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FIRM SIZE-WAGE PREMIUMS: USING EMPLOYER DATA TO UNRAVEL THE MYSTERY

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Abstract

The literature on establishment size-wage effects has consistently shown a positive relationship between the number of employees and workers' wages. While several theories have been offered to explain these outcomes, the use of data with limited employer characteristics make for a dubious connection between theory and results. This study examines the firm size-wage effect using a dataset which captures typical worker demographics, but also contains employer information not typically captured in larger datasets. The results provide strong evidence that these wage effects are the result of several forces, including worker sorting/matching, efficiency wages, internal labor markets, and, to a lesser degree, working conditions.

The literature on establishment size-wage effects has repeatedly produced similar answers. In general, the findings point to a positive relationship between the number of employees and workers' wages. Numerous theories have been offered to explain this observed phenomenon. Unfortunately, the testing of these theories has been restricted by observable data on workers and the limited employer characteristics available in large datasets. The result is that each empirical study has usually directly tested only one or two of the possible explanations for this size-wage relationship. In these cases, employer size premiums have tended to persist even after including a large set of control variables.

We begin by describing the theoretical explanations that have been given for firm size-wage premiums and review many of the previous empirical findings in this area. This discussion provides a foundation for our estimation methodology. Then, we estimate the firm size-wage effect using a pooled cross-section of the 1994 and 1997 waves of the National Employer Survey. The dataset captures typical worker demographics, but also contains employer information on production organization, worker screening, non-wage benefits, training activities, sales revenue, and capital value. The empirical model tests the most common explanations given for observing employer size-wage effects. The results provide some support for the assertion that variation in working conditions across occupations are responsible for establishment size premiums, but even stronger evidence that these wage effects are the result of worker sorting/matching, efficiency wages, and internal labor markets.

Theoretical Explanations

While there seems to be a consensus on the presence of positive firm size-wage effects, there is less agreement about the reason for this empirical phenomenon. In general, the theories argue that employer and/or worker characteristics, that are likely to be correlated with firm size, are responsible for these observations. However, the precise structure that lies behind these characteristics can lead to drastically different justifications for this relationship. These explanations can be briefly summarized as follows.

Working Conditions

One of the early explanations of the positive correlation between firm size and wages suggested that firm size is a proxy for an alienating work environment that offers less autonomy. These workplaces may also lack cleanliness and have higher risks of injury, so the observed effects are a form of compensating wage differential (Lester 1967; Kruse 1992). In some cases, data on firm injury and death rates are now available and can be explicitly included in empirical models. The models are not without criticism because they rely on assumptions about worker knowledge of working conditions, overlook the impacts of worker attitudes toward risk on workplace injury rates, and are not robust to changes in sample selection (Leigh 1989). Nevertheless, firm size may remain as a sensible proxy for the absence or scarcity of workplace amenities that are not restricted to traditional measures of injury or fatality.

Sorting and Job Matching

This explanation argues that larger firms tend to get more productive workers because the nature of work organization makes them more attractive to the most productive workers (Garicano and Rossi-Hansberg 2006). In particular, this would include workers who have a broad skill set or can quickly acquire the knowledge to complete a variety of tasks. In turn, these workers are likely to be more motivated and industrious with non-hierarchical work organization. This type of human resource relation has become increasingly popular and includes opportunities for job rotation, team production, and shared leadership (Champlin 1995). In addition, large firms need to have better screening techniques and monitoring mechanisms, but this ultimately allows them to offer higher wages, more fringe benefits, and better training programs, so that "high productivity" workers will be matched with "high quality" employers (Troske 1999). If so, outcomes in the labor market will not be consistently characterized by trade-offs between monetary and non-monetary compensation, as is typically highlighted by neoclassical theory.

Capital-Labor Complementarities

Another reason for observing positive firm size-wage premiums suggests that capital and labor are complements in production. Larger firms, which tend to be more capital-intensive, are able to achieve higher productivity with similar workers

(Hamermesh 1980). These firms not only utilize a larger amount of capital, but use higher-quality equipment with the most advanced technology. Consequently, worker productivity increases because employees are able to work with the best equipment and not as a result of differences in human capital characteristics. The abundance of capital and diversity of production activities can also increase the opportunity for large firms to allocate workers to tasks in which they have a comparative advantage (Ehrenberg and Smith 2008). This can generate wage differentials, even between firms in the same industry and workers with similar demographic characteristics.

Unionization

This theory begins by highlighting the fact that large firms are the primary targets for unionization. Given the higher costs of a unionized labor force, larger firms may attempt to thwart unionization efforts by offering wages above competitive levels (Voos 1983). While an argument that union spillover effects are more significant with larger firms may be convincing in a manufacturing setting with considerable union influence, the story is less persuasive in a service-oriented economy with limited union power. Another difficulty in testing this theory results from a measurement issue; even though measures of union "presence" at firms are typically available, union "threat" is not directly observable. Furthermore, the treatment of unionization in isolation of other factors which affect the firm-worker relationship (e.g., product market structure and managerial decisions about the

organization of work) results in misspecified empirical models and potentially misleading results (Zappalà 1994).

Efficiency Wages

This view claims that moral hazard is more prevalent in large firms because individual productivity becomes increasingly difficult to observe when more workers are involved in the production process. Although it may be possible to monitor workers in these firms, it is difficult and costly. Consequently, large firms offer wages above the average market level (increasing the opportunity cost of unemployment) in an attempt to reduce shirking and turnover (Shapiro and Stiglitz 1984). With lower turnover, the higher costs associated with these efficiency wages can be offset by reduced hiring and training costs. Furthermore, the costs of losing workers may be compounded in larger firms if job tasks and production are interdependent (Ehrenberg and Smith 2008). Finally, since higher wages can create a queue for these jobs, firm owners can extract more effort from their workers.

Internal Labor Markets

This explanation argues that large firms tend to group workers into job clusters requiring specialization and job-specific skill acquisition. A firm's long-term success depends on their ability to keep workers who acquire these skills attached to the firm for extended periods of time. This is accomplished by

developing systems of employee evaluation which reward workers for increased productivity and seniority, but are also driven by institutional (firm- and industry-specific) forces (Kerr 1950; Doeringer and Piore 1971). Over time, as these workers become increasingly valuable to the firm, significant wage differentials will develop between them and similarly positioned workers at smaller firms with no internal labor market.[1]

Rent-Sharing and Market Power

This theory claims that larger firms have more financial resources (e.g., access to credit markets, larger profits, etc.) and use their ability-to-pay to increase worker morale and effort (Slichter 1950; Akerlof 1982). Sharing the benefits of success can create a cooperative environment with higher productivity, but it is also possible that workers simply use the firm's product market power to secure higher wages for themselves (Nickell, Vainiomaki, and Wadhwani 1994). In this scenario, it is not clear that a firm's market power alone would allow workers to obtain the higher wages they seek. It assumes that some mechanism exists for workers to exert their voice and collective influence within those larger firms. Additionally, it ignores any direct relationship between product market power and monopsonistic labor market characteristics. If a firm's product market power leads to geographical and/or industry dominance, this is likely to be reflected in the labor market as well with wage-setting power (Dunlop 1957; Gimble 1991). This would allow firms to

pay lower salaries, so the connection between firm size and wages is ambiguous even if the conditions necessary for rent-sharing are present.

Previous Empirical Evidence

The basic empirical approach has estimated the impacts of firm size utilizing an augmented human capital equation. In addition to the typical measures of educational attainment, occupation, industry, and demographic characteristics, information on the size of the worker's firm is included among the explanatory factors. This may appear as a set of categorical or continuous variables, depending on the nature of the available data. In a few instances, when firm-level data is available, empirical models have also included controls for training and sales revenue. In most cases, the positive relationship between wages and firm size has persisted (although sometimes decreased), even after the inclusion of several controls intended to capture the source of these wage premiums.

Evans and Leighton (1989), after estimating a first-differenced form of a traditional human capital equation, find that firm size affects wages only in the largest firms. They argue that monitoring is most difficult for these firms, so they screen more and acquire higher productivity workers.[2] Rebitzer (1993) explains that good measures of monitoring activity are not available in the data, but that differences in the wage-firm size relationship between primary and secondary sector jobs suggests that monitoring differences could explain the results. In contrast, Kruse (1992) utilizes direct measures of employee supervision and finds that these

have no effect on firm size-wage premiums; thus, efficiency wages resulting from shirking is not a likely source of firm size-wage effects.

Another explanation for persistent firm size-wage differentials is offered by Idson and Oi (1999). They suggest that the wage premiums result from greater productivity of workers in large establishments. Larger firms tend to implement high performance human resource strategies. These differences in the organization of production and the rate of adopting the most technologically advanced capital generate a sorting mechanism whereby the most productive employers and employees are matched.[3]

Troske (1999) claims that fixed costs associated with hiring more skilled workers can result in lower average costs associated with skill matching in larger establishments. Bayard and Troske (1999) use a 1990 cross-section of matched employer-employee data. Examining industries separately, they estimate that the establishment size-wage premium is 14% for workers in manufacturing, 10% in retail trade, and 11% in services. Similar premiums suggest that establishment-level factors that differ across industries (e.g., capital-labor ratios, computer usage, etc.) do not account for much of the wage premium and is consistent with Troske (1999). When the specification is modified to include firm-level workforce characteristics and measures of revenue, the firm size-wage premium is significantly reduced; they claim that this is evidence of productive employees matching with more productive firms. However, this could also be the result of rent-sharing.

Mayo and Murray (1991) find that when measures of firm and employment risk (unstable workers) are included in the model, the independent influence of firm size on wages disappears. They conclude that small firms, which tend to have higher probabilities of failure, attract less stable workers, while larger firms attract workers with more complete and consistent work histories. Consequently, the results suggest that firm size captures unobservable heterogeneity in firms and workers by functioning as a proxy for both the risk of firm failure and worker commitment. Again, this outcome is most consistent with a story of sorting and matching in the labor market.

Industry differences in wage premiums for larger firm size, which is observed in several of these studies, suggest that rent-sharing may also be a plausible explanation as firms share their profits with workers. Rebitzer and Taylor (1995) find that lawyers in large law firms receive higher rents. This occurs despite the existence of performance bonuses, which reduce the need to monitor these employees or offer efficiency wages. The rationale may be that a climate of reciprocity and fairness also benefits employers as workers will invest more effort on job tasks. Recently, Arai (2003) has argued that both profits and the capital-labor ratio are positively correlated with firm wages.

While the empirical literature has supported the positive association between wages and employer size, there has been only limited support for any one of the theoretical explanations. The reason for this is that data used to examine the relationship between employer size and wages has been limited by the available

proxies to control for worker and firm heterogeneity. Household data, while containing many details on individual-level attributes, typically has deficient, or is completely lacking, information about the individual's employer. Establishment data usually contains accurate industry, and size information, but is usually not publicly available and/or does not include rich, qualitative information related to the organization of work, screening efforts, fringe benefits, and training activities. In addition, company performance and measures of capital equipment are not consistently included. In the subsequent sections, we outline an estimation strategy and describe a dataset that allows us to address these deficiencies.[4]

Data and Methodology

This study utilizes the 1994 and 1997 National Employer Survey (NES). The Census Bureau's Standard Statistical Establishment List (SSEL), now called the Business Register, contains the master list of all establishments and enterprises in the United States and provides the sampling frame for the NES. The sample was evenly divided between manufacturers and non-manufacturers, with explicit over-sampling of establishments that have 100 or more employees and implicit over-sampling of manufacturers because they are greatly outnumbered by non-manufacturers in the SSEL universe. The surveys were administered by the U.S. Census Bureau as independent cross-sections in the summers of 1994 and 1997.[5] The analysis sample utilizes 1,500 establishments; 740 from 1994 and 760 from the

1997 survey. The presence of over-sampled establishments requires the use of the provided weights in order to produce representative parameter estimates.

It is important to note that there are two weaknesses associated with this data. One is that geographic information on the location (i.e., region or state) of the firm is not available. This is generally a disadvantage associated with the sensitivity of disclosure and confidentially guaranteed to firms when responding to public-use surveys. Nevertheless, this could result in omitted variable bias if large firms tend to be located in high-wage states. The second shortcoming is that firm size information is only available as a categorical variable identifying firms into one of four possible groups; less than 50 employees, between 50 and 99 employees, between 100 and 249 employees, and 250 or more employees. While this is also common with firm-level data, it can result in misspecification and firm size-wage identification issues, especially if the relationship is non-linear.

The lack of information regarding where most firms in a given size category are clustered can also create some difficulty in interpreting regression coefficients. For example, similar wage effects for two firm size categories could imply that the firms behave similarly with respect to wages. On the other hand, this result could be due to a clustering of small firms at the upper limit of the size category combined with many firms near the lower limit of the larger size category. In other words, these firms are quite similar, but have been arbitrarily placed in different categories. In that case, small differences between some firm size-wage effects would be expected and easily explained.

Table 1 provides descriptive statistics for the variables used in the analysis. Although we use the natural log of hourly wages as the dependent variable in the regressions, the table shows the average values of the hourly wages in each occupation group for ease of interpretation. As expected, hourly wages are highest for managerial workers and followed, in descending order, by supervisory, front-line, and finally support staff workers. Establishment size characteristics are similar for both the 1994 and 1997 survey, with multi-establishment firms comprising more than 50 percent of the sample. Industry distribution is also similar for both surveys, but the 1994 survey has a larger concentration of firms in construction and wholesale, while retail and health services have significantly more representation in 1997. Finally, more firms appear to be offering fringe benefits and training opportunities in 1997 compared to 1994.

[Insert Table 1]

The dataset contains a host of other variables that are likely to affect the wages of a firm's workforce. Some, such as gender and racial composition and average level of schooling mirror the kinds of variables one finds in estimated wage regressions using worker-level survey data. Others, such as production organization, firm recruiting costs, non-wage benefits, and sales are important determinants of wages that are rarely, if ever, found in individual survey data. The NES data provides an ideal opportunity to examine the relationship between firm

size and wages while incorporating both worker and firm characteristics in the analysis.

In order to gain some insights into the differences between smaller and larger firms, the sample means are partitioned by firm size categories. These are reported in Table 2. Differences in hourly wages are insignificant between firm size groups, except for the largest firms which tend to pay higher salaries than smaller firms. The data suggests that larger firms hire workers with education levels that are similar to those in smaller firms, but are less inclined to utilize high performance human resource practices such as job rotation and self-managed teams. On the other hand, they have higher propensities of union representation, are more likely to use benchmarking techniques, commit more resources (as a percentage of costs) to recruiting workers, offer more comprehensive fringe benefits, and provide more opportunities for on-the-job training. Since these characteristics are not independent from one another, the empirical model will assist us in understanding the connection between each individual factor and wage premiums.

[Insert Table 2]

Following the basic framework of previous studies, we utilize pooled ordinary least squares (OLS) to estimate the model

$$\ln w_{it} = \alpha + \mathbf{s}_{it}\boldsymbol{\delta} + \mathbf{x}_{it}\boldsymbol{\beta} + \mathbf{d}_{it}\boldsymbol{\theta} + \phi_t + \varepsilon_{it} \quad (1)$$

where the i and t subscripts represent an individual firm and year, respectively; w is the average wage of workers, **s** is a vector of firm size dummies, **x** is a vector of control variables, **d** is a vector of industry indicators, ϕ_t represents the year effect, and δ is the effect of firm size on wages. The control variables in **x** include typical worker characteristics (average years of education, percent minority, and percent female), firm production organization (multi-establishment firm, union representation, percent of workers in self-managed teams, percent in job rotation, percent of non-management using computers, percent of management using computers, and an indicator for the use of benchmarking), and a proxy for the firm's screening efforts (the percent of labor costs spent on recruitment).[6] The worker characteristics also include a variable designed to capture some dimensions of working conditions and employment stability (percent of workers with the firm less than 1 year).

Although measures of turnover have been found to be significant predictors of working conditions, in the absence of a universally acceptable index for these conditions, industry and occupation characteristics have also been used as proxies (Brown and Medoff 1989). In addition to including industry indicators, we are able to estimate the models for 5 occupation groups. The firm-level wage data includes all occupations, but we are also able to calculate the average wage of workers at firm i in each of the following occupations: front-line (sales or production), support staff, technical, supervisory, and managerial.

Previous work has not directly captured many of the included production characteristics or the screening efforts of firms. For example, measures of high performance human resource practices such as self-managed teams, job rotation, and the use of benchmarking have been missing from previous studies. Instead, they have relied on proxies or, in some cases, assumed that these can be accounted for by estimating firm fixed effects. However, since these variables can exhibit variation within firms over time, fixed effects are not likely to capture the impact of these management strategies.

Our estimates of equation (1) can identify the effects of human resource management, but other omitted variables correlated with firm size and wages could lead to biased estimates of firm size-wage premiums. For example, it is possible that fringe benefits and training may substitute for monetary compensation. If larger firms tend to offer fewer benefits and/or more limited training opportunities, then excluding controls for these factors will over-estimate the effect of firm size on wages. The initial model is modified to control for non-wage benefits offered to workers and training provided by the firm to estimate

$$\ln w_{it} = \alpha + \mathbf{s}_{it}\boldsymbol{\delta} + \mathbf{x}_{it}\boldsymbol{\beta} + \mathbf{D}_{it}\boldsymbol{\theta} + \phi_t + \mathbf{f}_{it}\boldsymbol{\omega} + \mathbf{g}_{it}\boldsymbol{\lambda} + \varepsilon_{it} \qquad (2)$$

where **f** is a vector of fringe benefit (severance pay, medical insurance, dental insurance, child care, family leave, life insurance, sick pay, and stock options)

dummies, and $\mathbf{g}$ is a vector of training provision (computer, safety, team-work/problem-solving, and remedial skills) controls.

Finally, in order to test for the possibility of rent-sharing and capital-labor complementarities, we include two additional variables capturing the firm's sales revenue and their capital equipment value. Instead of including these directly as explanatory variables, we follow the work of Arai (2003) and estimate

$$\ln w_{it} = \alpha + \mathbf{s}_{it}\boldsymbol{\delta} + \mathbf{x}_{it}\boldsymbol{\beta} + \mathbf{D}_{it}\boldsymbol{\theta} + \phi_t + \mathbf{f}_{it}\boldsymbol{\omega} + \mathbf{g}_{it}\boldsymbol{\lambda} + \varphi r_{it} + \psi k_{it} + \varepsilon_{it} \tag{3}$$

where r and k represent these variables per worker (i.e., as ratios to total employment in the firm).[7] Measuring the variables in this manner mitigates the inherent collinearity that exists between firm size, revenue, and capital that could, by default, render the estimates of $\boldsymbol{\delta}$ insignificant. Positive magnitudes for φ and ψ would provide evidence of rent-sharing and capital-labor complementarities and yield some insight on whether previous estimates of the size-wage premium are biased when these controls are excluded.[8]

Results

Our baseline specification estimates for all workers, in column (1) of Table 3, suggest that only workers in the largest establishments (with at least 250 employees) receive firm size-wage premiums. On average, workers in these establishments receive a 9 percent earnings premium. These wage premiums are

significantly reduced, however, when non-wage benefits and measures of training are included in the wage regressions. In column (2), the estimates suggest that workers in the largest firms receive about a 4 percent earnings premium. Finally, the results in column (3) show that neither controlling for firm revenue nor capital per worker has a significant effect on firm size-wage premiums.[9]

[Insert Table 3]

This pattern is fairly consistent for all occupation groups and only a few differences deserve special attention. Front-line workers, for example, also receive larger wage premiums in the largest firms. In column (4) of Table 3, the estimates imply that front-line workers in firms with more than 250 employees receive a relatively large (14 percent) earnings premium. As is generally the case though, the premium is reduced by approximately 50 percent after non-wage benefits and training controls are included. Again, as shown in column (6), all firm size-wage premiums remain essentially unchanged after controlling for revenue and capital equipment value.

Table 3 also includes the estimates for support staff workers. Interestingly, these workers receive earnings premium in the largest firms and those employing 50-99 employees. Consistent with most of our other results, the wage premiums are significantly reduced after controlling for non-wage benefits and training. Nevertheless, an earnings premium of approximately 4 percent remains for workers

employed at those firms. Again, the firms' revenue and capital are not significant determinants of earnings and do not alter the firm size-wage premiums.

The results for supervisory workers, in columns (10), (11) and (12) of Table 3, are nearly identical to support staff workers. These workers initially appear to receive earnings premiums in the largest firms and those employing 50-99 employees. After controlling for non-wage benefits and training, there is nearly a 50 percent reduction in the coefficient for the largest firms, but a 4-5 percent earnings premium continues to be present. Again, revenue and capital have no individual impact of reasonable significance on earnings for supervisory workers and there is no change in the firm size-wage premium from their inclusion.[10]

Finally, the results for managerial workers, in columns (13), (14), and (15) of Table 3, also exhibit a pattern similar to other occupations. After controls for fringe benefits and training have been included, firm size-wage premiums are reduced by approximately 30 percent. However, these workers continue to receive a 6-7 percent earnings premium if they are employed by a firm with 50-99 or more than 250 employees. As with other occupations, firm revenue and capital have no impact on managerial earnings and no effect on the firm size-wage premiums.

Conclusions

Consistent with several previous studies, the initial results indicate that the most prevalent firm size-wage premiums are associated with the largest firms (at least 250 employees). In many previous studies, however, large firm size-wage

premiums persist. Typically, this is explained by the inability to control for unobserved firm characteristics. In this study, the addition of numerous firm controls results in a significant reduction in most of the observed wage premiums. More importantly, the results provide a clear link with the firm characteristics that were likely to be the primary causes of observed size-wage premiums in previous work. Theoretical work in this area has offered several explanations that shed light on our empirical results. In addition to confirming some of those theoretical insights, we are able to identify which specific explanations of firm size-wage premiums are most relevant.

For all occupations, positive establishment size-wage effects are initially present. However, the firm size-wage premiums are reduced by 20-50 percent when controls for the offering of fringe benefits and on-the-job training are added. Thus, the establishment size-wage effects are biased in the absence of controls for these factors. The descriptive statistics indicate that not only do more of the larger firms provide non-monetary compensation and training, but they also tend to offer a broader set of benefits and skill investment opportunities. This combined with the effects on the regression coefficients is consistent with a story of worker sorting and matching. Another robust outcome is the lack of any evidence to suggest that rent-sharing is a direct component of workers' wages. Similarly, capital-labor complementarities have an insignificant association with wages and do not explain any fraction of the observed firm size-wage premiums.

Unionization, on the other hand, has a positive and significant impact on earnings for all occupations (except managers), but this variable also does not explain the establishment size-wage effects. We estimated all of the regressions with and without controls for union presence and found no significant impact on the firm size coefficients. Although this does not fully capture the "threat" of unionization for non-unionized firms, industry and other work organization controls may function as reasonable proxies. Nevertheless, wage premiums persist for all occupations even after controlling for unionization, non-wage benefits, training, sales revenue per worker, and capital-labor ratios.

While the results are not consistent with stories of rent-sharing, capital-labor complementarities, and unionization threats, several explanations that have been previously offered to explain firm size-wage differentials remain compelling. For example, some have argued that establishment size is a proxy for poor working conditions. Differential impacts of firm size across occupations suggest that this may be one component of the wage premium. However, the fact that these differences are not large across occupations may imply that efficiency wages (due to monitoring difficulties) and internal labor markets play a more important role in explaining average establishment wages and size-wage premiums, which is consistent with Fairris and Jonasson (2008).

In addition, it appears that larger, better-paying firms are able to train their employees and offer more attractive fringe benefit packages. This can be seen with the large reduction in the firm size-wage premiums when these factors are included

as controls. The consequences are that employees in large firms will receive higher returns with the accumulation of these specific human capital investments and the employers will have an advantage in retaining the most productive workers. This is consistent with Lazear (2003), who suggests that size-wage premiums could also be due to differences in employers' abilities to cater to workers' skills. Although this supports sorting and job matching as components of the wage premium story, it does not rule out the possibility that the provision of training and fringe benefits are an indirect form of rent-sharing.

Our results imply that there are several relevant factors in explaining the persistent and puzzling firm size-wage premiums observed in previous studies. In particular, efficiency wages, working conditions, and job sorting/matching are all reasonable explanations in light of our results. The observed differences in wage premiums across occupations suggest that working conditions are likely to have only a marginal effect. On the other hand, the impact of job sorting/matching is much more prevalent. Finally, the persisting wage premiums in large firms, even after controlling for numerous establishment characteristics, provide a window for the influence of efficiency wages and internal labor markets.

One lingering issue with our results is that firm size-wage premiums are positive for the small- to medium-sized firms (with 50-99 employees) and the largest firms (with more than 250 employees), while being insignificant in medium- to large-sized firms (with 100-249 employees). The result is quite robust, as it holds for all except front-line workers. Moreover, the summary statistics suggest that

these firms are significantly different by most measurable and observable characteristics, so explanations for this result are not obvious. It is possible that this could be the consequence of non-linear firm size effects, differences in the regional concentration of these firms, and/or other unobservable factors. In the future, firm-level data containing comparable richness, but with some supplementary information, may be able to provide additional insights into the differences between the wage-setting mechanism of small and large firms.

Notes

1. Gordon, Edwards, and Reich (1973) argue that these structures also benefit firm owners by allowing management to maintain control of the production process and generating the conditions for extracting a greater surplus from labor.
2. Garen (1985) obtains complementary results.
3. Haltiwanger, Lane, and Spletzer (1999) find that there are differences in the mix of workers across employers and that this is related to variation in firm productivity.
4. Lallemand, Plasman, and Rycx (2005, 2007), who use a matched dataset of employees and firms in Europe are exceptions to this. Their data allow them to simultaneously control for worker characteristics and numerous working conditions, but positive firm-size wage premiums persist.
5. This dataset should not be confused with the National *Employment* Survey or the National *Employee* Survey, which have also used the NES acronym. More recent versions of these aforementioned datasets are available, but they do not contain the information required for this type of analysis. Unfortunately, more recent data for the National *Employer* Survey is not available because the primary data collection was in 1994 and 1997 only.

6. Devaro (2005) finds a positive relationship between wages and recruitment efforts.

7. Ideally, a measure of the firm's profitability might be more appropriate than sales, but this information is not available.

8. An additional problem might arise with OLS estimation of these models, if the analyses sample (those firms who reported wages and other establishment characteristics), is a non-random selection of the population. We address this with maximum likelihood Heckman estimation, but find no evidence of selection. In many cases, the Wald chi-squared values are not significant and in all cases there is no substantive difference in the firm size coefficients.

9. In addition, all specifications in Table 3 include the variables in equation (1). Only the firm size coefficients and standard errors are reported in Table 3, but the others are available from the author upon request.

10. We also estimated the models for technical workers. Those results are not reported because they are nearly identical to the results for supervisory workers and do not substantively alter any of our conclusions.

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Table 1: Descriptive Statistics for Wages and Control Variables by Year

Variable	1994: Mean	1994: Std. Dev.	1997: Mean	1997: Std. Dev.
Dependent, Wage Variables:				
hourly wage, front-line	12.562	5.684	12.387	4.837
hourly wage, support staff	11.241	3.389	12.237	3.298
hourly wage, supervisory	17.420	5.486	16.761	4.618
hourly wage, managerial	24.457	8.766	23.332	7.991
Establishment and Firm Size:				
50-99 employees	.195	.396	.163	.370
100-249 employees	.206	.404	.196	.397
250+ employees	.468	.499	.507	.500
multi-establishment firm	.658	.475	.653	.476
Worker Characteristics:				
education level, front-line	12.242	1.156	12.155	1.177
education level, support staff	12.691	1.078	12.711	1.068
education level, supervisory	13.378	1.490	13.300	1.444
education level, managerial	15.632	1.368	15.536	1.362
% with firm less than 1 year	13.808	14.861	14.370	14.473
% women	35.143	23.550	36.236	23.675
% minority	23.373	23.151	26.876	24.958
Production Organization:				
union representation	.315	.465	.313	.464
% non-mng in slf-mng teams	12.216	24.773	16.102	28.386
% non-mng in job rotation	14.672	26.361	19.667	28.847
firm uses benchmarking	.378	.485	.378	.485
Screening:				
% labor costs on recruitment	3.420	5.566	3.308	5.647
Industry:				
finance	.016	.126	.013	.114
food/tobacco	.050	.218	.071	.257
business services	.026	.158	.024	.152
chemical/petroleum	.060	.237	.065	.246
communications/utilities	.061	.239	.043	.204

construction	.060	.237	.049	.215
hotel	.028	.166	.022	.148
insurance	.022	.146	.020	.139
lumber/paper	.073	.260	.076	.266
machinery manufacturing	.095	.293	.087	.282
printing/publishing	.066	.249	.054	.226
retail	.012	.110	.009	.096
textile/apparel	.053	.224	.041	.198
transportation equipment	.051	.221	.065	.246
metal products	.073	.260	.087	.282
wholesale	.045	.207	.038	.192
health services	.016	.126	.037	.189
Non-wage Benefits:				
pension	.788	.409	.800	.400
severance pay	.437	.496	.418	.494
medical insurance	.985	.121	.993	.081
dental insurance	.760	.428	.786	.411
child care	.123	.329	.112	.315
family leave	.835	.371	.699	.459
life insurance	.949	.221	.936	.246
sick pay	.805	.396	.803	.398
stock options	.291	.454	.553	.498
Training:				
computer	.797	.402	.836	.371
safety	.931	.254	.797	.402
team-work/problem-solving	.660	.474	.792	.406
remedial skills	.501	.500	.278	.448
Revenue and Capital Value:				
natural log of revenue	17.176	1.824	17.302	1.689
natural log of capital value	15.725	2.086	15.834	2.182
N	740		760	

Table 2: Selected Variable Means by Firm Size

Variable	<50	50-99	100-249	250+
hourly wage, front-line	12.463	11.830	11.962	12.922
hourly wage, support staff	11.217	11.621	11.183	12.167
hourly wage, supervisory	16.263	16.489	16.470	17.785
hourly wage, managerial	22.929	23.448	23.039	24.659
multi-establishment firm	.355	.455	.608	.830
education level, front-line	12.370	12.231	12.209	12.134
education level, support staff	12.825	12.675	12.661	12.692
education level, supervisory	12.900	13.086	13.143	13.632
education level, managerial	15.005	15.302	15.502	15.878
% with firm less than 1 year	12.647	15.205	14.804	13.787
% women	28.170	32.420	37.624	38.164
% minority	16.674	25.616	29.653	25.439
union representation	.140	.179	.262	.432
% non-mng in slf-mng teams	14.331	14.482	12.630	14.676
% non-mng in job rotation	20.131	13.695	15.950	18.203
firm uses benchmarking	.245	.269	.289	.491
% labor costs on recruitment	2.020	2.937	3.452	3.851
pension	.595	.705	.774	.889
severance pay	.195	.284	.342	.579
medical insurance	.975	.978	.987	.999
dental insurance	.620	.668	.731	.870
child care	.075	.056	.090	.163
family leave	.530	.765	.748	.839
life insurance	.895	.888	.910	.988
sick pay	.725	.772	.741	.863
stock options	.280	.287	.359	.539
computer	.675	.784	.761	.891
safety	.780	.795	.834	.923
team-work/problem-solving	.575	.634	.654	.832
remedial skills	.220	.291	.332	.492
natural log of revenue	15.492	16.078	16.765	18.340
natural log of capital value	13.974	14.542	15.060	17.025
N	200	268	301	731

Table 3: Effects of Firm Size on Hourly Wages

Firm Size	All Workers:			Front-Line:			Support Staff:			Supervisory:			Managerial:		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
50-99	.032	.014	.014	.032	.005	.007	.053**	.045*	.047*	.057**	.043*	.040*	.067*	.062*	.057*
	(.025)	(.023)	(.024)	(.030)	(.029)	(.030)	(.024)	(.024)	(.024)	(.025)	(.024)	(.025)	(.034)	(.033)	(.034)
100-249	.019	-.004	-.005	.046	.013	.016	.020	.004	.005	.047*	.024	.021	.038	.025	.020
	(.024)	(.023)	(.0230)	(.029)	(.028)	(.029)	(.023)	(.022)	(.023)	(.026)	(.025)	(.025)	(.034)	(.033)	(.034)
250+	.087***	.038*	.037*	.138***	.073***	.076***	.074***	.038*	.039*	.094***	.048*	.045*	.103***	.069**	.065**
	(.023)	(.023)	(.023)	(.028)	(.028)	(.028)	(.022)	(.022)	(.022)	(.025)	(.025)	(.025)	(.033)	(.033)	(.033)
R^2	.493	.529	.529	.441	.477	.477	.294	.322	.322	.337	.376	.376	.187	.207	.207
Benefits and Training	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Revenue and Capital	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes

Notes: The dependent variable is the natural log of the hourly wage. In addition to the firm size variables above, all regressions include the set of worker, production, screening and industry controls. See Table 1 for the complete list of variables. The sample size for all regressions is 1,500. Robust standard errors are in parentheses; * statistically significant at the .10 level, ** at the .05 level, and *** at the .01 level.