Establishment wage differentials

Microdata from the BLS Occupational Employment Statistics program are providing researchers a fresh approach to use in studying how wages are influenced by the establishment in which an individual works

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Economists have long known that individual wages depend on a combination of employee and employer characteristics, as well as the interaction of the two. Although understanding establishment wage differentials is important for labor economics and theories of the firm, little is known about the magnitude of these wage differentials. Primarily this stems from the lack of microdata linking individuals to the establishments where they work, but also it reflects the technical difficulties associated with separating out employee and employer effects. This article provides new findings using microdata from the Occupational Employment Statistics program at the Bureau of Labor Statistics that permit both of these issues to be addressed. The data used for the research contain information from more than half a million establishments, in all sectors of the economy, with wages reported for over 34 million individuals in more than 800 occupations. This article contributes to the growing body of literature analyzing the impact of firms' compensation policies, and specifically, that which explores the topic of employer effects on wages.

The main contributions made by this research are the empirical estimates of the ways in which wages are influenced by the establishment at which the individual works. The decomposition of wages into employee and employer effects uses Ordinary Least Squares (OLS) regressions to partition the sum of squares of wages into worker and establishment components. The results show that employer effects contribute substantially to earnings differences—the results from the basic model show that controlling for detailed occupation, establishment dummies account for more than one-fifth of individual wage variation. The results also show that these large employer effects can be only partially explained by observable characteristics, such as the location, size, age, and industry of the establishment.

In order to examine the breadth of the establishment wage differentials across occupations, correlations of occupational wages within establishments were calculated. The results are striking—establishments that pay well for one occupation also pay well for others. Even after controlling for observable establishment characteristics, positive wage correlations within establishments for occupations that are closely related were found, as well as for occupations that one would not expect to be closely related in the production process. This empirical finding may offer interesting implications for theories that attempt to explain the source of establishment wage differentials.

Background and literature review

Empirical estimates of establishment wage differentials. Establishment wage differentials are defined as the wage premium which controls for occupation and individual characteristics, and is common to all individuals in an establishment. While economists have known about these differentials ever since studies of employer wage policies were undertaken in the 1940s and 1950s, it is only

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recently, with the advent of large electronically linked employer-employee micro-databases, that systematic statistical analyses of establishment wage differentials have been conducted. The empirical strategy used by almost all of these recent studies has been to define the differentials as the percentage of individual wage variation accounted for by adding establishment indicators to a regression that already includes controls for occupation and worker characteristics.

In 1991, Erica Groshen wrote the seminal article in the modern literature.[1] Using data for six manufacturing industries from the Bureau of Labor Statistics Industry Wage Surveys, she decomposed earnings variation into occupational and establishment differentials as well as the interaction between the two. She found that establishments contribute substantially to earnings differences—when controlling for occupation, establishment wage differentials account for a sizeable amount of individual wage variation, ranging from a low of 12 percent in the cotton and man-made textiles industry to a high of 58 percent in the industrial chemicals industry.

Groshen's methodology and basic findings have been replicated with other data in recent studies. Using data from 241 establishments that responded to the Bureau of Labor Statistics White Collar Pay Survey, and controlling for individual worker characteristics, Stephen Bronars and Melissa Famulari found that 18 percent of individual wage variation is due to establishment wage differentials.[2] Using data on 50,000 managerial positions in 39 companies, and controlling for job characteristics and job requirements, K. C. O'Shaughnessy, David Levine, and Peter Cappelli found that 8 to 9 percent of individual wage variation is due to firm (or establishment) wage differentials.[3] Finally, in a study of the Brazilian and Chilean labor markets, Alejandra Mizala and Pilar Romaguera report that 7 to 9 percent of Brazilian wage variation and 6 to 18 percent of Chilean wage variation can be attributed to firm wage differentials.[4]

These studies cited above use cross-sectional data with multiple individuals per establishment (or firm) and report estimates of differentials controlling for observed differences across individuals. It is natural to wonder whether these estimated differentials might be measuring unobserved differences in average worker skill across establishments, which would result from a sorting of individuals into establishments based on characteristics unobserved by the data analyst. Evaluating this hypothesis requires panel data with multiple observations per individual and multiple individuals per establishment. John Abowd and Francis Kramarz show that firm wage differentials in France account for 25 percent of wage variation conditional on observed worker characteristics and account for 19 percent of wage variation conditional on both observed and unobserved worker heterogeneity.[5] These results demonstrate that using longitudinal microdata to account for unobserved differences across individuals diminishes but does not remove the estimated employer effect on wages.

Theoretical explanations for establishment wage differentials. Erica Groshen's classic 1991 reference effectively documented the theoretical explanations for establishment wage differentials.[6] She proposed and evaluated five explanations as the reasons why individual wages vary among employers. These explanations for establishment wage differentials can also be found in the somewhat older and more firmly established industry wage differentials literature.[7]

The first explanation is that of *labor quality*, in which employers systematically sort workers by ability as predicted by team production models. Groshen offers two key reasons explaining why the sorting model is not the sole source of establishment wage differentials. First, differentials are estimated conditional on controls for occupation, and Groshen argues that detailed occupational information can serve as a proxy quite effectively for standard human capital variables. Similarly, industry wage differentials are estimated conditional on human capital controls, and these differentials still exist after controlling for unobserved individual ability in a longitudinal analysis. Second, it is difficult to reconcile the sorting explanation with the finding that establishment and industry wage differentials apply to all occupations.

A second explanation offered for the existence of establishment wage differentials is that of *compensating differentials*. Compensating differentials are defined as a wage premium paid to workers compensating them for undesirable working conditions. This explanation is problematic because the risk of injury is occupation specific, and does not necessarily apply to all workers in the establishment. Furthermore, the industry wage differentials literature has empirically examined and rejected the hypothesis of compensating differentials as an explanation for the wage differentials.

A third explanation suggested for the existence of establishment wage differentials is that *costly information may generate random variation* in wages across employers. For example, employers may profit from individuals who find it costly to search for alternative wage offers, or employers who hire infrequently may not have adjusted their pay structure since their last hiring cycle. Groshen rejects

this explanation based on evidence that employer wage differentials are persistent over time.

A fourth explanation proposed for the existence of establishment wage differentials is *efficiency wages*. Efficiency wages refer to employers paying their workers more than the market-clearing wage in order to increase worker productivity. Efficiency wage theories, particularly those that emphasize the humanistic qualities of morale, loyalty, and teamwork, offer one explanation as to why workers in all occupations receive the establishment wage premium. Unfortunately, little, if any, direct empirical evidence has been found to exist that fully supports a relationship of this nature between efficiency wages and establishment wage differentials.

A fifth explanation is a model in which wage variation across employers results from *workers bargaining over rents, or employers sharing profits with employees* for other reasons. These models can generate the result that the establishment wage premium covers all occupations. The bargaining models are difficult to evaluate, however, especially their applicability outside the union sector. Groshen finds some support for rent-sharing models, citing research from the empirical literature which tends to show a positive relationship between an individual's wage and the employer's or the industry's profits.

The literature on employer-size wage differentials also offers and evaluates similar explanations regarding the reasons why the individuals' wages are associated with the establishment where they work.[8] Briefly, the evidence from this literature suggests that theories based on compensating differentials, union avoidance, monitoring, and rent sharing accruing from product market power contribute little to explaining the employer-size wage differential. Sorting is a more likely possibility: Charles Brown and James Medoff find that labor-quality variables reduce the simple size coefficients by roughly one-half, and controlling for unobserved labor quality in a longitudinal fixed-effects regression reduces the size coefficients by an additional 5 to 45 percent.[9] Even so, there remains a significant size effect after controlling for both observed and unobserved labor quality. Kenneth Troske uses linked employer-employee microdata that allows him to evaluate explanations which cannot be analyzed using most databases.[10] He finds that more skilled workers tend to work together, as predicted by team production models, and this grouping reduces the employer-size wage premium by approximately 20 percent. However, Troske concludes that a large and significant employer-size wage premium still exists and remains unexplained.

A recent and comprehensive analysis of employer effects on wages is provided by John Abowd and Francis Kramarz.[11] Their study decomposes estimates of a simply estimated employer differential into components that are due to unobserved individual heterogeneity and unobserved firm heterogeneity. Using data for both France and the United States, Abowd and Kramarz find that 45 to 50 percent of the "raw" industry wage differential is due to unobserved firm heterogeneity, and 71 to 76 percent of the "raw" firm size wage differential is due to unobserved firm heterogeneity. While the sources of the unobserved firm heterogeneity remain unknown, these empirical estimates document that employer effects on wages do indeed exist.

The wage decomposition methodology

This article's empirical analysis is based on the methodology used by Erica Groshen.[12] It has a measure of log wages W_{iej} for individual "i" in establishment "e" in occupation "j." By decomposing the variation in wages into components attributable to occupational differentials, establishment differentials, and differences across individuals, and following Groshen, the following four regressions are estimated:

(Occ)
$$W_{iej} = \mu + OCC_j\alpha + \varepsilon_{iej},$$

(Est)
$$W_{iej} = \mu + EST_e\beta + \varepsilon_{iej},$$

(Main)
$$W_{iej} = \mu + OCC_j\alpha + EST_e\beta + \varepsilon_{iej},$$

(Cell)
$$W_{iej} = \mu + OCC_j\alpha + EST_e\beta + (OCC_j{*}EST_e)\gamma + \varepsilon_{iej}.$$

In these regressions, OCC_j is a vector of dummy variables indicating the occupation, EST_e is a vector of dummy variables indicating the establishment, and $(OCC_j{*}EST_e)$ is a vector of dummy variables indicating an occupational-establishment job cell.

This wage decomposition partitions the sum of squares of wages into its various components. As Groshen mentions, this statistical technique avoids imposing structure on unbalanced data. The OES microdata are unbalanced, with a different number of workers across occupations and a different number of occupations across establishments. The R-squareds from each of the four regressions are the key to the decomposition (not reported are the regression coefficients α, β, or γ). Notational definitions for these R-squareds are R^2_{Occ}, R^2_{Est}, R^2_{Main}, and R^2_{Cell}.

As seen from the first three regressions above, log wages are regressed on vectors of occupation and establishment indicators separately, and then on both sets of indicators together (the main-effects model). The marginal contribution of establishment indicators to the main-effects model, relative to the regression with occupation indicators only, measures the portion of wage variation associated unambiguously with the establishment indicators. This is calculated as $(R^2_{Main} - R^2_{Occ})$. Similarly, the marginal contribution of occupation indicators is calculated as $(R^2_{Main} - R^2_{Est})$ and measures the portion of wage variation associated unambiguously with the occupation indicators.

The explanatory power of occupation and establishment together in the main-effects model does not necessarily equal the sum of the marginal contributions to the main-effects model from the establishment indicators and from the occupation indicators. This difference, which is measured as $(R^2_{Est} + R^2_{Occ} - R^2_{Main})$, is referred to as the "joint" explanatory power of occupation and establishment. This joint contribution is nonzero if there is any sorting of occupations across establishments. Positive sorting occurs if high-wage occupations are concentrated in high-wage establishments $(R^2_{Est} + R^2_{Occ} > R^2_{Main})$, whereas negative sorting occurs if high-wage occupations are concentrated in low-wage establishments $(R^2_{Est} + R^2_{Occ} < R^2_{Main})$. Research taken from the existing literature has shown positive sorting does occur between occupational wage differentials and establishment wage differentials.[13]

In the fourth regression above, the job-cell interactions measure the wage premium paid to a particular occupation in a particular establishment above or below the wage premium predicted by the occupational and the establishment differentials. The relative contribution of the job cells in our wage decomposition is measured as $(R^2_{Cell} - R^2_{Main})$. The explanatory power of job cells captures what Erica Groshen and David Levine refer to as the "internal (wage) structure effect."[14] In a wage regression, the job cells can reflect many factors. For example, the initial phases of an establishment's production process may resemble the average in the industry requiring workers of average ability, but its finishing process may require workers of higher-than-average ability. Another example may be that the wage profile in the establishment is tilted, either because of on-the-job training given to entry-level workers, or as a result of deferring wages in order to offer workers incentives not to shirk in their duties. The job-cell effects could also reflect differences in occupational tenure across establishments.

The final contribution to wages is the individual contribution. This is measured as $(1 - R^2_{Cell})$ and is the portion of the total sum of squares of wages that cannot be explained by occupation and establishment indicators. This individual contribution is undoubtedly due to unobserved wage effects that result from gender, education, tenure, or other individual attributes that are not captured by the interactions of the occupation and establishment indicators.

In summary, four regressions of log wages on various combinations of occupation and establishment dummy variables are estimated, with the focus on the R-squareds from these four regressions. Simple comparisons of these R-squareds provide information on occupational and establishment wage differentials, the degree of occupational sorting across establishments, the importance of employer-specific wage structures, and the importance of unobserved individual heterogeneity (controlling for occupation and establishment).

The data

As stated in the beginning of this article, microdata from the Occupational Employment Statistics (OES) program at the Bureau of Labor Statistics (BLS) were used. The OES is an annual mail survey measuring occupational employment and wage rates by geographic area and by industry. Approximately 400,000 establishments are surveyed each year. The OES survey covers all full-time and part-time wage and salary workers in nonfarm industries. The survey does not cover the self-employed, owners and partners in unincorporated firms, household workers, or unpaid family workers. In 1996, the OES program began collecting wage-rate data along with occupational-employment data in every State. The survey is designed as a three-year sample, with one-third of both the certainty and noncertainty strata sampled each year.

The 1996 and 1997 microdata were used in this analysis. The sample had 573,586 establishments with no imputations of wage or employment data.[15] It included occupation and wage information for all of the 34,453,430 individuals employed in these establishments, along with information on the location, industry, size, and age of each establishment.

The OES survey asks establishments to fill out the elements of a matrix, in which occupations are listed on the rows and various wage ranges are listed in the columns. For each occupation, respondents are asked to report the number of employees paid within specific wage intervals. An example of the OES survey form, with many of the occupations omitted for presentation purposes, is given in the appendix. Separate OES survey forms are designed for

each industry group and list the occupations that are typical in the industry. Survey forms contain between 50 and 225 OES occupations, depending on the industry classification and size class of the sampled establishments. If an occupation is not listed on a survey form, the respondent is asked to include the information on a supplemental page. To reduce paperwork and respondent burden, no survey form contains every OES occupation.

The occupational data in the 1996 and 1997 OES surveys are based on the 1980 Standard Occupational Classification (SOC) System. Occupations are classified based upon work performed, skills, education, training, and credentials. There are 824 detailed occupations in this OES microdata. In some of the analysis, these 824 detailed (5-digit) occupational codes were aggregated into 7 major (1-digit) occupations: Management, Professional, Sales, Clerical, Services, Agricultural, and Production.

The wage information provided by establishments in the OES survey is recorded in intervals for either hourly or annual rates of pay. (See appendix.) The actual values used for these intervals are the mean wage of all workers within the interval, as computed from the National Compensation Survey for that year.[16] All of the wages used in this analysis were measured, in real terms, as the natural logarithm of hourly rates of pay.[17]

The obvious strengths of the OES microdata for economic analysis are the sample size and the level of occupational detail. Specifically, there are more than half a million establishments in our sample, with wages reported for over 34 million individuals in more than 800 occupations. As such, the OES data can be viewed as a type of matched employer-employee microdata. The second strength of the OES is the employer-reported occupational data. Although the dataset contains no information regarding the worker's demographic characteristics (such as age, race, or gender) or the worker's labor-market information (such as tenure, experience, or training), it should be noted that the detailed occupational information should be a proxy for a worker's skills. This latter point will be considered in the discussion of the empirical estimates.

Empirical wage decompositions

Basic results. The results of our wage decomposition are shown in table 1. In the first column, estimates using the seven 1-digit occupation measures are reported. In the second column, estimates using the 824 5-digit occupation measures are reported. The first four rows report the R-squareds from the regressions described earlier. These regressions are estimated from the sample of more than 34 million individuals.[18] The next five rows report the various contributions of occupation and establishment to wage variation.

Table 1. Wage variance decomposition

Item	(1)	(2)
R^2: W_{iej} = Occ dummies	0.2870	0.5466
R^2: W_{iej} = Est dummies	.4955	.4955
R^2: W_{iej} = Occ + Est	.6468	.7552
R^2: W_{iej} = Occ * Est	.7252	.8798
Occupation	.1513	.2597
Joint occupation and establishment	.1357	.2869
Establishment	.3598	.2086
Job cell	.0784	.1246
Individual	.2748	.1202
One-digit occupation	Yes	—
Five-digit occupation	—	Yes

NOTE: 34,453,430 individuals. Wages are measured in natural logarithms: Mean=2.5133, Std.Dev.=0.5446.

There are 7 1-digit occupations, 824 5-digit occupations, and 573,586 establishments.

The R-squareds in the fourth row of table 1 demonstrate that knowing an individual's occupation and workplace provides substantial information towards explaining individual wage variation. More than 72 percent of wage variation is explained by knowing the individual's 1-digit occupation and establishment, and close to 88 percent of wage variation is explained by knowing the individual's 5-digit occupation and establishment. This implies that approximately 12 percent of wage variation is left to unobserved individual heterogeneity (although it is acknowledged that this is probably an underestimate because of the use of interval data).

The importance of the information contained in the detailed occupational categories becomes clear from an analysis of the first row in table 1. In the first column, the seven 1-digit occupation indicators explain more than 28 percent of wage variation. In the second column, the 824 5-digit occupation indicators explain more than 54 percent of wage variation. This empirically confirms the belief that the OES occupational data provide meaningful information about the work performed in the job, as well as the skills, education, training, and credentials of the persons performing the work. The R-squareds in the second row illustrate that establishment indicators alone explain approximately half of individual wage variation.

In the lower half of table 1, the decomposition of individual wage variation into its component parts is reported.

By looking at the second column, which is based on regressions of log wages on detailed-occupation dummies and establishment dummies, it may be seen that 26 percent of wage variation is associated unambiguously with occupation, and 21 percent of wage variation is associated unambiguously with information on the individual's establishment. An important part to understand is the sorting among occupations and establishments—this joint contribution accounts for 29 percent of wage variation. The final portion of the explained wage variation is the job-cell contribution, which accounts for slightly more than 12 percent of wage variation. The residual 12 percent of wage variation in the OES data is due to unobserved variation across individuals within a job cell.

It is worthwhile to compare the results of this study's wage decomposition with the results reported by Erica Groshen.[19] If a computation is run on the simple average across the six industries reported by Groshen, her results fall in between the results reported in columns 1 and 2 of table 1. For example, Groshen's estimates imply that occupation indicators account for a mean of 20 percent of wage variation, and establishment indicators account for a mean of 32 percent of wage variation. This article's estimates of the occupation effect range from 15 to 26 percent, and the estimates of the establishment effect range from 21 to 36 percent. Estimates of the joint-sorting effect (14 to 29 percent), the job-cell effect (8 to 12 percent), and the individual effect (12 to 27 percent) are also comparable to the means of the estimates reported by Groshen (17 percent, 10 percent, and 22 percent, respectively).

The estimates in table 1 provide interesting insight into the labor market and the wage-setting practices of businesses. The occupation and establishment information in the OES data explain most of the wage variation across individuals. Not surprisingly, detailed information on the individual's occupation explains a sizable amount of wage variation. Building on a small but growing literature, substantial establishment wage differentials are found.

Sensitivity analysis. The R-squared of 0.8798 in table 1 is unusually high if it is compared with most earnings regressions based on worker surveys. This article is not the first study to find such a high R-squared when employers are included: Erica Groshen finds that "occupation and establishment identity alone can explain over 90 percent of wage variation among blue-collar workers."[20] It is notable that this high R-squared is achieved despite the fact that education and other individual determinants of wages are not available, confirming that occupation serves as a strong proxy for these factors. This is also supported by the finding that the residual individual component falls from 0.27 to 0.12 when moving from 1-digit to 5-digit occupation controls.

However, it is possible that, despite the fact that the OES survey contains some of the most detailed and accurate occupational data available in any dataset, the R-squared may be inflated for technical reasons—the wage intervals in which the data are reported may be "too wide" relative to the wage variation within establishments. Clearly, as the occupational classifications become more detailed, or as the wage intervals become wider, the average number of wage intervals reported per job cell will decrease and the R-squareds will increase. In the longer working paper version of this article, we have examined the possibility that this may be a source of bias by undertaking an extensive sensitivity analysis. Specifically, in that version, an econometric framework was presented that simulates how the interval method of collecting individual wage data affects the estimates from our wage decomposition. It was found that collecting individual wage data as intervals in an establishment survey does not distort the conclusions drawn from our wage decomposition. Indeed, the sensitivity analysis in the longer working paper supports the notion that an important source of earnings variation

Table 2. The effect of observable establishment characteristics on empirical wage decompositions

Item	(1)	(2)	(3)	(4)	(5)	(6)
R^2: $W_{iej} = X$	0.0833	0.0243	0.0727	0.1294	0.2955	0.3469
R^2: $W_{iej} = Occ + X$	.5884	.5499	.5684	.5658	.6104	.6515
Establishment effect	.2086	.2086	.2086	.2086	.2086	.2086
Explained	.0418	.0033	.0218	.0192	.0638	.1049
Unexplained	.1668	.2053	.1868	.1894	.1448	.1037
County controls	Yes	—	—	—	—	Yes
Age controls	—	Yes	—	—	—	Yes
Size controls	—	—	Yes	—	—	Yes
Major industry controls	—	—	—	Yes	—	Yes
4-digit industry controls	—	—	—	—	Yes	Yes

NOTE: 34,453,430 individuals. Wages are measured in natural logarithms: Mean=2.5133, Std.Dev.=0.5446.

There are 7 1-digit occupations, 824 5-digit occupations, and 573,586 establishments. There are 3,194 counties, 5 age categories, 9 size categories, 10 major industries, and 937 4-digit industries.

comes from between, rather than within, establishment variation.[21]

A closer examination of establishment wage differentials. In column 2 of table 1, 20.9 percent of wage variation is found to be attributable to differences across establishments. This provides strong evidence for establishment wage differentials. These estimated differentials, however, might simply reflect cost-of-living differences across establishments in different geographical areas, or might be acting as a proxy for other characteristics, such as size or industry. The importance of these effects is explored by modifying the decomposition to include establishment-level explanatory variables, such as age, size, industry, and county in the right-hand side of the wage regression.

The wage decomposition is now based on five regressions, for which the additional regression is:

$$W_{iej}^{(Occ,X)} = \mu + OCC_j\alpha + X_e\delta + \varepsilon_{iej}.$$

The components of X_e are dummy variables for industry, county, age, and size. The R-squared from this fifth regression is notationally defined as $R^2_{Occ,X}$. Because these explanatory variables are linear combinations of the establishment dummies, the establishment contribution of the wage decomposition can be decomposed into two pieces: the explained and the unexplained contribution. The explained component of the establishment effect is defined as $(R^2_{Occ,X} - R^2_{Occ})$, and the unexplained component of the establishment effect as $(R^2_{Main} - R^2_{Occ,X})$. These two components sum to the total establishment effect in table 1, which is calculated as $(R^2_{Main} - R^2_{Occ})$.

The wage decompositions controlling for the effects of observable establishment characteristics are presented in table 2. In column 1, the wage decomposition controlling for any county effects, including cost-of-living differences that are common within counties, are presented. These county controls account for one-fifth of the estimated establishment wage differentials (0.0418/0.2086), and thus local area differences explain some of the reasons why wages vary across establishments. Similarly, in columns 2 through 5 of table 2, the conclusion is reached that age, size, and industry can each explain only a small portion of the reasons why wages vary across establishments. When all observable effects are controlled for together in column 6 of table 2, half of the estimated establishment wage differentials are accounted for. It may be concluded that establishment wage differentials can be only partially explained by observable establishment characteristics, and thus, establishment wage differentials are an important explanation for the reasons why wages vary across individuals.

Further empirical results. Many of the explanations put forward for the existence of employer effects on wages vary in importance for different industries. For example, capital-labor complementarity should be more important in the goods-producing industries than in the service-providing industries, unionization rates vary dramatically across industries, and skill sorting should be more important in industries that produce heterogeneous output. The results presented in table 3 show noticeable differences across major industries. Establishment wage differentials are most important in construction, mining, manufacturing, and transportation and public utilities (TCPU); they are least important in public administration; finance, insurance and real estate (FIRE); agriculture; and services. Establishment wage differentials explain 37 percent of wage variation in construction, yet only 16 percent of wage variation in the services industry. A number of reasons for these industry differences are possible: the traditional goods-producing industries are more unionized than the other sectors (with the exception of public administration), and these industries may well have greater variation in capital usage.

Interestingly, the construction and services industries are also quite different with regard to the contribution of occupational sorting: this component of the wage decomposition contributes little to variation in earnings in construction, but is quite important in services. This suggests that establishments in the construction industry bundle their workers in very similar ways, while establishments in the services industry bundle their workers very differently.

It is equally rewarding to analyze differences by establishment size. As seen in table 4, the importance of establishment wage differentials drops markedly and monotonically with the size of the establishment. Establishment wage differentials explain 30 percent of wage variation for establishments with two to nine employees, yet explain 16.5 percent of wage variation for the largest establishments. Also, it may be seen that the percentage of the establishment effect which can be explained by observed characteristics rises with the size of the establishment. The finding that small establishments exhibit more variation, both total and unexplained, in their contribution to wages is consistent with the notion that small establishments are more idiosyncratic than large establishments with regard to their personnel and paysetting practices.[22]

Table 3. Wage variance decomposition, by major industry

Item	Agriculture	Mining	Construction	Manufacturing	TCPU
R^2: W_{iej} = X	0.2819	0.4187	0.2511	0.3542	0.3114
R^2: W_{iej} = Occ	.5960	.4858	.3332	.5112	.4496
R^2: W_{iej} = Occ + X	.6596	.7042	.5325	.6765	.5826
R^2: W_{iej} = Est	.4340	.5284	.4556	.5144	.4844
R^2: W_{iej} = Occ + Est	.7666	.7829	.7017	.7855	.7171
R^2: W_{iej} = Occ * Est	.8921	.9114	.8595	.9110	.8565
Occupation	.3326	.2545	.2461	.2711	.2327
Joint occupation and establishment	.2634	.2313	.0871	.2401	.2169
Establishment	.1706	.2971	.3685	.2743	.2675
Explained	.0636	.2184	.1993	.1653	.1330
Unexplained	.1070	.0787	.1692	.1090	.1345
Job cell	.1255	.1285	.1578	.1255	.1394
Individual	.1079	.0886	.1405	.0890	.1435
Number of individuals	268,958	180,110	1,358,346	6,020,917	1,895,225
Number of establishments	10,995	3,744	47,434	73,390	31,136
Number of 5-digit occupations	229	287	391	643	502

Item	Wholesale	Retail	FIRE	Services	Public administration
R^2: W_{iej} = X	0.1612	0.1912	0.2032	0.2937	0.2207
R^2: W_{iej} = Occ	.4778	.4575	.5319	.6075	.4282
R^2: W_{iej} = Occ + X	.5547	.5516	.6111	.6769	.5615
R^2: W_{iej} = Est	.3880	.3784	.3465	.4360	.2909
R^2: W_{iej} = Occ + Est	.7063	.6932	.7028	.7630	.6111
R^2: W_{iej} = Occ * Est	.8789	.8466	.8376	.8802	.7626
Occupation	.3183	.3148	.3563	.3270	.3202
Joint occupation and establishment	.1595	.1427	.1756	.2805	.1080
Establishment	.2285	.2357	.1709	.1555	.1829
Explained	.0769	.0941	.0792	.0694	.1333
Unexplained	.1516	.1416	.0917	.0861	.0496
Job cell	.1726	.1534	.1348	.1172	.1515
Individual	.1211	.1534	.1624	.1198	.2374
Number of individuals	1,568,727	4,367,477	1,553,429	10,914,875	6,325,366
Number of establishments	53,433	134,886	36,408	167,371	14,789
Number of 5-digit occupations	559	534	409	759	669

NOTE: 34,453,430 individuals. Wages are measured in natural logarithms: Mean=2.5133, Std.Dev.=0.5446. There are 7 1-digit occupations, 824 5-digit occupations, and 573,586 establishments. There are 3,194 counties, 5 age categories, 9 size categories, 10 major industries, and 937 4-digit industries. Explanatory variables "X" are county, age, size, and 4-digit industry.

Occupational wages within establishments

The empirical evidence from the wage decompositions highlights the importance of the establishment itself for understanding the variation of individual wages. Even after controlling for observable characteristics that vary across establishments, substantial evidence of establishment wage differentials was found. By definition, these establishment wage differentials measure the wage premium paid to all workers in the establishment, regardless of occupation. This study now turns toward examining the correlations of occupational wages within establishments. The analysis here is motivated by the team-production model, well described by Michael Kremer.[23] Simply put, in this model, workers of similar skill will be grouped together in firms—highly skilled supervisors will work with highly skilled production workers. This reflects the complex nature of a multi-stage production process that requires the coordinated and successful completion of distinct tasks. In many production processes, it is not possible for several low-skilled workers to substitute for one high-skilled worker. Empirically, this should result in a positive correlation of occupational wages within establishments.

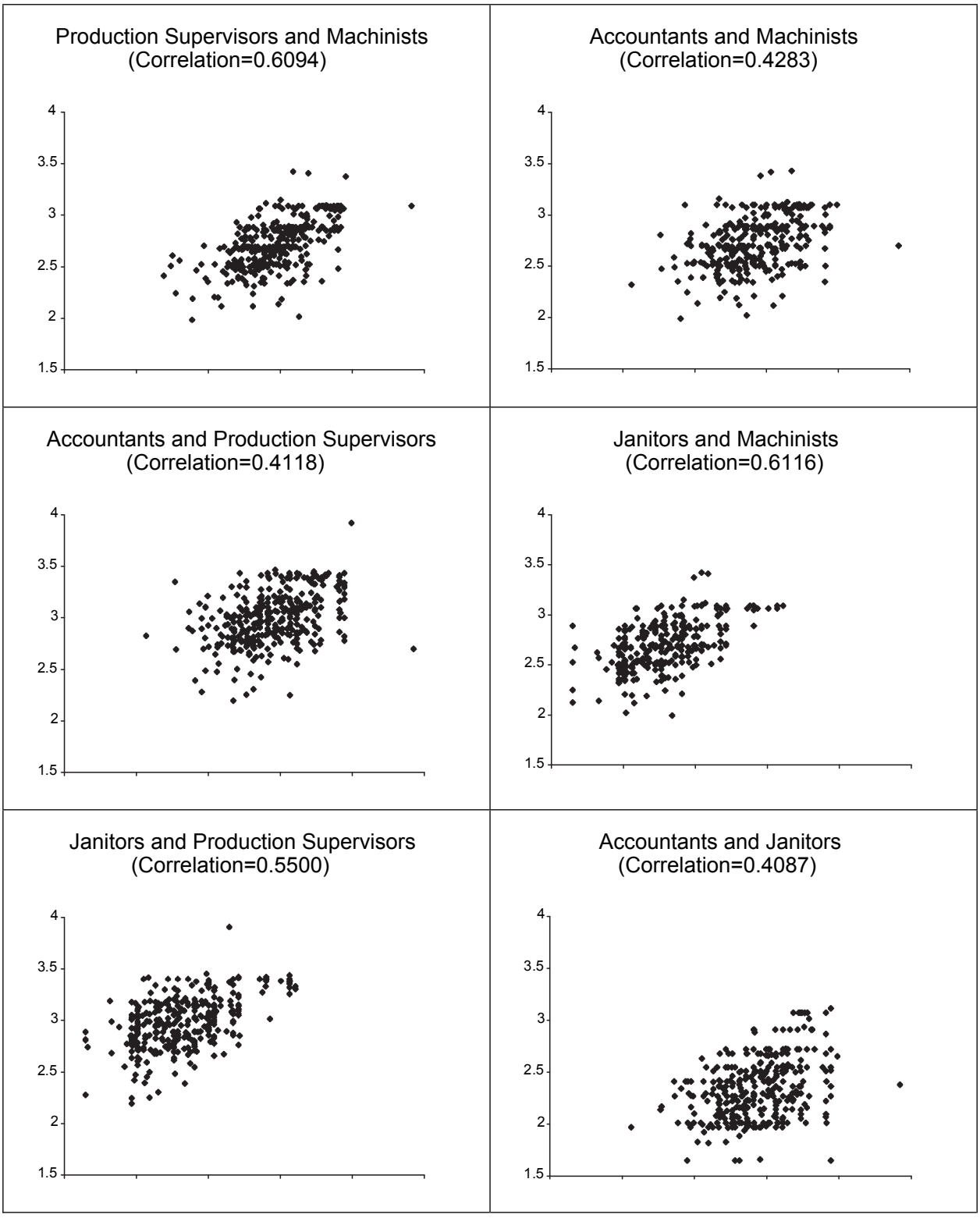
The analysis in this section is similar to previous work of William Dickens and Lawrence Katz, as well as previous work of Stephen Bronars and Melissa Famulari.[24] The objective of the correlation analysis is to examine the breadth of the establishment wage differentials across occupations, with the goal being an enhanced understanding of their effects. For example, in a manufacturing plant, it is

Table 4. Wage variance decomposition, by establishment size

Item	Size =1	Size 2–9	Size 10–15	Size 16–25	Size 26–50	Size 51–100	Size 101–250	Size 251–500	Size >500
R^2: W_{iej} = X	0.6535	0.2756	0.2844	0.3032	0.3191	0.3335	0.3373	0.3630	0.3042
R^2: W_{iej} = Occ	.4735	.4692	.5082	.5366	.5575	.5666	.5670	.5826	.5438
R^2: W_{iej} = Occ + X	.8125	.5595	.5946	.6213	.6361	.6505	.6586	.6888	.6590
R^2: W_{iej} = Est	1.000	.5392	.4991	.4940	.4994	.5022	.4958	.4932	.3858
R^2: W_{iej} = Occ +Est	1.000	.7684	.7589	.7626	.7646	.7655	.7632	.7714	.7088
R^2: W_{iej} = Occ *Est	1.000	.9270	.9136	.9079	.9008	.8960	.8875	.8843	.8288
Occupation	.0000	.2292	.2598	.2686	.2652	.2633	.2674	.2782	.3230
Joint occupation and establishment	.4735	.2400	.2484	.2680	.2923	.3033	.2996	.3044	.2208
Establishment	.5265	.2992	.2507	.2260	.2071	.1989	.1962	.1888	.1650
Explained	.3390	.0903	.0864	.0847	.0786	.0839	.0916	.1062	.1152
Unexplained	.1875	.2089	.1643	.1413	.1285	.1150	.1046	.0826	.0498
Job cell	.0000	.1586	.1547	.1453	.1362	.1305	.1243	.1129	.1200
Individual	.0000	.0730	.0864	.0921	.0992	.1040	.1125	.1157	.1712
Number of individuals	3,149	1,098,076	1,292,496	1,806,070	3,073,260	3,890,886	5,477,999	3,880,169	13,931,325
Number of establishments	3,149	177,200	106,272	90,111	86,388	55,087	36,111	11,280	7,988
Number of 5-digit occupations	377	791	802	806	815	819	821	812	816

NOTE: 34,453,430 individuals. Wages are measured in natural logarithms: Mean=2.5133, Std.Dev.=0.5446. There are 7 1-digit occupations, 824 5-digit occupations, and 573,586 establishments. There are 3,194 counties, 5 age categories, 9 size categories, 10 major industries, and 937 4-digit industries. Explanatory variables "X" are county, age, size, and 4-digit industry.

Figure 1. **Mean occupational wages, manufacturing industry**



NOTE: Wages are measured in natural logarithms. Sample is 338 establishments in the manufacturing industry with at least two employees in each of the following 5-digit occupations: machinists, production supervisors, accountants, and janitors.

expected that the wages of machinists and production supervisors would be positively correlated, as they work side by side on the assembly line. It is less likely, however, that wages of the accountants or the janitors in this manufacturing plant would be positively correlated with the wages of the machinists and the production supervisors.

An examination of the data reveals that while the correlations across closely related occupations are quite high, supporting a team-production hypothesis, correlations are also surprisingly high across unrelated occupations. In figure 1, continuing with the example from the previous paragraph, the average wages of one occupation against the average wages of another occupation in the same establishment are graphed.[25] Not surprisingly, it was found that the wages of machinists and the wages of production supervisors are closely correlated (the correlation is 0.61). Also found were that the wages of accountants are positively correlated with the wages of machinists and production supervisors (the correlations are 0.43 and 0.41), and the wages of janitors are positively correlated with the wages of machinists and production supervisors (the correlations are 0.61 and 0.55). Perhaps most surprisingly, the wages of accountants are highly correlated with the wages of janitors in the same establishment (the correlation is 0.41).

Consistent with the earlier analysis of establishment wage differentials outlined in this article, the enormous heterogeneity in wages across the manufacturing establishments that is evident in figure 1 deserves mention. For example, the establishment mean ln (wage) of accountants in this sample ranges from 2.1 to 3.9 (with a mean of 2.94 and a standard deviation of 0.26). This heterogeneity is consistent with the findings of John Haltiwanger, Julia Lane, and James Spletzer, who outline a model wherein an unobserved business "type" generates heterogeneity in establishment productivity and wages.[26] Furthermore, the findings in figure 1 of skill complementarity across occupations within the establishment fit quite nicely with Haltiwanger, Lane, and Spletzer's model of complementarity between the "type" of business and the skill composition of its workforce.

The relationship of occupational mean wages within establishments is investigated more formally in table 5. For the seven major occupations, the correlation matrix of occupational mean wages within establishments is presented. Two correlations for each occupational pair are shown. The top correlation is unadjusted for observable establishment characteristics, whereas the bottom correlation is based on individual wage data with county, age, size, and major industry means removed.

Table 5. Correlation of mean 1-digit occupational wages within establishments

Item	Management	Professional	Sales	Clerical	Services	Agricultural	Production
Management	1 1 (N=378,960)	0.5054 .3964 (N=190,508)	0.5696 .3668 (N=177,866)	0.4503 .3346 (N=309,002)	0.3510 .2041 (N=123,393)	0.3668 .1798 (N=29,415)	0.3790 .1935 (N=234,127)
Professional	—	1 1 (N=242,710)	.4515 .2249 (N=95,201)	.4788 .3604 (N=212,116)	.4237 .2900 (N=91,243)	.3625 .1293 (N=20,786)	.4671 .2315 (N=126,181)
Sales	—	—	1 1 (N=263,965)	.5004 .2072 (N=179,827)	.3822 .0912 (N=67,313)	.3869 .2273 (N=12,940)	.5020 .2469 (N=145,992)
Clerical	—	—	—	1 1 (N=410,387)	.5138 .4387 (N=128,401)	.4904 .3054 (N=32,757)	.4878 .3033 (N=255,165)
Services	—	—	—	—	1 1 (N=173,193)	.5827 .3351 (N=17,470)	.4602 .2591 (N=88,471)
Agricultural	—	—	—	—	—	1 1 (N=41,203)	.5780 .3447 (N=25,329)
Production	—	—	—	—	—	—	1 1 (N=316,958)

NOTE: 573,586 establishments. Wages are measured in natural logarithms. Upper correlation: no controls for establishment characteristics. Lower correlation: controls for county, age, size, and major industry.

Looking at the data unadjusted for establishment characteristics, the average of the 21 off-diagonal correlations is 0.4614. This is very similar to the estimate of Stephen Bronars and Melissa Famulari, who report a correlation of mean occupational wages between professionals and nonprofessionals of 0.499.[27] All these correlations in table 5 are positive and statistically greater than zero at conventional levels of significance. This says that establishments that pay well for one occupation also pay well for all other occupations. One particularly interesting pattern is that all correlations below 0.4 are in the upper-right corner of the table—it would seem that the least skill matching within establishments occurs between traditional white-collar occupations (managers, professionals, and sales) and blue-collar occupations (services, agricultural, and production). The correlations in table 5 are consistent with theories which predict that workers are sorted into establishments based on skill.

As was seen with the wage-decomposition analysis, it is possible that these correlations are biased upward by not controlling for observable characteristics of the establishment. After removing the effects of county, age, size, and industry, it is clear that the correlations fall. The average off-diagonal correlation fell dramatically from 0.4614 to 0.2700. The correlations remain quite large, however, and all the correlations remain statistically greater than zero. This leads to the conclusion that the unadjusted occupational mean correlations within establishments do measure cost-of-living differences, industry effects, or size effects to a large extent, but also they are measuring establishment-specific pay practices that are otherwise unobservable to the data analyst.

Discussion

Using a simple regression-based wage decomposition effectively documents the magnitude of occupation and establishment wage differentials, the sorting of high-wage occupations into high-wage establishments, and the extent of employer-specific wage structures—the wage premium paid to particular occupations in particular establishments above or below the wage premium predicted by the occupational and the establishment differentials. The key finding in this article is that an establishment can and does exert a significant effect on the wages of the individuals who work therein. It may be seen that controlling for detailed occupation, 21 percent of wage variation can be explained merely by knowing the individual's particular establishment. Accounting for observable characteristics of the employer reduces these establishment wage differentials by half. Taking the empirical analysis one step further, it was shown that the establishment's wage premium is correlated across major occupation groups within the establishment. These empirical estimates complement and enhance previous work on the topic of employer effects on wages.

One of the dominant themes running through the literature of employer effects on wages is that establishments systematically sort workers by skill. The existing literature has found that this sorting explains much but not all of the observed employer effects on wages. The findings documented in this article are certainly consistent with such a conclusion. In the wage decomposition described earlier, merely knowing the worker's establishment explains 50 percent of the observed wage variation across individuals. Controlling for the seven 1-digit occupation indicators lowers this wage variation explained by establishments to 36 percent, and controlling for 5-digit occupation indicators lowers this further to 21 percent. Because the detailed occupational information serves as a proxy for the worker's skills, it was also found that controlling for skill explains much, but certainly not all, of the estimated establishment wage differentials in the raw data.

Another of the themes running through the literature is that establishment wage differentials are merely a proxy, at least in part, for unobserved characteristics of the establishment that are correlated with wages. The results found are consistent with this hypothesis. To the extent that differences across establishments in working conditions, costs of living, rent sharing, and capital-labor ratios can be proxied for by observable establishment characteristics, such as county, age, size, and industry, it was found that controlling for these characteristics lowers the estimated establishment wage differentials from 21 percent of wage variation to 10 percent.

The question remaining is how to explain the estimated establishment wage differentials. Any explanation proposed must simultaneously account for the finding that the establishment wage differentials are common to workers in all occupations in the establishment.

One possible explanation is that the observed differentials simply reflect differences in unobserved labor quality across establishments, and that more detailed information on individual ability and human capital would serve to eliminate the differentials. To the extent that this explanation is true, differentials support the sorting theory; to the extent that it is not, differentials support variations in establishment pay practices. Testing this hypothesis is beyond the capabilities of this dataset, for it does not have information on worker characteristics, such as education,

age, tenure, or training. In addition, there are several reasons to doubt that this hypothesis is the sole explanation of the estimated differentials. First, the work of Erica Groshen and David Levine suggests (but does not prove) that occupation adequately controls for standard measures of human capital.[28] Moreover, in the work by K. C. O'Shaughnessy, David Levine, and Peter Cappelli, it was found that measures of skill and job characteristics do not explain much of the difference in wages across employers (although these measures of skill do explain quite a bit of wage variation across individuals).[29] The findings of John Abowd and his colleagues, who have access to longitudinal linked employer-employee microdata and are thus able to control for unobserved skill using person-specific dummy variables, suggest that unmeasured heterogeneity across individuals explains some but not all of the estimated employer effects on wages.[30] Finally, it is difficult to theorize how unobserved ability and human capital could be important contributors to wage differentials across all occupations in the establishment—such as janitors and accountants.

Another possibility is that the observed differentials reflect differences in technology or capital across establishments. Recent work using establishment microdata has illustrated the striking amount of heterogeneity across establishments within narrowly defined aggregates.[31] While this study used establishment characteristics such as age, size, and industry to serve as a proxy for such differences, it would be useful to incorporate establishment-level information on inputs to (and outputs from) the production process into the analysis. However interesting and worthwhile this line of research would be, it may prove unlikely that capital intensity or technology per se would produce establishment wage differentials that are common to all occupations—again, the example of janitors and accountants comes to mind.

Any explanation for the existence of establishment wage differentials will, in all likelihood, rest on a combination of theories. Empirical work from recent analysis of matched employer-employee data shows that higher-skilled workers not only work together in the same establishment, but also tend to work with higher-quality capital and technology.[32] Modeling these basic human-capital results, augmented with a theory of why human resource pay policies might differ across establishments, should show how the gains from skill sorting and capital-labor complementarities can be extended to workers in all occupations in the establishment. Thoughts such as these run throughout the existing body of literature that examines the reasons why the wages of individuals are, to an extent not entirely understood, affected at a variety of levels by their employer. Additional theoretical and empirical research will have much more information to offer. □

Notes

[1] Erica L. Groshen, "Sources of Intra-Industry Wage Dispersion: How Much Do Employers Matter?" *The Quarterly Journal of Economics,* August 1991, pp. 869–884.

[2] Stephen G. Bronars and Melissa Famulari, "Wage, Tenure, and Wage Growth Variation Within and Across Establishments," *Journal of Labor Economics*, April 1997, pp. 285–317.

[3] K. C. O'Shaughnessy, David I. Levine, and Peter Cappelli, "Changes in Managerial Pay Structures, 1986–1992, and Rising Returns to Skill," National Bureau of Economic Research (NBER) Working Paper No. 7730 (Cambridge, MA, NBER, 2000).

[4] Alejandra Mizala and Pilar Romaguera, "Wage Differentials and Occupational Wage Premia: Firm-Level Evidence for Brazil and Chile," *Review of Income and Wealth*, June 1998, pp. 239–257.

[5] John M. Abowd and Francis Kramarz, "Inter-Industry and Firm-size Wage Differentials in France and the United States," unpublished paper (Ithaca, NY, Cornell University, 1999.)

[6] Erica L. Groshen, "Five Reasons Why Wages Vary Among Employers," *Industrial Relations*, Fall 1991, pp. 350–381.

[7] Key references that have influenced the industry wage differentials literature are William T. Dickens and Lawrence F. Katz, "Inter-Industry Wage Differences and Theories of Wage Determination," NBER Working Paper No. 2271 (Cambridge, MA, NBER, 1987); Lawrence F. Katz and Lawrence H. Summers, "Industry Rents: Evidence and Implications," *Brookings Papers on Economic Activity* (Washington, DC, The Brookings Institution, 1989), pp. 209–275; and Alan B. Krueger and Lawrence H. Summers, "Efficiency Wages and the Inter-Industry Wage Structure," *Econometrica*, March 1988, pp. 259–294.

[8] One survey of the employer-size wage differentials literature is Walter Y. Oi and Todd L. Idson, "Firm Size and Wages," in *Handbook of Labor Economics*, edited by Orley Ashenfelter and David Card (Amsterdam, North-Holland Press, 1999), pp. 2165–2214.

[9] Charles Brown and James Medoff, "The Employer Size-Wage Effect," *Journal of Political Economy*, October 1989, pp. 1027–1059.

[10] Kenneth R. Troske, "Evidence on the Employer Size-Wage Premium from Worker-Establishment Matched Data," *The Review of Economics and Statistics*, February 1999, pp. 15–26.

[11] Abowd and Kramarz, "Inter-Industry and Firm-size Wage Differentials," unpublished paper (Cornell University, 1999.)

[12] Groshen, "Sources of Intra-Industry Wage Dispersion" *Quarterly Journal of Economics*, August 1991, pp. 869–884.

[13] See Groshen, "Sources of Intra-Industry Wage Dispersion" *Quarterly Journal of Economics*, August 1991, pp. 869–884; and Erica L.

Groshen and David I. Levine, "The Rise and Decline (?) of U.S. Internal Labor Markets," Working Paper No. 9819, Federal Reserve Bank of New York (New York, 1998).

[14] Groshen and Levine, "The Rise and Decline (?) of U.S. Internal Labor Markets," Working Paper No. 9819, Federal Reserve Bank of New York (1998).

[15] The response rate for the OES survey is 78 percent (thus we have survey responses from roughly 624,000 of the 800,000 sampled establishments). The remaining sample reduction is to exclude the establishments that report employment or wage data for some but not all occupations.

[16] The interval mean for the bottom interval may vary for States with a minimum wage above the Federal minimum. The interval mean for the top interval is set in nominal terms at $60.01. This upper wage interval contains 0.7 percent of the individuals in our sample (244,727 / 34,453,430). It has been found that the results from the wage decomposition are not sensitive to the point estimate used for this upper interval: the establishment effects reported in table 1 are 20.86 percent using the point estimate of $60.01, and would be 20.78 percent using a point estimate of $70.01 and 20.69 percent using a point estimate of $80.01.

[17] Given that the wage data can be reported as either annual or hourly, there is a concern that the establishment wage differentials could reflect hours differences across establishments. The example of banking comes to mind: a bank with "bankers' hours" may have tellers working six hours per day, whereas a full-service bank may have tellers working eight hours per day. Our estimated establishment wage differentials could be affected if earnings for occupations with hours variation across establishments are reported on an annual basis. This potential bias should be mitigated, however, by the fact that the OES survey respondents are instructed to classify part-time workers according to an hourly rate.

[18] The R-squareds from a regression using 34 million individuals are identical to the R-squareds from a regression using 7,778,248 "cells" weighted by employment, where a "cell" is a wage interval within an establishment-occupation job cell.

[19] Groshen, "Sources of Intra-Industry Wage Dispersion," *Quarterly Journal of Economics*, August 1991, pp. 869–884. The authors recognize that it may be conceptually difficult to compare this study's results (which are computed from a national sample) with Groshen's results (which are computed from six industries). One purpose of this simple comparison is to demonstrate that the results from this study's estimation, and in particular the high R-squareds, are similar to results from other data which use the same methodology.

[20] This quote is from Groshen, "Sources of Intra-Industry Wage Dispersion," *Quarterly Journal of Economics*, August 1991, p. 869.

[21] The longer working paper version of this article is Julia I. Lane, Laurie A. Salmon, and James R. Spletzer, "Establishment Wage Differentials," BLS Working Paper No. 403 (Washington, DC, U.S. Department of Labor, Bureau of Labor Statistics, March 2007).

[22] This conclusion mirrors the findings of John C. Haltiwanger, Julia I. Lane, and James R. Spletzer, "Wages, Productivity, and the Dynamic Interaction of Businesses and Workers," *Labour Economics*, June 2007, pp. 575–602, which show that new businesses exhibit greater earnings heterogeneity than do mature businesses.

[23] Michael Kremer, "The O-Ring Theory of Economic Development," *The Quarterly Journal of Economics*, August 1993, pp. 551–575.

[24] Dickens and Katz, "Inter-Industry Wage Differences and Theories of Wage Determination," NBER Working Paper No. 2271 (1987); and Bronars and Famulari, "Wage, Tenure, and Wage Growth Variation," *Journal of Labor Economics*, April 1997, pp. 285–317.

[25] There are 47,633 manufacturing establishments with at least 1 worker in any of the four occupations. We have selected the 338 manufacturing establishments with at least 2 workers in each of the four occupations.

[26] Haltiwanger, Lane, and Spletzer, "Wages, Productivity, and Dynamic Interaction," *Labour Economics*, June 2007, pp. 575–602.

[27] Bronars and Famulari, "Wage, Tenure, and Wage Growth Variation," *Journal of Labor Economics*, April 1997, pp. 285–317.

[28] Groshen, "Sources of Intra-Industry Wage Dispersion," *Quarterly Journal of Economics,* August 1991, pp. 869–884; and David I. Levine, "Can Wage Increases Pay for Themselves? Tests with a Production Function," Economic Journal, September 1992, pp. 1102–1115.

[29] O'Shaughnessy, Levine, and Cappelli, "Changes in Managerial Pay Structures, 1986–1992, and Rising Returns to Skill," NBER Working Paper No. 7730 (2000).

[30] See Abowd and Kramarz, "Inter-Industry and Firm-size Wage Differentials," unpublished paper (Cornell University, 1999); John M. Abowd, Francis Kramarz, and David Margolis, "High Wage Workers and High Wage Firms," *Econometrica*, March 1999, pp. 251–334; and John M. Abowd, Hampton Finer, and Francis Kramarz, "Individual and Firm Heterogeneity in Compensation: An Analysis of Matched Longitudinal Employer-Employee Data for the State of Washington," in *The Creation and Analysis of Employer-Employee Matched Data*, edited by John C. Haltiwanger, Julia I. Lane, James R. Spletzer, Jules J. M. Theeuwes, and Kenneth R. Troske (Amsterdam, North-Holland Press, 1999), pp. 3–24.

[31] See, for example, Haltiwanger, Lane, and Spletzer, "Wages, Productivity, and Dynamic Interaction," *Labour Economics*, June 2007, pp. 575–602.

[32] See Mark Doms, Timothy Dunne, and Kenneth R. Troske, "Workers, Wages, and Technology," *The Quarterly Journal of Economics*, February 1997, pp. 253–290; and Haltiwanger, Lane, and Spletzer, "Wages, Productivity, and Dynamic Interaction," *Labour Economics*, June 2007, pp. 575–602.

Appendix: Example of OES Survey Form

OCCUPATIONAL TITLE AND DESCRIPTION OF DUTIES	NUMBER OF EMPLOYEES IN SELECTED WAGE RANGES (Report Part-time Workers According to an Hourly Rate)												
	A	B	C	D	E	F	G	H	I	J	K	L	T
Hourly (part-time or full-time)	under $7.50	$7.50–9.49	$9.50–11.99	$12.00–15.24	$15.25–19.24	$19.25–24.49	$24.50–30.99	$31.00–39.24	$39.25–49.74	$49.75–63.24	$63.25–79.99	$80.00 and over	Total Employment
Annual (full-time only)	under $15,600	$15,600–19,759	$19,760–24,959	$24,960–31,719	$31,720–40,039	$40,040–50,959	$50,960–64,479	$64,480–81,639	$81,640–103,479	$103,480–131,559	$131,560–166,399	$166,400 and over	
Architects, Except Landscape and Naval - Plan and design structures, such as private residences, office buildings, theaters, factories, and other structural property. **17-1011**													
Landscape Architects - Plan and design land areas for such projects as parks and other recreational facilities, airports, highways, hospitals, schools, land subdivisions, and commercial, industrial, and residential sites. **17-1012**													
Cartographers and Photogrammetrists - Collect, analyze, and interpret geographic information provided by geodetic surveys, aerial photographs, and satellite data. Research, study, and prepare maps and other spatial data in digital or graphic form. May work with Geographic Information Systems (GIS). **17-1021**													
Surveyors - Make exact measurements and determine property boundaries. Provide data relevant to the shape, contour, gravitation, location, elevation, or dimension of land or land features on or near the earth's surface. **17-1022**													
Aerospace Engineers - Perform a variety of engineering work in designing, constructing, and testing aircraft, missiles, and spacecraft. **17-2011**													
Agricultural Engineers - Apply knowledge of engineering technology and biological science to agricultural problems concerned with power and machinery, electrification, structures, soil and water conservation, and processing of agricultural products. **17-2021**													
Biomedical Engineers - Apply knowledge of engineering, biology, and biomechanical principles to the design, development, and evaluation of biological and health systems and products, such as artificial organs and medical information systems. **17-2031**													
Chemical Engineers - Design chemical plant equipment and devise processes for manufacturing chemicals and products by applying principles and technology of chemistry, physics, and engineering. **17-2041**													