041)	(0.089)
Involvement					
Meeting (% wkrs)			-0.059	0.022	-0.146**
			(0.055)	(0.053)	(0.086)
Team (% wkrs)			0.099	-0.030	0.190*
			(0.077)	(0.089)	(0.112)
Job Rotation (% wkrs)			-0.006	0.075	-0.027
			(0.073)	(0.067)	(0.146)
R2	0.233	0.333	0.343	0.265	0.475
N	735	648	648	476	172

a-The dependent variable is the log of the ratio of average wages of managers and production workers.
b-Also include industry and firm-size dummies. Standard errors computed using the White correction. 1% significance level: ***. 5% significance level: **. 10% significance level: *.

Table 6: Workplace Organization and Wage Dispersion - NES 1993

Specifications[b]	(1)	(2)	(3)	(3) Manuf.	(3) Non Man.
Workforce					
Education Managers	0.038**	0.035**	0.032**	0.046**	0.010
	(0.019)	(0.017)	(0.016)	(0.02)	(0.019)
Education Ft-Lines	-0.047	-0.045*	-0.049*	-0.115**	-0.026
	(0.029)	(0.026)	(0.027)	(0.058)	(0.031)
% Women	0.065	0.084	0.076	0.178	0.042
	(0.115)	(0.121)	(0.116)	(0.115)	(0.149)
% Minorities	0.357***	0.302***	0.309***	0.315***	0.054
	(0.118)	(0.105)	(0.104)	(0.115)	(0.139)
% New Hired	-0.094	-0.083	-0.025	0.483	-0.197
	(0.153)	(0.174)	(0.172)	(0.332)	(0.156)
Union Dummy	-0.041	-0.039	-0.037	0.024	-0.102
	(0.057)	(0.055)	(0.055)	(0.073)	(0.087)
% Managers	-0.494	-0.507	-0.498	-0.503	-0.507
	(0.476)	(0.444)	(0.440)	(0.554)	(0.519)
% Ft-Lines	-0.164	-0.238*	-0.250*	-0.448**	-0.110
	(0.145)	(0.140)	(0.140)	(0.188)	(0.165)
Technology					
% Equipment $<$ 1 yr	-0.229	-0.216	-0.282	-0.409*	-0.016
	(0.171)	(0.173)	(0.174)	(0.225)	(0.219)
% Equipment 5-10 yr	-0.041	-0.045	-0.069	-0.202	0.015
	(0.113)	(0.124)	(0.119)	(0.165)	(0.144)
% Equipment $>$ 11 yr	-0.166*	-0.187*	-0.202*	-0.318**	-0.013
	(0.104)	(0.107)	(0.105)	(0.131)	(0.140)
Capital Stock	0.019	0.005	-0.004	-0.027	0.003
$ value, in log	(0.024)	(0.024)	(0.022)	(0.023)	(0.029)
New Equipt	0.022	0.026	0.037	0.024	0.035
$ value, in log	(0.019)	(0.019)	(0.017)	(0.023)	(0.022)
Labor Cost	-0.030	-0.043	-0.050	0.002	-0.088
$ value, in log	(0.044)	(0.041)	(0.040)	(0.040)	(0.060)
Other Costs	0.016	0.045	0.054	-0.040	0.120
$ value, in log	(0.053)	(0.052)	(0.052)	(0.053)	(0.077)

a-The dependent variable is the log of the ratio of average wages of managers and production workers.

b-Also include industry and firm-size dummies. Standard errors computed using the White correction. 1% significance level: ***. 5% significance level: **. 10% significance level: *.

Table 6: Workplace Organization and Practices and Wage Dispersion[a] - NES 1993
(Continued)

Specifications[b]	(1)	(2)	(3)	(3) Manuf.	(3) Non Man.
Computer Use					
% Managers		-0.168*	-0.213**	-0.088	-0.394***
		(0.091)	(0.089)	(0.108)	(0.125)
% Others		0.058	0.055	-0.085	0.168*
		(0.083)	(0.079)	(0.101)	(0.099)
Workplace					
# Management Levels		-0.008	-0.004	0.038	-0.002
		(0.015)	(0.015)	(0.021)	(0.019)
# Wkrs/Supervisor		0.003**	0.003**	0.001	0.007***
		(0.001)	(0.001)	(0.001)	(0.002)
Benchmarking		0.032	0.008	0.009	0.027
		(0.052)	(0.048)	(0.062)	(0.059)
TQM		-0.020	-0.021	0.020	-0.020
		(0.055)	(0.055)	(0.062)	(0.075)
Ft-lines Team/meetings Training		-0.020	-0.027	0.033	-0.024
		(0.053)	(0.052)	(0.069)	(0.070)
Pay					
Stock Option-Profit Sharing		-0.011	-0.014	-0.049	0.072
		(0.068)	(0.069)	(0.065)	(0.093)
Involvement					
Meeting (% wkrs)			0.054	-0.030	0.138*
			(0.053)	(0.065)	(0.079)
Team (% wkrs)			0.180**	0.074	0.225**
			(0.090)	(0.101)	(0.104)
Job Rotation (% wkrs)			-0.070	0.005	-0.140
			(0.085)	(0.067)	(0.173)
R2	0.225	0.268	0.283	0.330	0.419
N	729	729	729	489	240

a-The dependent variable is the log of the ratio of average wages of managers and production workers.
b-Also include industry and firm-size dummies. Standard errors computed using the White correction. 1% significance level: ***. 5% significance level: **. 10% significance level: *.

Table 7: Involvement Practices and Wage Dispersion[a]
Quantile Regressions

	Manufacturing				Non Manufacturing			
Quantiles[b]	10th	25th	75th	90th	10th	25th	75th	90th
NES96								
Meeting (% wkrs)	-0.002	0.099**	0.093	0.029	0.047	0.083	-0.158	-0.336**
	(0.051)	(0.044)	(0.063)	(0.087)	(0.125)	(0.104)	(0.124)	(0.160)
Team (% wkrs)	-0.106*	-0.161**	-0.009	-0.059	0.107	-0.086	0.161	0.142
	(0.064)	(0.065)	(0.090)	(0.080)	(0.199)	(0.165)	(0.173)	(0.171)
Job Rotation (% wkrs)	0.081	0.113*	0.000	0.083	-0.151	-0.122	0.148	0.030
	(0.076)	(0.067)	(0.074)	(0.081)	(0.185)	(0.179)	(0.166)	(0.184)
NES93	**Manuf**				**Non Manuf**			
Meeting (% wkrs)	-0.000	0.042	0.035	0.036	0.016	0.121**	0.050	0.100
	(0.050)	(0.052)	(0.062)	(0.091)	(0.073)	(0.061)	(0.070)	(0.129)
Team (% wkrs)	0.031	-0.028	-0.107	0.026	-0.018	-0.018	-0.019	-0.011
	(0.087)	(0.064)	(0.109)	(0.124)	(0.159)	(0.162)	(0.147)	(0.200)
Job Rotation (% wkrs)	0.105	0.068	0.021	-0.112	0.193	0.047	0.212	0.221
	(0.082)	(0.057)	(0.087)	(0.139)	(0.142)	(0.171)	(0.233)	(0.238)

a-The estimation also includes variables describing technology and workforce characteristics, industry and firm-size dummies. Standard errors computed using bootstrapping. 1% significance level: ***. 5% significance level: **. 10% significance level: *.

b-Quantile regression based on the 10th, 25th, 75th, and 90th percentiles of the distribution of manager to production workers wage ratios.

Appendix A.1: Percentage of Employee Involvement by Practice Dummy

This appendix discusses the definition of employee involvement practices adoption based on the percentage of workers under the given practice. The table below computes average percentages of workers under each of the bundles of employee involvement practices. One can see that the average percentages vary a lot from across practices, whether they are considered individually as combinations. They vary between 15 and 70% in 1993 and between 6 and 80% in 1996. Job rotation is the practice that hardly reaches 50% of workers. Therefore, letting the definition of the adoption start at a percentage of workers higher than 1% leads to the question of which ideal percentage should apply. Moreover, choosing any percentage higher than 25% implies that teamwork and job rotation cannot be analyzed as individual practices. To avoid this problem, I kept the 1% definition in the remaining of the paper.

Practices	Meeting	Team	Job Rot.	Meeting & Team	Meeting & Job Rot.	Team & Job Rot.	All
Year				**1993**			
Sector				**Manuf.**			
% Meet.	46.75	0	0	54.97	49.41	0	56.82
	(3.55)			(5.05)	(4.17)		(3.81)
% Team	0	15.16	0	43.80	0	33.74	37.44
		(8.28)		(4.36)		(11.65)	(2.91)
% Job Rot.	0	0	36.59	0	34.31	24.35	49.56
			(9.66)		(3.36)	(6.04)	(3.65)
N	116	2	14	62	91	10	103
Sector				**Non Man.**			
% Meet.	71.02	0	0	74.62	43.08	0	59.82
	(3.37)			(4.41)	(4.35)		(4.72)
% Team	0	55.01	0	37.73	0	39.16	35.75
		(21.28)		(4.09)		(17.66)	(3.35)
% Job Rot.	0	0	19.31	0	31.34	24.32	25.11
			(5.96)		(3.43)	(12.54)	(3.11)
N	107	3	13	49	65	4	73
Year				**1996**			
Sector				**Manuf.**			
% Meet.	60.30	0	0	59.06	67.89	0	55.10
	(3.97)			(3.97)	(3.58)		(2.82)
% Team	0	6.39	0	35.07	0.00	79.49	47.71
		(0.60)		(3.04)		(11.17)	(2.77)
% Job Rot.	0	0	44.76	0	47.19	27.97	45.22
			(12.57)		(3.02)	(8.14)	(2.60)
N	84	7	9	78	112	7	160
Sector				**Non Man.**			
% Meet.	77.29	0	0	77.52	82.69	0	76.45
	(3.40)			(5.40)	(3.56)		(3.27)
% Team	0	70.51	0	53.01	0	28.65	38.10
		(16.05)		(5.01)		(2.63)	(3.24)
% Job Rot.	0	0	21.76	0	38.27	27.94	40.75
			(4.77)		(3.79)	(3.17)	(3.77)
N	80	6	9	45	76	4	82

Appendix A.2: Wage[a] Dispersion and Experience - March CPS 1993 and 1996

In this appendix I analyze whether the lack of control for managers and production workers' average experience modifies the cross-establishment variations in wage differentials. To do so, I used the March CPS for the year 1993 and 1996 in which there is information on workers' education and age to construct potential experience and information on the company size. To characterize variations in managers-production workers wage differentials, I used information on firm size and industry of the workers. In the March CPS, firm size is a discrete variable that takes 6 values from firms with less than 10 employees to firms with more than 1000 employees. I classified industries according to the same method as in the NES, with 20 different industries. I next selected individuals reporting managerial occupations and defined as production or front-line workers anyone reporting a profession directly linked to the firm's production. I estimated the wage differentials by regressing the log of hourly wages on a dummy for managerial occupations. The cross-establishment variations in wage differentials are defined by interacting the manager dummy to dummies defining the interaction of size and industry.

The table below presents the results of the estimations. Four series of regressions have been performed: an estimation of the raw wage differentials (column (1)), a regression with the inclusion of workers controls such as gender, race and union status (column (2)), a regression where education is added as an additional control (column (3)), a regression where experience and experience squared are added as additional controls (column(4)).

Manager/Prod. Wage Diff.[als]	(1) No Controls	(2) + Fem, Mino, Union	(3) (2) + Educ.	(4) (2) + Exp.
1993				
Manuf*Large	0.709	0.773	0.635	0.718
	(0.046)	(0.045)	(0.043)	(0.043)
Manuf*Medium	0.811	0.849	0.670	0.766
	(0.081)	(0.077)	(0.074)	(0.075)
Manuf*Small	0.760	0.760	0.600	0.693
	(0.070)	(0.067)	(0.064)	(0.064)
Non Manuf*Large	0.377	0.419	0.349	0.391
	(0.033)	(0.032)	(0.030)	(0.030)
Non Manuf*Medium	0.411	0.415	0.347	0.377
	(0.053)	(0.051)	(0.049)	(0.049)
Non Manuf*Small	0.399	0.456	0.365	0.403
	(0.034)	(0.033)	(0.032)	(0.032)
F-Test[b] (p-value)	128.6 (0.000)	157.2 (0.000)	107.2 (0.000)	139.1 (0.000)
1996				
Manuf*Large	0.729	0.800	0.640	0.737
	(0.055)	(0.054)	(0.052)	(0.052)
Manuf*Medium	0.692	0.720	0.567	0.699
	(0.093)	(0.090)	(0.086)	(0.086)
Manuf*Small	0.725	0.796	0.629	0.748
	(0.089)	(0.085)	(0.082)	(0.082)
Non Manuf*Large	0.480	0.512	0.425	0.477
	(0.037)	(0.036)	(0.035)	(0.035)
Non Manuf*Medium	0.508	0.519	0.413	0.509
	(0.064)	(0.061)	(0.059)	(0.059)
Non Manuf*Small	0.410	0.437	0.335	0.399
	(0.041)	(0.040)	(0.039)	(0.038)
F-Test[b] (-p-value)	102.0 (0.000)	124.3 (0.000)	80.2 (0.000)	115.2 (0.000)
Detailed Variables Industry*size				
1993				
F-Test[b] (p-value)	16.4 (0.000)	15.7 (0.000)	11.2 (0.000)	14.5 (0.000)
1996				
F-Test[b] (p-value)	12.5 (0.000)	11.9 (0.000)	8.3 (0.000)	11.3 (0.000)

a-Based on a sample of 5423 observations for 1993 and 3828 for 1996. Individual hourly wages for managers and production workers. Base category is front-line in small manufacturing firms.
b-Test of joint equality of coefficients.

The idea is to see whether cross- establishment variations approximated by cross-"industry*size" variations in the differentials is affected by the inclusion of the experience variables. To test that point, a F-test for the joint equality of the wage differentials is performed.

Inter-establishment variations in wage differentials have been approximated first in a large way by interacting dummies for manufacturing and non manufacturing firms and for large (more than 500 employees), medium (between 100 and 500 employees) and small firms. The last part of the table show the results of the estimations with a more detailed division of industries and firm size. More precisely, 6 different types of firm size are interacted with 20 different types of industries. The results show the F-test from the regressions.

Looking at the estimated wage differentials in the first estimations with a large definition of establishment, one can see a clear drop in the coefficients when education is added to the specification (2). The drop is much weaker when experience is added to specification (2). Experience has an impact on the manager-production workers wage differentials but the question is whether the effect is similar across establishments. An F-test for the joint equality of the differentials across manufacturing and non manufacturing large, medium and small firms show that including experience does not eliminate the variations in wage differentials (the test reject the null of equality of the wage differentials). With a finer characterization of establishments (bottom of the table), one arrives to the same conclusions.

In summary, manager-production-worker wage dispersion within establishments does not seem to be strongly modified when controlling for experience. In addition, the variations across establishments are better explained by education than experience.

Appendix B: Workforce and Firm Weighted-Average Characteristics by Practices- NES93 and NES96

Year	NES 1993			NES 1996		
System	No EI	Partial	Full	No EI	Partial	Full
Workforce						
Education						
Managers	14.20	15.11	15.31	14.35	14.70	15.12
	(0.21)	(0.07)	(0.11)	(0.25)	(0.07)	(0.10)
Front-line	11.84	12.11	12.24	11.98	12.26	12.90
	(0.09)	(0.04)	(0.07)	(0.09)	(0.05)	(0.10)
Composition						
% Women	26.06	43.49	38.32	31.89	36.21	42.52
	(2.73)	(1.27)	(1.83)	(3.74)	(1.15)	(1.46)
% Minorities	13.31	23.31	21.92	20.33	21.99	21.38
	(2.78)	(1.05)	(1.62)	(2.78)	(1.01)	(1.39)
% New Hired	19.32	24.62	27.46	10.01	17.58	17.65
	(1.56)	(1.05)	(1.80)	(1.22)	(0.69)	(0.77)
% Managers	14.72	10.39	9.95	10.89	13.19	11.68
	(1.05)	(0.32)	(0.61)	(0.92)	(0.51)	(0.49)
% Front-lines	59.17	65.65	66.34	58.66	57.06	53.12
	(2.26)	(1.00)	(1.81)	(2.78)	(1.00)	(1.53)
Pay						
Wages						
Managers (in log)	2.88	2.81	2.85	3.20	2.99	3.15
	(0.04)	(0.02)	(0.04)	(0.06)	(0.02)	(0.03)
Front-lines (in log)	2.35	2.16	2.18	2.45	2.38	2.40
	(0.04)	(0.02)	(0.03)	(0.04)	(0.02)	(0.03)
Log of the ratio	0.48	0.64	0.65	0.63	0.63	0.73
	(0.05)	(0.02)	(0.03)	(0.04)	(0.01)	(0.02)
Incentive pay						
Prof. Sha. or Stck opt.	0.72	0.72	0.90	0.42	0.43	0.50
	(0.06)	(0.02)	(0.02)	(0.07)	(0.02)	(0.03)
Prof. Sharing (1993)	0.04	0.15	0.33			
	(0.02)	(0.02)	(0.03)			
Stck. Option (1993)	0.52	0.45	0.58			
	(0.06)	(0.02)	(0.04)			
Prof. Sharing Ft-L. wkers only (1993)	0.72	0.74	0.90			
	(0.06)	(0.02)	(0.02)			
Involvement						
Workers						
% Ft-lines Meetings		54.84	69.07		66.30	64.57
		(1.77)	(2.77)		(1.70)	(2.18)
% Ft-lines Team		7.77	31.45		13.24	42.86
		0.89)	(2.21)		(1.24)	(1.87)
% Ft-lines Job Rotation		11.80	25.91		13.39	30.79
		(1.07)	(2.15)		(1.11)	(1.51)
Training						
Training Team-Meetings (Ft-lines)		0.51	0.73		0.68	0.89
		(0.02)	(0.03)		(0.02)	(0.01)
Training Team-Meetings (Mngers) (1996)					0.83	0.81
					(0.01)	(0.02)

Appendix B: Workforce and Firm Weighted-Average Characteristics by Practices- NES93 and NES96
(Continued)

Year	NES 1993			NES 1996		
System	No EI	Partial	Full	No EI	Partial	Full
Firm						
Technology						
Sales ($Millions)	9.96	36.34	27.73	23.05	20.75	20.36
	(4.61)	(6.37)	(7.89)	(8.65)	(4.92)	(3.50)
Capital ($Millions)	9.04	6.57	6.53	6.96	11.37	6.90
	(5.81)	(1.37)	(2.23)	(4.56)	(7.94)	(2.19)
Labor ($Millions)	2.76	4.04	5.12	3.00	3.53	3.48
	(0.84)	(0.65)	(1.76)	(1.31)	(0.49)	(0.65)
New Eqpt ($Millions)	0.29	1.12	0.56	0.94	0.53	0.71
	(0.16)	(0.19)	(0.21)	(0.78)	(0.14)	(0.19)
Other Costs ($Millions)	6.33	9.35	11.52	15.81	12.24	11.07
	(1.39)	(1.31)	(2.96)	(5.15)	(1.91)	(1.68)
% $<$ 1 yr	14.49	15.83	9.78	10.04	17.84	10.39
	(1.72)	(0.96)	(0.65)	(1.38)	(1.13)	(0.60)
% 1-4 yr	35.22	32.60	40.10	33.76	34.64	42.02
	(2.91)	(0.99)	(2.18)	(2.78)	(1.23)	(1.33)
% 5-10 yr	23.76	35.65	35.34	32.81	29.90	36.35
	(2.03)	(1.04)	(2.11)	(3.38)	(1.16)	(1.19)
% $>$ 11 yr	26.52	16.43	14.93	22.88	17.30	11.03
	(4.49)	(1.10)	(1.77)	(3.71)	(1.10)	(1.23)
Other						
% Unionized	0.13	0.12	0.12	0.16	0.14	0.09
	(0.04)	(0.01)	(0.02)	(0.05)	(0.01)	(0.02)
% Manuf	0.45	0.31	0.26	0.32	0.27	0.31
	(0.06)	(0.02)	(0.03)	(0.06)	(0.02)	(0.03)
Workplace						
# Mng Levels	2.12	1.89	2.62	1.52	1.69	1.92
	(0.16)	(0.07)	(0.12)	(0.19)	(0.12)	(0.10)
# Wkrs Superv.	12.15	14.64	18.95	10.65	11.49	15.09
	(1.65)	(0.56)	(2.41)	(0.96)	(0.47)	(0.92)
% Benchmarking	0.05	0.26	0.46	0.19	0.28	0.44
	(0.03)	(0.02)	(0.04)	(0.05)	(0.02)	(0.03)
% TQM	0.09	0.34	0.52	0.10	0.28	0.35
	(0.04)	(0.02)	(0.04)	(0.04)	(0.02)	(0.03)
% Mngers using PC	69.48	73.48	77.28	78.70	77.83	87.97
	(4.58)	(1.52)	(2.18)	(3.92)	(1.51)	(1.48)
% Other using PC	20.14	42.09	44.30	59.52	53.69	68.31
	(3.09)	(1.66)	(2.67)	(5.75)	(1.77)	(2.09)
N	64	553	194	53	543	265
System Frequencies	7.89	68.19	23.92	6.15	63.06	30.77