Evidence on the Employer Size-Wage Premium From Worker-Establishment Matched Data

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Abstract

In spite of the large and growing importance of the employer size-wage premium, previous attempts to account for this premium using observable worker or employer characteristics have met with limited success. The problem is that, while most theoretical explanations for the size-wage premium are based on the matching of employers and employees, previous empirical work has relied on either worker surveys with little information about a worker's employer, or establishment surveys with little information about workers. In contrast, this study uses the newly created Worker-Establishment Characteristic Database, which contains linked employer-employee data for a large sample of U.S. manufacturing workers and establishments, to examine seven explanations for the employer size-wage premium. A number of the explanations can account for some of the observed cross-sectional variation in worker wages. However, none of the explanations can fully account for the employer size-wage premium. In the end there remains a large, significant, and unexplained premium paid to workers of large employers.

I. Introduction

The fact that large employers pay higher wages than small employers has long been recognized as an important component of the variation in worker wages. This phenomenon was first documented by Moore (1911) and later confirmed by King (1923), Mellow (1982), Oi (1983), and Brown and Medoff (1989) among others. Brown, Hamilton and Medoff (1990, p. 30) report that workers in companies with 500 or more employees earn 35 percent higher wages than workers in companies with fewer than 500 employees, making the employer size-wage premium as large as the gender wage gap and larger than the wage differential associated with race and union status. Davis and Haltiwanger (1991) show that the gap in real hourly wages between production workers in plants with 20 to 49 employees and production workers in plants with more than 5000 employees increased by 79 percent between 1963 and 1986 and that the gap for nonproduction workers in these same plant increased by 49 percent over this period. Davis and Haltiwanger also show that this increase in the employer size-wage premium accounts for over one-third of the increase in wage inequality among U.S. manufacturing production workers between 1975 and 1986 (p. 154).

In spite of the large and growing importance of the employer size-wage premium, previous attempts to account for this premium in terms of observable worker or employer characteristics have met with limited success.[1] For example, Brown and Medoff (1989), using Current Population Survey (CPS) data, find that there remains a large and significant size-wage premium even after controlling for workers' age, sex, race, marital and union status, industry and occupation. Davis and Haltiwanger (1991), using data from the Longitudinal Research Database (LRD), are unable to fully account for the size-wage premium even after controlling for plant age, energy cost, product specialization, and four digit industry. The reason for this lack of success seems to be the lack of suitable data. While most theoretical explanations for the size-wage premium stress the matching of employers and employees as the driving force behind this phenomenon (e.g., Oi, 1983, 1990; Hamermesh, 1980, 1993; Barron, Black, and Lowenstein, 1987; Dunne and Schmitz, 1992), previous empirical work has relied on either

[1] The existence of the size-wage premium is a puzzle because empirical evidence shows that jobs with small employers are of much shorter duration than jobs with large employers due to the higher failure rate and greater turnover of employment among small employers (Brown, Hamilton, and Medoff, 1990; Davis, Haltiwanger and Schuh, 1993). Given this, the theory of equalizing differences says that workers in small firms and establishments should receive *higher* wages to compensate them for the increased risk of unemployment (Rosen 1986).

worker surveys with little information about the characteristics of a worker's employer, or establishment surveys with little information about the characteristics of workers in the plant.[2]

In contrast, this paper uses newly created employer-employee matched data to examine seven possible explanations for the employer size-wage premium that, for the most part, are impossible to examine without matched data. (1) The employer-size wage premium is due to a complementarity between worker skill and physical capital (Griliches, 1970; Hamermesh, 1980, 1993). (2) The size-wage premium is due to larger firms being managed by more skilled managers who hire more skilled workers (Oi, 1983). (3) The size-wage premium is the result of more skilled workers being matched together in larger plants (Baron, Black and Lowenstein, 1987; Kremer, 1993; Kremer and Maskin, 1995). (4) The employer size-wage premium is the result of larger plants and firms being more likely to employ sophisticated capital, such as computers, and in turn employing more skilled workers (Dunne and Schmitz, 1992; Reilly, 1995). (5) The size-wage premium reflects a trade off made by large firms in favor of higher wages and less monitoring of workers (Bulow and Summers, 1986). (6) The size-wage premium results from a positive correlation between the wages a firm pays it's workers and the firm's subsequent growth and survival (Brown and Medoff, 1989). (7) The employer size-wage premium is the result of rent sharing between large employers and their workers (Weiss, 1966; Mellow, 1982; Akerlof and Yellen, 1990).

This newly created data set, the Worker Establishment Characteristics Database (WECD), is unique in its ability to examine these hypotheses because it is the largest employer-employee matched database available for the U.S. The WECD consists of approximately 200,000 manufacturing workers who responded to the 1990 Decennial Census long form, linked to over 16,000 separate manufacturing establishments. Once linked to data for a worker's employer available in the Longitudinal Research Database (LRD), these data provide not only information on worker characteristics such as age, sex, race, and education, but also information about a worker's employer such as total output, total employment, capital stock, and the skill of the workforce. While the WECD has many attractive features, it is important to note that the WECD is not a random sample of either manufacturing workers or establishments (Troske forthcoming). However, results reported here and in previous work (Troske forthcoming) show that these data do replicate previously documented relationships

[2] One exception is the study by Reilly (1995) which finds that the employer size-wage premium is the result of workers in large plants having greater access to computers. However, the Reilly study is based on a rather small sample of workers and establishments located in the Maritime Provinces of Canada. Therefore, there is some question as to whether his findings generalize to more representative samples of workers and plants.

between worker characteristics and wages. This suggests that these data can be used to investigate possible explanations for the employer size-wage premium.

The results presented in this paper show that a number of the explanations for the employer size-wage premium can account for some of the observed cross-sectional variation in worker wages. Worker wages are higher in plants with a higher capital-labor ratio, in plants with a more skilled workforce, in plants that produce output in more concentrated markets, and in firms with more skilled managers. In addition, workers who work in plants with more intensive monitoring receive lower wages. However, only explanations (1) and (3) account for any of the size-wage premium and neither of these explanations account for more than one-half of the premium. In the end, there still remains a large, significant, and unexplained premium paid to workers in large plants and firms.

The rest of the paper is as follows. The next section reviews a number of possible explanations for the employer size-wage premium. Section III presents the results from an empirical examination of these explanations. Section IV concludes.

II. Explanations for the Employer Size-Wage Premium

A number of theories of the employer size-wage premium argue that employer size is a proxy for unobserved worker ability. One of the earliest such theories is the capital-skill complementarity hypothesis (Hamermesh, 1980, 1993). This explanation is based on the Lucas (1978) model which predicts that the most skilled managers manage the largest firms, both in terms of the number of employees and capital stock. If capital and worker skill are complements in production, then these managers will also employ the most skilled, highly paid workers. The capital-skill complementarity hypothesis implies that the observed size-wage premium arises from not controlling for the capital-labor ratio in a worker's plant.

A related explanation for the size-wage premium is the Oi model (1983). This model is similar to the Lucas model in that the most skilled managers manage the largest firms. However, in Oi's model managers must divide their time between two tasks, monitoring workers and managing the firm. More skilled managers are more adept at the latter task, all managers are equally proficient at the former task. Oi also assumes that more skilled workers require less monitoring.[3] Thus, more skilled

[3] One criticism of the Oi model is that there is no explanation for why more skilled managers are not also more skilled at monitoring workers, or why more skilled workers require less monitoring.

managers employ more skilled, highly paid, workers. In this hypothesis the size-wage premium results from not controlling for the skill of managers in a worker's firm.[4]

A third explanation for the size-wage premium assumes that employers care about the mix of workers in the plant. Employers find it more profitable to match high skilled workers with other high skilled workers and low skilled workers with other low skilled workers (Kremer, 1993; Kremer and Maskin, 1995). If there are large fixed costs associated with hiring more skilled workers, such as more formal recruiting and training processes, then large plants will be more likely to match high skilled, high paid workers together (Barron, Black, and Lowenstein, 1987). Here the size-wage premium arises from failing to control for the overall skill of the workforce in an individual worker's plant.

A final hypothesis for why employer size may be a proxy for unobserved worker ability is the model of Dunne and Schmitz (1992). Again, the Dunne and Schmitz model is based on the Lucas model so the most skilled managers manage the largest firms. In addition, large employers are more likely to employ more sophisticated capital equipment, such as computers, because they have larger amounts of output over which to amortize the fixed costs associated with adopting this type of capital. If there is also a complementarity between the "skill" of capital and the skill of workers, then large employers are also more likely to employ more skilled, highly paid workers. Thus, in the Dunne and Schmitz framework the size-wage premium results from failing to control for the skill of the capital in a worker's plant.[5]

There are also a number of explanations for the employer size-wage premium that are not based on the assumption that worker quality is positively correlated with employer size. For example, in the Bulow and Summers (1986) model workers are able to exert less than the optimal amount of effort in production. Employers have two means to deter this shirking, intensively monitoring workers or paying workers higher wages and firing them if they are caught shirking. Bulow and Summers show that if the cost of detecting shirking rises with the number of employees in the plant or firm, then

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[4] Note, none of these explanation, nor their implications, should be viewed as being mutually exclusive. Obviously, both the capital-skill complementarity hypothesis and the Oi model imply that more skilled managers manage larger firms and employ more skilled worker. I am focusing on what I view to be the main implication of these models.

[5] An alternative explanation is that plants which employ more sophisticated capital earn rents that they share with their workers. In either case the size-wage premium is due to not controlling for the skill of capital.

large employers will choose to pay higher wages and reduce the amount of monitoring (p. 308).[6] The observed size-wage premium arises from not controlling for the amount of monitoring that occurs in a worker's plant.

A related explanation hypothesizes that size is related to market power (Weiss, 1966; Mellow, 1982; Akerlof and Yellen, 1990). Large employers are more likely to be monopolists and earn rents. In order to elicit the optimal effort from their employees, these employers must share some of these rents with their workers. If this is the case then the observed size-wage premium results from not controlling for the market power of a worker's firm.[7]

The final explanation for the employer size-wage premium holds that employers which pay their workers "well" are more likely to survive and grow (Brown and Medoff, 1989).[8] Thus, including plant age in worker wage regressions should eliminate the estimated size-wage premium.

III. The Data

The data used in this study primarily come from the WECD and the LRD. The WECD is a cross-sectional database containing manufacturing workers' responses to the 1990 Decennial Census long form, along with a link to establishment data in the LRD. The LRD is a panel database consisting of establishment responses to the Census of Manufactures (CM) and the Annual Survey of Manufactures (ASM). The construction of these two data sets, the information contained in each, and possible problems with the matched data, will be discussed in turn.[9]

The WECD was constructed by matching manufacturing worker records from the 1990 Sample Detail File (SDF) to establishment records in the 1990 Standard Statistical Establishment List (SSEL).

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[6] One problem with the Bulow and Summers model is that it provides no explanation for why the cost of monitoring should rise with the number of employees in the plant or firm.

[7] It could be that this "market power" arises through employing more skilled workers who produce a higher quality product relative to the rest of the market. If this is the case then measures of market power may be a proxy for unobserved worker skill.

[8] Obviously, this hypothesis is the opposite of what would arise from a standard competitive model. Plants which pay above average wages should be more likely to shrink and fail. However, in a noncompetitive model, such as an efficiency wage model for example, if workers respond to higher wages by working harder, it may be the case that higher wages are positively correlated with firm growth and survival.

[9] See Troske (forthcoming) and McGuckin and Pascoe (1988) for a more complete discussion of these databases.

The 1990 SDF consists of all household responses to the 1990 Decennial Census long form. The SDF contains the standard demographic information for workers collected in the Census, along with detailed location information and a three-digit Census Industry code for each respondent's place of work. The SSEL is a complete list of all establishments in the U.S. in a given year. The SSEL contains detailed location information and a four-digit SIC code for each establishment along with a unique establishment identifier that is common to other Census Bureau economic surveys and censuses. Workers and establishments were matched using the detailed location and industry information available in both data sets.[10] The first step in the matching process was to keep only manufacturing establishments that were unique in an industry-location cell. Next, all workers indicating that they work in the same industry-location cell as an establishment were linked to the establishment. Then all matches based on imputed data were dropped.[11] Finally, the establishment's unique identifier was appended to the workers' records. This identifier enables the worker data to be linked to the employer data in the LRD.[12]

The second data set used in the analysis is the LRD. The LRD consists of every CM since 1963 (1963, 1967, 1972, 1977, 1982, 1987) as well as the 1973-90 ASMs.[13] To construct the data used in this analysis I link the WECD to the LRD using each establishment's identifier. Since the

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[10] For establishments in urban areas (primarily MSAs) a plant's location is coded at the block-level. For establishments in rural areas, a plant's location is coded at the place-level. The term "place" refers to either an incorporated governmental unit, or an area with a significant population concentration that is not incorporated but that has characteristics similar to incorporated places. For a more complete description of geographic codes see "1990 Census of Population and Housing-Guide Part A. Text" U.S. Bureau of the Census (1992).

[11] The only data that are imputed are the location or industry codes for workers in the SDF. Imputation of these data items is done by cold decking. In this process, when information for an individual is either missing or incomplete a record for another individual is randomly selected from a pool of individuals with similar characteristics. Then information from the selected record replaces the missing information in the original record. Obviously, using matches based on imputed data would increase the number of incorrect matches.

[12] The SSEL is used by the Census Bureau in conducting its various economic surveys and censuses. As such, it contains the street address for each establishment, along with geographic codes which identify an establishment's location down to the block level. However, other information for an establishment, such as the amount of inputs purchased or the total output produced in a given year, is only available from establishment responses' to censuses or surveys. Thus, once a worker record has been matched to an establishment in the SSEL, it still must be linked to the establishment's record in the LRD.

[13] The CMs are a complete census of all manufacturing establishments in a given year. The ASMs are a probability sample of establishments, surveyed over a five year period. A new ASM sample is drawn two years after a census, with the probability of an establishment being included in the ASM increasing with its total employment in the previous CM. Establishments with more than 250 employees in the previous CM are in the ASM with certainty. Thus, establishments that always have more than 250 employees will appear in every year in the LRD, while smaller establishments will only appear in the LRD in census years and for a five year period if they are in a given ASM.

hours worked, weeks worked, and earnings data for workers in the WECD refers to 1989, I link the WECD records to establishments in the LRD in 1989. In addition, since capital stock data are only available in Census years, I require all establishments in the data set to be in the LRD in both 1987 and 1989. Finally, to minimize the effect of outliers and reporting problems, I select workers who report working more than 30 weeks in the previous year, usually working more than 30 hours a week, and who report a wage that is within five standard deviations of the predicted wage from a standard log worker wage regression.[14] To help ensure that I have a representative sample of workers in a plant, I only keep plants with at least three workers matched to the plant. The resulting data set contains 129,901 workers matched to 3,841 establishments. From the WECD comes worker information such as age, education, sex, race, three-digit occupation, as well as usual hours worked last year, weeks worked last year, and annual earnings last year, all for 1989. In addition, data from the WECD allow me to know who works with whom. Thus, I am able to construct measures of the skill distribution of workers in a plant or firm. From the LRD comes employer information such as the total employment in both the plant and the firm, total capital stock and output, the age of the plant, and the ownership structure.

Tables 1 and 2 present descriptive statistics for workers and plants, respectively, that make up the primary data set, along with statistics from the underlying populations. Table 1 shows that, relative to all manufacturing workers in the SDF, workers in the WECD data are slightly more likely to be married, male, and receive higher wages. Table 2 shows that the plants in these data are much larger, more capital intensive, and more likely to be located in an MSA, than the typical plant in the LRD in 1989. The fact that plants in the WECD are larger than average helps explain why WECD workers receive higher wages than the typical manufacturing worker.

One concern with these data is that, because they are not a random sample of either workers or establishments, results based on these data may be biased. However, the numbers in tables 1 and 2 suggest that, if any selection is occurring, it is based on size. Since size only appears as an independent variable in my analysis it is not clear, a priori, why any of my results should suffer from

[14] Five standard deviations is 2.1 log points. There are 102 workers that are eliminated because they are outliers. While throwing out these workers does decrease the standard error of the estimates, it has very little affect on the point estimates (results available from the author). The 1990 Decennial Census asks workers to report the address of the establishment where they worked in the previous week. Keeping workers that usually work more than 30 hours a week and who worked more than 30 weeks in the previous year increases the probability that the worker was employed in the same establishment in 1989 (Troske, forthcoming).

selection bias.[15] However, whenever appropriate, I will compare results from these data with results based on the underlying population data, as well as with results from previous research based on alternative data sets.

IV. Empirical Investigation of the Employer Size-Wage Premium

A) *Replicating Previous Results*

I begin by postulating an earnings function in which wages depend on both worker characteristics and the characteristics of a worker's employer. Let,

$$lnW_i = \alpha + \boldsymbol{X_i}\beta + \boldsymbol{Z_i}\gamma + u_i, \quad \textbf{(1)}$$

where W_i is the wage of worker *i*, $\mathbf{X_i}$ is a vector of worker *i*'s characteristics, $\mathbf{Z_i}$ is a vector of characteristics of worker *i*'s employer, and u_i is a worker specific error term.

To begin the analysis, table 3 presents results from estimating equation (1) in a number of different ways. Column (1) presents results from estimating equation (1) on a random sample of workers from the SDF who meet the same criteria as workers in the WECD. Equation (1) is estimated including the standard set of worker characteristics in $\mathbf{X_i}$ (a quartic in experience, education, race, sex, marital status, along with 11 occupation dummies) and setting $\gamma=0$. Column (2) presents the results from estimating equation (1) on workers in the WECD, again with the standard set of worker characteristics in $\mathbf{X_i}$ and setting $\gamma=0$. Column (3) presents the results from estimating equation (1) on WECD workers including the log of establishment employment (LTE) and the log of firm employment

[15] See Troske (forthcoming) for further evidence that selection seems to be related to size and that this does not appear to affect the results from standard worker wage regressions. In addition, to further examine the sensitivity of these results to the nonrandom selection, I have re-estimated the basic wage regressions found in table 3 in two ways. First, by weighting the data so that the cross-worker establishment size distribution in these data matches the cross-worker establishment size distribution found in the May 1988 Current Population Survey. Second, including in the regressions the inverse Mill's ratio estimated from a probit regression of the conditional probability that a worker appears in the data. In neither case are the estimated coefficients significantly different from those reported in the paper (results available from the author).

(LFTE) in $\mathbf{Z_i}$ and setting $\beta=0$.[16] Finally, column (4) presents results from estimating equation (1) on workers in the WECD including the standard set of worker characteristics in $\mathbf{X_i}$ and LTE and LFTE in $\mathbf{Z_i}$.

Comparing the coefficients reported in columns (1) and (2) shows that the WECD data produces wage regression results similar to the SDF data. In both regressions the coefficients on Female, Black, Ever Married, the interaction between Female and Ever Married, and the interaction between Female and Black are similar and show that women earn 13-15% less than men, black men earn 5-7% less than nonblack men, married men earn 14-17% more than single men, and black and nonblack women earn approximately the same wages. In addition, both regressions show the usual quartic in experience and both show that at the mean level of experience (20.9 years for SDF workers and 22.6 years for WECD workers) the return to an additional year of experience is 1.1%. Finally, both regressions show that wages rise with education. However, the return to education is smaller among the WECD workers.

The results in column (3) show that without controlling for worker characteristics there exists a large employer size-wage premium. The coefficient of 0.064 on LTE in column (3) shows that workers in plants with log employment one standard deviation (about 1.4) above mean log employment receive 18% higher wages than workers in plants with log employment one standard deviation below mean log employment.[17,18] The coefficient of 0.033 on LFTE shows that workers in firms with log employment one standard deviation (about 2.2) above the mean receive 15% higher wages than workers in firms with log employment one standard deviation below the mean.

The coefficients on LTE and LFTE in column (4) in table 3 are both encouraging and revealing. The estimates are encouraging because they show that there are large and significant

[16] Firm employment is measured as the sum of the total employment in all establishments that are part of the same firm and are in the 1987 CM. This includes both production establishments and auxiliary establishments. An auxiliary establishment is defined as an establishment whose employees are engage in support activities (e.g., management, research and development, warehousing, electronic data processing) performed centrally for manufacturing establishments that are part of the same firm. The cross-worker mean of this variable is given in table 1.

[17] The mean and standard deviation of plant and firm log employment are given in appendix table 2. Through out this paper the term "establishment size-wage premium" will refer to the difference in log wages between workers in plants one standard deviation above mean log employment and workers in plants one standard deviation below mean log employment. The term "firm size-wage premium" is defined in a like fashion.

[18] One problem with using standard OLS here is that the plant and firm-level explanatory variables are not independent across workers in the same plant or firm. Therefore, the regression error may be correlated across these grouped workers resulting in standard errors that could have a significant downward bias. To correct for this problem all of the standard errors reported in this paper have been adjusted to reflect this intragroup error correlation (See Moulton, 1986 and White, 1980 for a further discussion of this issue and the appropriate correction).

establishment and firm size-wage premia in these data, even after controlling for worker characteristics. The 0.047 coefficient on LTE shows that workers in plants with log employment one standard deviation above the mean receive 13% higher wages than workers in plants with log employment one standard deviation below the mean. The 0.026 coefficient on LFTE in the same regression shows that workers in firms with log employment one standard deviation above the mean earn 11% higher wages than workers in firms with log employment one standard deviation below the mean. These results are also encouraging because they are similar to previous studies which found that the firm size-wage premium is generally smaller than the establishment size-wage premium (Brown and Medoff, 1989).

These results are revealing because they provide support for the hypothesis that more skilled workers work in large establishments. Comparing the coefficients on LTE and LFTE in columns (3) and (4) shows that the establishment size-wage premium falls by 26% once I control for the observable skill of the worker, while the firm size-wage premium drops by 21%. Comparing the coefficients on the experience variables in columns (2) and (4) shows that at the mean level of experience the return to an additional year of experience falls from 1.1% to 0.7% once I control for establishment and firm size. Finally, comparing the coefficients on the education variables in columns (2) and (4) shows that the estimated return to education also falls once I control for the size of a worker's establishment and firm. Since SDF workers work in smaller plants and firms, this finding also accounts for the difference in the return to education between the SDF and WECD workers seen in columns (1) and (2).[19]

B) *Examining Explanations for the Size-Wage Premium*

1) Worker Skill

To examine the hypothesis that the size-wage premium reflects the fact that large firms hire more skilled workers I estimate equation (1) including measures of the skill of the workforce in the

[19] Examining the size-wage premium by worker type shows that managers and professional workers receive the smallest premium, blue collar workers receive the largest and technical, sales, and clerical workers receive a premium in between these two extremes (appendix table 1). This is again consistent with previous results (Brown and Medoff, 1989).

plant in $\mathbf{Z}_i$ along with LTE and LFTE.[20] These skill measures are: the mean years of potential experience of workers in the plant (Mean Experience), the percent of workers in the plant that are scientists, engineers or technical workers (Percent Skill), the percent of workers who have some post-secondary education but not a college degree (Percent Some College), and the percent of workers with at least a college degree (Percent Degree).[21] These measures are based on all workers in the WECD matched to the same plant.[22] The results from this regression are reported in column (1) of table 4.

The positive and significant coefficients on Mean Experience, Percent Some College, and Percent Degree again show that more skilled workers do tend to work together. In addition, the coefficients on LTE and LFTE show that this is correlated with plant and firm size. The coefficient of 0.037 on LTE in column (1) translates into an 11% establishment size-wage premium which is 20% smaller than the estimated premium without controlling for the skill of the workforce. The coefficient of 0.020 on LFTE in column (1) translates into a 9% firm size-wage premium which is 18% smaller than the premium estimated without workforce skill in the regression.[23] The matching of more skilled workers into larger employers does seem to be part of the story. However, even after controlling for these effects, there still exists a large establishment and firm size-wage premium. The matching of more skilled workers together in larger plants does not appear to be the complete story.

Since these plant-level measures of worker skill are based on a sample of workers matched to the plant, they are all going to be measured with error. However, even though I know the number of workers matched to each plant, I have not implemented a formal correction for the measurement error bias. This is because the correction would require a consistent estimate of the variance of the measurement error, which varies by plant depending on the true proportion of workers in any particular category. (For example, at one extreme in a plant with no workers with a college degree,

[20] Both the worker skill and capital-skill complementarity hypothesis are explanations for why there is a firm size-wage effect. In order to use them as an explanation for an establishment size-wage effect I must assume that within multi-plant firms there is a positive correlation across plants in the skill of managers.

[21] Workers who have a two year degree from a vocational or junior college are considered to be workers who have some post-secondary education, but not a college degree (Percent Some College). The cross-worker means of these variables are given in table 1.

[22] I have also constructed these skill measures using all workers matched to the same *firm* and repeated the analysis without any significant changes in the results.

[23] A Wald test of the hypothesis that the coefficients on LTE and LFTE are the same in the two regressions shows that we can reject this hypothesis at the 0.01% significance level.

the variance of the measurement error in the Percent Degree variable is zero). Previous work has found that measurement error corrections of this type (with non-homogeneous error variances across observations) results in near-singular covariance matrices because of a high ratio of error variance to total variance (Cockburn and Griliches, 1987).

However, I am concerned about the effect of measurement error on these results. To examine this effect I have estimated all of the regressions in columns (1) and (3) in table 4 separately for plants above and below median employment (732 workers) and above and below median percent of workers matched to the plant (11 percent). In none of these regressions is it the case that including the worker skill variables accounts for a majority of either the establishment or firm size-wage premium (results available from the author). Therefore, it appears that the presence of measurement error in the right hand side variables does not affect my conclusion that the matching of more skilled workers together in large plants and firms is only a partial explanation for the size-wage premium.

2) Capital-Skill Complementarity

To examine whether the employer size-wage premium is the result of a complementarity between capital and worker skill, I estimate equation (1) including the log of the capital-labor ratio in a worker's plant (K/L) in $\mathbf{Z}_i$ along with LTE and LFTE.[24] The results from this regression are reported in column (2) in table 4. The positive and significant coefficient on K/L in this regression supports the capital-skill complementarity hypothesis, workers who work in more capital intensive plants are paid higher wages.

Comparing the coefficient on LTE in this regression with the coefficient reported in table 3 column (4) shows that including K/L in the regression has almost no impact on the establishment size-wage premium. This is identical to the result in Reilly (1995) which finds that worker wages are positively correlated with the capital-labor ratio in the plant, but that this does not account for the establishment size-wage premium. However, comparing the coefficients on LFTE in this regression with the coefficient reported in table 3 column (4) shows that the capital-skill complementarity

[24] I have also estimated equation (1) including the capital-labor ratio for a worker's *firm* in $\mathbf{Z}_i$. The results are identical.

hypothesis can account for some of the firm size-wage premium. Including K/L in the regression reduces the estimated firm size-wage premium by 27%.[25]

Since the capital-skill complementarity hypothesis implies that more skilled workers work in larger, more capital-intensive plants, column (3) presents results from estimating equation (1) including LTE, LFTE, K/L and the workforce skill measures, in $\mathbf{Z}_i$. The coefficient on LTE in column (3) is identical to the coefficient in column (1). Adding K/L does not account for any more of the establishment size-wage premium than is accounted for by adding measures of worker skill. The coefficient on LFTE in column (3) shows that including both worker skill and K/L does account for a significant portion of the firm size-wage premium. The coefficient of 0.013 on LFTE in column (3) translates into a 6% firm size-wage premium, which is 45% smaller that the estimated premium without controlling for K/L and workforce skill. While it appears that the capital-skill complementarity hypothesis can account for some portion of the firm size-wage premium most of this premium remains unexplained. In terms of the capital-skill complementarity model these results suggest that there is a positive relationship between the size and capital intensity of a firm. However, these results also show that within a firm there is not a strong relationship between establishment size and capital intensity (although there is a strong relationship between capital intensity and worker skill).

3) Plant Age

To investigate the hypothesis that plants which pay their worker's higher wages are more likely to survive and grow, I include the log of plant age in $\mathbf{Z}_i$. For 86% of the plants in these data, plant age is based on two supplements to the ASM given in 1979 and 1981 which asks plant managers the year the plant originally began operating at the present location. For the rest of the plants in the data (those born after 1981) plant age is measured from the year the plant first appears in the LRD.[26] The results from this regression are reported in column (4) of table 4. The coefficient on plant age shows that the age of a worker's plant is uncorrelated with a worker's wage. This is identical to the results in Brown and Medoff (1995) who show that the positive correlation between plant age and wages found in previous plant studies (Dunne and Roberts, 1990a, 1990b; Davis and Haltiwanger, 1991; Troske,

[25] Again a Wald test of the hypothesis that the coefficient on LFTE is the same in the two regressions is rejected at the 0.01% significance level.

[26] Plant Age is missing for 148 plants containing 1406 workers. Estimating equation (1) for workers with nonmissing plant age results in coefficients of 0.047 and 0.026 on LTE and LFTE, respectively.

forthcoming) is the result of plant age proxying for cross-plant differences in worker characteristics such as experience and education. In addition, the coefficients on LTE and LFTE in column (4) show that plant age has no effect on the size-wage premium.

4) Rent Sharing

Next I investigate the hypothesis that large plants pay higher wages because they have market power and are sharing rents generated from this power with their workers in order to obtain the optimal amount of worker effort (Akerlof and Yellen, 1990). To examine this hypothesis I include two measures of a plant's market power in $\mathbf{Z}_i$. The first is the proportion of the total value of a seven digit product produced by a worker's plant (Share).[27] The second is the Herfindahl index of concentration for the primary five digit product produced by a worker's plant. The Herfindahl index is measured as the sum of squares of the share of total output from the fifty largest firms producing the five digit product. It is based on data from the 1987 CM. The results from this regression are given in column (5) in table 4.

The coefficient on Share in column (5) both has the wrong sign and is insignificant. The coefficient on the Herfindahl index is positive and significant, indicating that workers in plants which produce output in a concentrated market receive higher wages.[28] However, including these variables has very little impact of the coefficients on LTE and LFTE. One interpretation of these findings is

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[27] Share is measured as the total value of a seven digit product produced by a plant in 1987, divided by the total value of the product produced by all manufacturing plants in 1987. For plants who produce more than one seven digit product, I use the product with the largest value in 1987. Seven digit product information is missing for 688 workers in 31 plants. I measure share using the plant as the unit of observation as opposed to the firm because it is almost impossible to associate a large, multi-plant firm with a single seven digit product. However, I have repeated this analysis measuring share as the plant's share of output in a four digit industry as well as the *firm's* share of output in a four digit industry. In both cases, the results are identical.

[28] I also estimate equation (1) including the value-added per employee in a worker's plant and the profit per employee in a worker's plant in $\mathbf{Z}_i$. Value-added is measured as the total value of shipments from the plant minus the cost of materials. Profit is measured as the total value of shipments from the plant minus the costs of materials and labor (I measure these variables in levels instead of logs because for some plants in these data these measures are negative). Obviously both of these variables, along with the Herfindahl index, could be a proxy for unobserved worker ability. The coefficients on both of these variables are positive and significant. However, neither variable has any effect on the coefficient on LTE or LFTE.

that, while firms with market power do share rents with their workers, market power is uncorrelated with the size of a plant or firm.[29]

5) Managerial Skill

I turn next to examining whether the employer size-wage premium reflects more skilled managers managing larger plants and firms and also hiring more skilled workers. Obviously this theory addresses why nonmanagerial workers receive a size-wage premium. Therefore, I focus exclusively on nonmanagerial workers in this part of the analysis.[30] Column (1) in table 5 presents the results from estimating equation (1) on nonmanagerial workers, just including LTE and LFTE in $\mathbf{Z_i}$. The coefficients of 0.053 and 0.030 on LTE and LFTE, respectively, shows that nonmanagerial workers receive a 15% establishment size-wage premium and a 13% firm size-wage premium.

To examine whether these premia are correlated with managerial skill, I include measures of the skill of managers in a worker's *firm* in $\mathbf{Z_i}$. I use two measures to control for managerial skill. First, the mean experience of all managers in a worker's firm (Manager Exp.) and second, the percent of managers in a worker's firm that have a post graduate degree (Percent Grad. Degree). These measures are based on all managers in the WECD matched to the same firm. The results from estimating equation (1) including these two measures in $\mathbf{Z_i}$ are reported in column (2) of table 5.

The coefficients on Manager Exp. and Percent Grad. Degree are positive and significant suggesting that more skilled managers do hire more skilled workers. However, the coefficients on LTE and LFTE show that this relationship is uncorrelated with the size of the plant or firm. Even after controlling for the skill of managers in the firm, nonmanagerial workers still receive a 15% establishment size-wage premium and a 13% firm size-wage premium.[31]

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[29] An alternative explanation is that firms and plants operating in more concentrated markets employ more skilled workers.

[30] I define nonmanagerial workers as workers who are not classified in the managerial and other professional occupations. Thus, I exclude any accountants, lawyers, or economists who work in manufacturing plants, but include secretaries, sales staff, technical support workers, along with both supervisory and nonsupervisory blue collar workers.

[31] To again check for the effects of measurement error I have estimated all of the regressions in table 5 separately for workers in above and below median employment plants and for workers in plants above and below median percent of workers matched to the plant. I find similar results in all four subsets of data. In addition, in the

6) Monitoring

Next I examine whether the size-wage premium reflects a trade-off made by larger plants and firms in favor of paying higher wages and reducing the monitoring of workers. Since this is an explanation for why nonsupervisory workers receive a size-wage premium, I focus exclusively on nonsupervisory workers in this section.[32] Column (3) in table 5 presents the results from estimating equation (1) on nonsupervisory workers, just including LTE and LFTE in $\mathbf{Z}_i$. The coefficients on LTE and LFTE in this regression show that nonsupervisory employees receive a 15% establishment size-wage premium and a 14% firm size-wage premium.

I use the number of supervisory workers per employee in the plant (Percent Supervisors) as the measure of monitoring intensity in the plant.[33] Column (4) in table 5 presents the results from estimating equation (1) including Percent Supervisors in $\mathbf{Z}_i$, along with LTE and LFTE. The coefficient of -0.015 on Percent Supervisors indicates that there is a significant trade-off between worker wages and the level of supervision in the plant. However, comparing the coefficients on LTE and LFTE in columns (3) and (4) shows that this trade-off is largely uncorrelated with the number of workers in a plant or firm. Even after controlling for the percent of supervisors in the plant, nonsupervisory workers still receive a 15% establishment size-wage premium and a 13% firm size-wage premium. The reason that Percent Supervisors has very little impact on the size-wage premium is that this variable in uncorrelated with either the size of a worker's plant or firm (the cross-worker correlation between Percent Supervisors and LTE and LFTE is -0.06 and -0.09, respectively). In terms of the Bulow and Summers (1986) model these results suggest that the cost of monitoring workers is not a function of the size of the plant or the firm.

7) The Skill of Capital

The next hypothesis I investigate is whether the employer size-wage premium is the result of failing to control for the skill of capital in a worker's plant. To ensure that this analysis is similar to

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regressions in columns (3) and (4) I have replaced the percent supervisors variable with the percent of nonproduction workers in the plant. Since this latter variable is based on the plant-level data, and not on the worker data, it is not subject to the same measurement error. The results are the same with this alternative measure.

[32] I define nonsupervisory workers as technical, sales, clerical and blue collar workers who are not supervisors. I eliminate both all supervisors and all managerial and other professional workers from the analysis.

[33] This is measured as the number of workers matched to the plant whose occupation code indicates they are a supervisor, divided by the total number of workers matched to the plant.

previous work (Krueger, 1993; Reilly, 1995), I measure the skill of capital as the log of total new investment in computers in the plant in 1987 divided by total employment in the plant in 1987 (Computer Investment). This information was collected from a random sample of plants in the 1987 Census of Manufacturers.[34] While I would prefer to use a stock measure as opposed to a flow measure, previous research has shown that computer investment is related to both the level and the change in the skill of workers at both the plant and industry-level (Berman, Bound and Griliches, 1994; Autor, Katz and Krueger, 1996; Doms, Dunne and Troske, 1997).

Column (1) in table 6 presents the results from estimating equation (1) just including Computer Investment in $\mathbf{Z}_i$. Column (2) presents the results from including LTE, LFTE and Computer Investment in $\mathbf{Z}_i$. In addition, to distinguish between working in a plant with more skilled capital from working in a plant with more capital, I also include K/L in $\mathbf{Z}_i$ in column (2). Finally, column (3) presents the results from including all of the plant and firm-level variables that have been found to be statistically significantly related to worker wages (including Computer Investment).

Similar to previous work, the coefficient on computer investment in column (1) shows that the workers who have access to a computer at work receive higher wages even after controlling for worker characteristics (Krueger, 1993; Dunne and Schmitz, 1992; Reilly, 1995). The results in column (2) suggest that this observed relationship is the result of a positive correlation between size, capital intensity, and capital skill. Once I include LTE, LFTE, and K/L in $\mathbf{Z}_i$ the relationship between computer investment and worker wages disappears.[35]

The results in column (3) in table 6 are almost identical to the results in column (3) in table 4. Even after controlling for all of the employer characteristics that I have found to be significantly related to wages, there remains a large and significant establishment and firm size-wage premia.

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[34] In particular, this information was collect from plants that were part of the ASM in 1987. Plants were asked to report their total expenditure on new computers and peripheral data processing equipment. Because this information was only collected from a subset of plants in the 1987 CM I can only construct this measure for 118,320 workers. The cross-worker mean of this variable is given in table 1. Estimating equation (1) on just these workers results in coefficients of 0.047, 0.018, and 0.074 on LTE, LFTE, and K/L, respectively.

[35] This is consistent with the findings in Dunne (1994) which show that larger plants are more likely to use all types of advanced technology. This result is also consistent with the results in Schmidt and Zimmermann (1991) which uses data for German workers and employers to show that innovation is unrelated to the size-wage premium. I have constructed two alternative measures of the skill of capital in the plant. The first measure in the average of computer investment in the plant in 1977, 1982, 1987, and 1992. The second measure is a dummy variable which equals one if computer investment is positive in any of these years. For both of these alternative measures the coefficient on computer investment is positive in regressions where I do not control for employer characteristics, but becomes insignificant once I add LTE, LFTE and K/L to the regression.

How do these results compare with previous research? The results in column (1) are very similar to the results in Krueger (1993) -- without controlling for the characteristics of a worker's employer, workers who have access to a computer at work earn higher wages. However, the results in column (2) suggest that if Krueger had included additional controls for the characteristics of a worker's employer, such as size and capital intensity, the observed relationship between computer use and wages would have disappeared.[36]

These results appear to be somewhat at odds with the findings in Reilly (1995). Using data on a matched sample of private sector workers and establishments located in the Maritime Providence of Canada, Reilly shows that almost all of the establishment size-wage premium disappears once he controls for whether or not a worker's firm has access to a computer. One difference between the Reilly study and this study is that Reilly's data contain nonmanufacturing establishments and workers. Repeating Reilly's analysis using just manufacturing establishments and workers shows that access to a computer accounts for none of the establishment size-wage premium among manufacturing workers (results available from the author). This suggests that, while computer use may account for the size-wage premium outside of manufacturing, it does not appear to account for this phenomenon among manufacturing workers.

IV. Conclusion

This paper uses a unique new employer-employee matched data set to examine seven possible explanations for the employer size-wage premium. While the results show that a number of these hypotheses can account for some of the observed cross-sectional variation in worker wages, only two account for any of the observed employer size-wage premium. The matching of more skilled workers together in larger plants accounts for approximately 20% of both the establishment and firm size-wage

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[36] For a subsample of workers in the WECD I have information on the presence of a computer in a worker's plant. This information comes from the 1988 Survey of Manufacturing Technology (SMT). The 1988 SMT is a survey that asked plant managers in SIC industries 34-38 about their use of seventeen different technologies (including computers). The results from estimating equation (1) using this alternative measure of the skill of capital are presented in appendix table 3. The coefficient on Computer in column (3) shows that workers who work in a plant with a computer earn 11 percent higher wages. Using Krueger's data restricted to workers in industries 34-38 I find that workers who use a computer at work earn 17 percent higher wages (results available from the author). However, the results in column (4) in appendix table 3 again show that once I control for the size and capital intensity of a worker's plant, the relationship between computer use and wages disappears. These results add further support to the conjecture that the difference between the results reported in this paper and Krueger's results is the addition of controls for the characteristics of establishments.

premia, while the capital-skill complementarity hypothesis accounts for approximately 45% of the firm size-wage premium. In all cases there still remains a large, significant, and unexplained employer size-wage premium.

So in the end we are still left with the question: "Why do large employers pay higher wages?" One possible explanation that is consistent with the results reported in this paper is that large employers hire better workers and that both large employers, and their employees, are more likely to invest in firm specific human capital.[37] Recent research on training shows that large employers are more likely to offer training and that their employees are more likely to invest in firm specific training (Barron, Black and Lowenstein, 1987; Holtmann and Idson, 1991; Idson, 1993). Thus, large employers may not only be hiring more skilled workers but they may also be more likely to "produce" more skilled workers. Hopefully, as we develop more employer-employee matched data with information on employer training, we will be better able to examine this hypothesis.

[37] Brown and Medoff (1989) examine this issue by interacting employer size with experience and tenure and find very little evidence in support of this hypothesis. However, they reach the same conclusion as I do, that more complete data is needed to investigate the relationship between size, training, and wages.

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TABLE 1

Summary Statistics for Manufacturing Workers in the Sample Detail File (SDF) and for WECD Workers

	1990 SDF Manufacturing Workers	WECD Workers
Percent Male	68.4	73.5
Percent White	92.1	92.9
Percent Ever Married	83.1	87.7
Education		
Percent With a High School Diploma or Less	59.0	60.0
Percent with Some College or A.A. Degree	25.9	25.9
Percent with B.A. or B.S.	11.7	10.7
Percent with Post Graduate Degree	3.8	3.4
Occupation		
Managerial and Professional	18.5	16.0
Technical, Sales, Clerical and Other White Collar	19.7	17.3
Supervisors	7.0	7.4
Nonsupervisory Blue Collar	54.6	59.2
Region		
Northeast	20.7	26.3
Midwest	33.9	47.4
South	31.3	21.4
West	14.9	5.3
Mean Age	39.1 (38)	40.7 (40)
Hourly Wage	12.60 (10.77)	14.05 (12.98)
Log (Hourly Wage)	2.37 (2.38)	2.52 (2.56)
Mean Wage or Salary Income Last Year (1989)	27,753 (23,500)	30,982 (28,869)
Mean Log 1989 Plant Employment	---	6.73
Mean Log 1987 Firm Employment	---	9.00
Mean Log Capital-Labor Ratio	---	3.96

TABLE 1 (Continued)

	1990 SDF Manufacturing Workers	WECD Workers
Mean Plant Age	---	38.5
Mean Share of Output	---	0.03
Mean Herfindahl Index	---	0.14
Mean Computer Investment	---	0.40
Mean Experience of Workers in the Plant	---	22.6
Percent of Skilled Workers in the Plant	---	27.5
Percent of Workers with at least Some College	---	69.3
Percent of Workers at least a College Degree	---	14.1
Number of Workers	668,011	129,901

Note: The numbers in parentheses are medians of the distributions. The statistics from the SDF are based on a random sample of workers who meet the same criteria as the WECD workers: work more than 30 weeks in the previous year, usually worked more than 30 hours a week in the previous year and report a wage that is within five standard deviations of the predicted wage from a standard log wage regression.

TABLE 2

Summary Statistics for All Manufacturing Plants in the LRD and for WECD Plants

	LRD Plants	Sample Plants
Mean Total Employment	241.25	425.43
Mean Log (Total Employment)	4.58	5.34
Mean Earnings Per Worker	24,459	26,744
Percent Production Workers in Plant	71.7	70.5
Mean Capital Stock (in thousands of dollars)	15,392	32,939
Mean Log(Capital Stock) (in thousands of dollars)	3.49	3.70
Percent of Plants that are part of Multi-Unit Firm	69.0	84.2
Percent Located in an MSA	75.5	86.3
Percent in Durable Industries	52.7	45.4
Region		
Northeast	21.4	31.0
Midwest	29.1	40.3
South	31.3	23.2
West	18.1	5.7
Percent of Workers Matched to the Plant	---	10.1
Mean Firm Employment	---	15,305.2
Percent Skilled Workers in the Plant	---	
Percent of Workers with at least Some College	---	
Percent of Workers With a College Degree	---	
Percent of Supervisors in the Plant	---	8.2
Share of Output	---	0.07
Mean Herfindahl Index	---	0.09
Number of Observations	49,254	3,841

Note: LRD plants must be in the LRD in both 1989 and 1987.

TABLE 3

Individual Log Wage Regression

	Just Worker Characteristics - SDF Workers (1)	Just Worker Characteristics - WECD Workers (2)	Just Plant Characteristics - WECD Workers (3)	Both Worker and Plant Characteristics - WECD Workers (4)
Exp	0.05 (0.001)	0.05 (0.002)	----	0.05 (0.002)
Exp^2*10	-0.02 (0.0004)	-0.01 (0.001)	----	-0.02 (0.001)
Exp^3*1000	0.03 (0.001)	0.02 (0.004)	----	0.03 (0.004)
Exp^4*100000	-0.02 (0.001)	-0.01 (0.003)	----	-0.02 (0.003)
Female	-0.13 (0.003)	-0.15 (0.008)	----	-0.16 (0.008)
Ever Married	0.17 (0.002)	0.14 (0.006)	----	0.13 (0.005)
Black	-0.07 (0.003)	-0.05 (0.010)	----	-0.06 (0.010)
Female*Black	0.07 (0.004)	0.06 (0.013)	----	0.06 (0.012)
Female*Ever Married	-0.20 (0.003)	-0.16 (0.008)	----	-0.14 (0.007)
Less than High School Diploma	----	----	----	----
High School Diploma	0.15 (0.002)	0.11 (0.005)		0.09 (0.005)
Some College, No Degree	0.24 (0.002)	0.19 (0.006)	----	0.16 (0.006)
B.A. or B.S. Degree	0.48 (0.002)	0.39 (0.009)	----	0.35 (0.008)
Graduate Degree	0.64 (0.003)	0.55 (0.012)	----	0.48 (0.012)
LTE	----	----	0.064 (0.006)	0.047 (0.005)
LFTE	----	----	0.033 (0.003)	0.026 (0.003)
Adj. R^2	0.46	0.45	0.24	0.49
Number Obs.	667341	129901	129901	129901

Note: Standard errors are in parentheses. All regressions include controls for two-digit industry, region, and whether the plant is located in a metropolitan statistical area (MSA). The regressions in columns (1) and (3) also included eleven occupation dummies. All standard errors have been corrected for heteroskedasticity and for the clustered sampling scheme.

TABLE 4

Individual Log Wage Regression, Including Measures of: the Capital-Labor Ratio, Workforce Skill, Plant Age, and Market Power

	Including Workforce Skill (1)	Including K/L (2)	Including Workforce Skill and K/L (3)	Including Log of Plant Age (4)	Including Market Power Measures (5)
LTE	0.037 (0.004)	0.045 (0.005)	0.037 (0.004)	0.047 (0.005)	0.044 (0.006)
LFTE	0.020 (0.002)	0.017 (0.002)	0.013 (0.002)	0.026 (0.003)	0.024 (0.003)
K/L	----	0.073 (0.006)	0.066 (0.005)	----	----
Mean Experience	0.012 (0.001)	----	0.011 (0.001)	----	----
Percent Skilled	-0.020 (0.038)	----	-0.040 (0.032)	----	----
Percent Some College	0.331 (0.025)	----	0.269 (0.032)	----	----
Percent Degree	0.506 (0.051)	----	0.450 (0.044)	----	----
Log(Plant Age)	----	----	----	0.002 (0.005)	----
Share	----	----	----	----	-0.049 (0.032)
Herfindahl Index	----	----	----	----	0.198 (0.060)
Adj. R^2	0.50	0.50	0.51	0.49	0.49
Number of Observations	129901	129901	129901	128495	129213

Note: Standard errors are in parentheses. All of these regressions include the same set of worker characteristics as the regressions in table 3 along with controls for two-digit industry, region, whether the plant is located in a metropolitan statistical area (MSA) and eleven occupation dummies. All standard errors have been corrected for heteroskedasticity and for the clustered sampling scheme.

TABLE 5

Individual Log Wage Regression Including: Measures of Managerial Skill and Percent of Supervisors in the Plant

	Nonmanagerial Employees		Nonsupervisory Employees	
	Just Including Size (1)	Including Size with Measures of Manager Skill (2)	Just Including Size (3)	Including Size and Percent Supervisors (4)
LTE	0.053 (0.006)	0.051 (0.006)	0.053 (0.006)	0.053 (0.006)
LFTE	0.030 (0.003)	0.029 (0.003)	0.031 (0.003)	0.030 (0.003)
Mean Exp.	----	0.002 (0.001)	----	----
Percent Grad. Degree	----	0.135 (0.032)	----	----
Percent Supervisors	---	----	----	-0.015 (0.006)
Adj. R^2	0.44	0.44	0.44	0.44
Number of Observations	103568	103568	94661	94661

Notes: Standard errors are in parentheses. All of these regressions include the same set of worker characteristics as the regressions in table 3 along with controls for two-digit industry, region, whether the plant is located in a metropolitan statistical area (MSA) and eleven occupation dummies. All standard errors have been corrected for heteroskedasticity and for the clustered sampling scheme.

TABLE 6

Individual Log Wage Regression Including Measure of Computer Investment

	Just Including Computer Investment (1)	Including Size, K/L, and Computer Investment (2)	Including All Variables that are Correlated with Wages (3)
LTE	----	0.047 (0.005)	0.037 (0.005)
LFTE	----	0.018 (0.002)	0.013 (0.002)
K/L	----	0.074 (0.006)	0.066 (0.006)
Computer Investment	0.017 (0.006)	-0.003 (0.004)	-0.005 (0.003)
Mean Experience	----	----	0.011 (0.001)
Percent Some College	----	----	0.283 (0.037)
Percent College Degree	----	----	0.458 (0.052)
Herfindahl Index	----	----	0.086 (0.056)
Adj. R^2	0.48	0.50	0.51
Number of Observations	118320	118320	118320

Notes: Standard errors are in parentheses. All of these regressions include the same set of worker characteristics as the regressions in table 3 along with controls for two-digit industry, region, whether the plant is located in a metropolitan statistical area (MSA) and eleven occupation dummies. All standard errors have been corrected for heteroskedasticity and for the clustered sampling scheme.

Appendix Table 1

Individual Log Wage Regressions for Managers, Technical, Sales and Clerical Workers and Blue Collar Workers

	Managers (1)	Technical, Sales and Clerical Workers (2)	Blue Collar Workers (3)
Exp	0.043	0.051	0.055
	(0.004)	(0.003)	(0.003)
Exp^2*10	-0.001	-0.017	-0.020
	(0.003)	(0.002)	(0.002)
Exp^3*1000	0.001	0.027	-0.024
	(0.001)	(0.005)	(0.007)
$Exp^4*100000$	-0.003	-0.02	-0.02
	(0.010)	(0.004)	(0.006)
Female	-0.14	-0.11	-0.17
	(0.014)	(0.013)	(0.011)
Ever Married	0.13	0.15	0.12
	(0.011)	(0.010)	(0.006)
Black	-0.10	-0.11	-0.04
	(0.029)	(0.016)	(0.009)
Female*Black	0.10	0.09	0.05
	(0.042)	(0.023)	(0.014)
Female*Ever Married	-0.15	-0.17	-0.12
	(0.016)	(0.014)	(0.010)
Less than High School Diploma	----	---	----
High School Diploma	0.08	0.08	0.09
	(0.025)	(0.009)	(0.005)
Some College, No Degree	0.21	0.15	0.15
	(0.025)	(0.010)	(0.007)
B.A. or B.S. Degree	0.45	0.36	0.24
	(0.027)	(0.013)	(0.011)
Graduate Degree	0.60	0.50	0.29
	(0.029)	(0.024)	(0.023)
LTE	0.031	0.044	0.54
	(0.005)	(0.005)	(0.006)
LFTE	0.004	0.021	0.032
	(0.003)	(0.003)	(0.003)
Adj. R^2	0.40	0.43	0.46
Number Obs.	20772	23751	85378

Note: Standard errors are in parentheses. All regressions include controls for two-digit industry, region, and whether the plant is located in a metropolitan statistical area (MSA). The regressions in columns (1) and (3) also included eleven occupation dummies. All standard errors have been corrected for heteroskedasticity and for the clustered sampling scheme.

Appendix Table 2

The Mean and Standard Deviation of Establishment and Firm Log (Employment)

	Mean	Standard Deviation
LTE	6.73	1.43
LFTE	9.00	2.21

Appendix Table 3

Individual Log Wage Regression Including Measure of Computer in the Plant

	Just Including Size (1)	Including Size and K/L (2)	Just Including Computer (3)	Including Size, K/L and Computer (4)
LTE	0.028	0.030	----	0.031
	(0.007)	(0.004)		(0.006)
LFTE	0.043	0.030	----	0.030
	(0.004)	(0.004)		(0.004)
K/L	----	0.068	----	0.068
		(0.011)		(0.011)
Computer	----	----	0.112	-0.013
			(0.027)	(0.024)
Adj. R^2	0.50	0.51	0.46	0.51
Number of Obs.	34401	34401	34401	34401

Notes: Standard errors are in parentheses. All of these regressions include the same set of worker characteristics as the regressions in table 3 along with controls for two-digit industry, region, whether the plant is located in a metropolitan statistical area (MSA) and eleven occupation dummies. All standard errors have been corrected for heteroskedasticity and for the clustered sampling scheme.