Is Bigger Still Better?

The Decline of the Wage Premium at Large Firms

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Abstract

This study shows that the wage premium paid by large firms fell over the past 20 years and that this decline in this size premium is most pronounced among the least educated workers. Empirical evidence supports several explanations for the shrinking size premium. First, there has been a convergence in the returns to worker characteristics at large and small firms over time. Second, small and large firms are hiring more similar workers. Particularly important has been the declining share of workers at large manufacturing firms and the rising share of workers at large retail firms. Also, the greater decline of unionism at large firms has contributed significantly to the decline in the size premium.

JEL: J31, J33

1. Introduction.

Large firms pay higher wages than small firms. This fact was first documented nearly 100 years ago and has been confirmed by myriad studies since then. Considerable effort has been directed toward testing different theoretical explanations for the size-premium. These include the fact that larger firms employ a more skilled work force and provide them with more and better capital; pay efficiency wages to deal with greater monitoring costs; pay compensating differences for less pleasant working conditions or greater risk that results from the type of human capital that is acquired; or share rents with workers because of union threats or monopoly profits.

While there has been extensive research attempting to determine the importance of these different explanations of the size-premium, a recent trend has gone unnoticed. Namely, the firm size premium fell substantially over the past 20 years. For example, we show that workers in firms with over 500 workers earned 55 percent more than workers in firms with less than 25 workers in the early 1990s. Our most recent data suggests that the size-premium dropped by 15 percentage points over the past 20 years. We also show that the size-premium fell much more rapidly among less educated workers. For example, among workers with less than a high school degree, the size-premium fell by 30 percentage points. This study documents the trends in the size-premium and explores some possible explanations for the trends.

Section 2 provides an overview of the theoretical explanations and empirical evidence on the size-premium. Section 3 discusses our data and reviews the evidence on trends in the size-premium. Empirical analysis of the trends is provided in section 4. Our main conclusions are as follows: First, the size-premium dropped over the past 20 years for two primary reasons: (i) the type of worker employed by large and small firms has become more similar over time, and

(ii) large and small firms have become more similar in terms of the way that they reward workers, holding observed characteristics constant. Also, while the size-premium diminished over time, it remains quantitatively significant – particularly among highly educated workers.

2. Background.

Oi and Idson (1999) provide a wide-ranging summary of the extant research on the size-premium. Their review points out that the size-premium was first documented nearly 100 years ago among women workers at textile firms. Their summary of empirical studies shows that the largest firms (e.g., firms with 500 or more employees) pay wages that are 30-50 percent higher than the smallest firms (e.g., firms with less than 25 employees).

Numerous theories for the size-premium have been proposed and no single theory is capable of providing an empirical explanation of the entire size premium. The more prominent theories for the size premium are based upon size-related differences in monitoring costs, capital/technology, working conditions, monopoly power, or union effects.

The monitoring costs explanation for the size-premium, first proposed by Oi (1983), argues that greater monitoring costs at large firms causes them to hire more able workers to conserve on monitoring costs. Because larger firms hire more able workers, wages increase with firm size. Also, because of greater monitoring costs, large firms may be more likely to pay efficiency wages or deferred pay to reduce monitoring problems, and utilize higher capital-labor ratios to conserve on the number of workers. Empirical evidence suggests that the greater use of advanced technology by large firms explains part of the size-premium (Reilly 1995; Dunne and Schmitz 1995; Tan and Batra 1997; Troske 1999; Yu et. al 2008).

Yet another explanation for the size-premium is that larger firms must pay a compensating difference for unpleasant work conditions. For example, Brown and Medoff

(1989) point to evidence that larger firms have more work rules and their workers have less freedom of action, greater commuting distances, and a more impersonal work atmosphere. However, their study finds little support for the hypothesis that inferior working conditions at large firms contribute to the size-premium, but they admit that proper measurement of all relevant working conditions is an arduous task and some studies find evidence of a compensating difference at large firms. For example, Kostiuk (1990) finds that some of the size-premium is a compensating difference for shift work that is more common at large firms.

Because larger firms are more likely to have monopoly power in product markets, some have argued (e.g., Mellow 1982) that large firms may engage in rent-sharing with the workers. There is relatively little support found for this hypothesis, however (e.g., Brown and Medoff 1989).

The union threat hypothesis is that large firms have a greater threat of unionization than small firms and attempt to avoid the union threat by paying higher wages. This would suggest that the size-premium would be larger in the non-union work force. However, Brown and Medoff (1989) find that the size-premium among non-union workers is not higher in occupations or industries where union threats are greatest.

Another dimension of the size-premium relates to whether the premium is better explained by firm or establishment size. That is, a large firm (e.g., Walmart) may have many separate establishments (stores). Evidence suggests that there is both a firm size and an establishment size premium (e.g., Idson and Oi 1999; Troske 1999).

While this brief literature review is by no means an exhaustive list of theories or empirical evidence on the size premium, it provides a general sense of the range of explanations that have been considered. This study does not try to distinguish between the various theories of the size premium. Rather, its objective is to document the trends in the size premium and

provide an understanding of why the size premium declined. The various theories of the size-premium will assist in interpreting the empirical evidence.

3. The Data and Trends in the Size Premium.

To investigate trends in the size premium, we use data from the March Current Population Surveys (CPS) administered between 1989 and 2008. Because the March CPS asks about earnings in the prior year, the earnings are for 1988 through 2007.

Our measure of the wage is constructed from a person's reported earnings, weeks worked, and hours worked in the prior year. Specifically, for each person we estimate the hourly wage rate as annual earnings divided by the product of weeks worked and usual hours per week. This measure of the wage rate includes any bonuses or overtime that the worker receives.[1]

Our measure of firm size represents the number of workers at the firm, not the establishment. The March CPS data does not provide establishment size. Consequently, if a firm owns 5 establishments with 100 workers each, it is classified as a firm with 500 workers. While there is both theory and evidence explaining separate firm and establishment size premia and the explanations for these premia may differ, we are not able to sort out these effects using the March CPS data.

We restrict our sample to private sector wage and salary workers between the ages of 21 and 64. We exclude observations with imputed wages because of the resulting bias that may emerge in the estimation of wage equations. We also eliminate workers reporting more than one

[1] Workers with top-coded annual earnings, for the years 1988 to 1994, have been assigned an estimated mean earnings value by assuming that the upper tail of earnings follows a Pareto distribution. Parameters of the Pareto distribution are estimated separately by year and gender. Starting with 1995 earnings, the March CPS assigns the mean value of earnings by demographic group for top-coded workers.

employer in the year prior to the interview since we cannot be certain that the firm size reported by these workers applies for the entire year.

Following the suggestion of Bollinger and Hirsch (2006), we correct for the omission of observations with imputed wages and multiple employers by creating weights that reflect the inverse of the probability of being included in the sample. The analysis also corrects for the sample design inherent in the CPS data.[2] Henceforth, any reference to "sample weights" refers to weights that reflect the product of the CPS sampling weights multiplied by the inverse probability weights that correct for exclusion of observations with imputed earnings or multiple employers in the prior year.

Fringe benefits represent an increasing share of labor costs. Since large firms are more likely to provide benefits like pension and health insurance for their workers, adding fringe benefits to the hourly cost of labor may alter both the size and trend in the size premium.

To examine the role of changes in fringe benefit costs on the size-premium, we add the per hour cost of fringe benefits to the wage rate and regenerate estimates of the size-premium over time. The two fringe benefits that we focus on are the employer cost of health insurance and pension coverage since the March CPS indicates whether the employee receives these fringe benefits. Since the March CPS data does not provide any information on the employer cost of pension or health insurance coverage, we estimate the hourly cost of health insurance and pensions by firm size using data available from the Bureau of Labor Statistics.[3]

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[2] The method for weighting for excluded observation first estimates a probit model of whether a person is included in the sample (i.e. the person's wage is not imputed and only one employer is reported for the year prior to the March survey). This probit model is estimated separately by year and used to generate a predicted probability of being included in the sample. Observations are then weighted by the inverse of this probability times the sample weights provided for variables in the March CPS annual demographic supplement.

[3] Details on the construction of the fringe benefit data are provided in Appendix 1 along with a summary of the hourly costs of each fringe benefit by year and education group. For health insurance, we calculate the cost per hour in dollars (conditional on coverage) by firm size; for pensions, we calculate the percentage of wages contributed (conditional on coverage) by firm size. The cost of these benefits (either as a dollar amount or as a percentage of the worker's wage) is added to the hourly wage rate for those who report coverage.

While the rising cost of fringe benefits may influence trends in the size premium in wages, we admit that we do not have a perfect measure of their cost. Consequently, in what follows, our analysis focuses primarily on the size-premium in wages, though we will provide some sensitivity analysis based on the size-premium in hourly compensation.

Trends in the Size Premium.

Figures 1 and 2 provide information on the size premium in wages between 1988 and 2007. All of the wage estimates reflect sample-weighted means and are measured in 2007 dollars. Figure 1 shows the mean of the real hourly wage for the four different firm size groupings (1-24, 25-99, 100-499, and 500+), whereas figure 2 illustrates the "size-premium" calculated as the difference in the mean of the log-wage for a given firm size category and that for the smallest firm size group (1-24). [4] The figures illustrate that, for every year in the sample, wages rise with firm size and that the size-premium decreased over time. For example, for the largest firm-size category (500+ employees), the log-wage premium fell from .44 to .34. This means that workers at the largest firms earned 55 percent more than workers at the smallest firms in the early period and 40 percent more than workers at the smallest firms in the late period.[5] The size premia for the 25-99 and 100-499 categories are smaller than for the 500+ category and the rate of decline is not as pronounced. In these two groups, the size-premium fell from .20 to .19 and from .30 to .25 over the sample period. This paper focuses on the decline in the size-premium in the largest size category.

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[4] The CPS actually provides 5 firm size categories, but we combined the 500-999 group with firms that have 1000 or more workers. The trends are not significantly altered by combining these groups and this gives us the advantage of having a larger sample for our analysis.

[5] A log-wage differential (β) can be converted into a percentage differential by using the formula: $(\exp(\beta)-1)*100$.

Table 1 provides additional information on the size and trend in the size premium over the sample period. The means of the log-hourly wage and log hourly compensation (wages plus pension and health insurance costs) are presented for the beginning and ending five years of the sample (1988-92 and 2003-2007) for the smallest and largest firm sizes. The difference between the log-wage at large and small firms is the estimated size premium.

For the sample as a whole, the size premium in log-wages dropped by .10 (from .44 to .34) between the 1988-92 and 2003-07 sample periods. The size premium in hourly compensation (wages plus health insurance and pensions) dropped by .08 (from .52 to .44). Adding fringe benefits to hourly wages increases the size premium but reduces its rate of decline. In fact, approximately one-fifth (.02/.10) of the decline in the size premium wages was offset by greater increases in the cost of fringe benefits at large firms.

Earlier work shows that the size premium rises with skill level. For example, Meagher and Wilson (2004) find the size-premium for supervisors is nearly twice that for non-supervisors, and Garen (1985) finds that the size-premium rises with worker education. We find a similar pattern in the 2003-07 sample, though it does not appear in the 1988-92 sample. Table 1 presents the size premium for each of four education groupings: (1) < 12 years of education; (2) high school graduates; (3) some college, but less than 16 years of education; and (4) a college degree. Among high school drop-outs, the size premium in hourly wages dropped by nearly two-thirds from .38 to .15; among college graduates, the premium dropped by nearly one-fifth from .45 to .36. If fringe benefits are added to hourly wages, the pattern remains the same – the size-premium fell most for the least educated workers.[6]

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[6] The fact that the size premium fell less in the sample of all workers than for 3 of the four education sub-groups may seem surprising. The most important explanation for this is that the fraction of workers in the highly educated subgroups where the size premium is greatest in the late period has been growing over time. For example, at large firms, the proportion of workers with college degrees rose from 26.3 to 34.1 percent of workers between the 1988-92 and 2003-07 sample periods.

An obvious question is how much of the size-premium is due to the fact that the workers at large firms are more skilled than those at small firms. A very simple way to address this question is to estimate a log-wage regression with firm size-dummies and see how the estimated size premium changes when controls for worker characteristics are added. The results of such an exercise are presented in table 2 for the 1988-92 and 2003-07 sample periods. The worker characteristics that we control for are listed at the bottom of the table.

Using the gap between the earnings of workers at the smallest (1-24) and largest (500+) firms to measure the size premium, controlling for worker characteristics cuts the estimated premium from .45 to .25 in the 1988-92 period; and from .34 to .20 in 2003-07. Consequently, differences in worker characteristics account for .20 of the size premium in the early period, but only .14 of the premium in the late period. This suggests that differences in worker characteristics at small and large firms have diminished over time and are partly responsible for a declining size premium. However, this regression approach does not provide any information about the dimensions in which workers have become more similar. For example, are workers at large and small firms becoming more similar in terms of their age, education, and unionism? Also, if workers are becoming more similar in a specific dimension, how much has this contributed to the decline in the size premium?

4. Decomposition of the Change in Size Premium.

In order to determine the relative contribution of different explanations for the decline in the size premium, we use an extension of a Blinder-Oaxaca methodology described in Belman and Levine (2004). Their study found a decline in the wage premium between 1979 and 1993 in

CPS data and employed a useful decomposition method for empirically estimating the relative importance of various factors in explaining the decline in the size premium.

The first step in the decomposition requires estimation of log-earnings equations by firm size at the beginning and end of the time period in question. We use the beginning and ending five years to examine the change in the size premium over time and compare the largest (500+) and smallest (1-24) employers to estimate the size premium. The estimated regression equations can be described as follows:

$$(1)\ w_{its} = X_{its}\,\beta_t^s + e_{it}^s\ ; \quad \mathrm{t} = 1, 2 \ \text{and s} = \mathrm{S}, \mathrm{L}$$

where w_{its} is the natural log of the real hourly wage for person i in period t at firm size s; X_{its} is a vector of control variables; and β_t^s is the coefficient vector in period t for firm size s. We define t=1 (2) as the early (late) period and s=S (L) as the small (large) firm. The regression coefficients are estimated to adjust for sampling weights and robust standard errors are used for calculation of t-statistics.

The change in the size premium can be written as:

$$(2)\ \Delta premium = \ (\bar{w}_{2L} - \bar{w}_{2S}) - (\bar{w}_{1L} - \bar{w}_{1S})$$

where $\bar{w}_{ts}$ is the weighted mean of the log-wage in period t for firm size s. The change in the premium can be decomposed into several components. To illustrate, define the change in large versus small gap in mean characteristics as:

$$(3)\ \Delta Xgap = (\bar{X}_{2L} - \bar{X}_{2S}) - (\bar{X}_{1L} - \bar{X}_{1S})$$

where $\bar{X}_{ij}$ represents the weighted mean of characteristics in period i at firm size j. Define the change in the large-small gap in coefficients as:

$$(4)\ \Delta\beta gap = (\beta_{2L} - \beta_{2S}) - (\beta_{1L} - \beta_{1S})$$

The change in the size premium can be decomposed into four parts:

$$(5)\ \Delta premium = \text{A} + \text{B} + \text{C} + \text{D}$$

where

$$(6)\ A = \bar{X}_S\, \Delta\beta gap$$

$$(7)\ B = \Delta X gap \bar{\beta}_S$$

$$(8)\ \text{C} = (\bar{X}_L - \bar{X}_S) * (\beta_{2L} - \beta_{1L})$$

$$(9)\ D = \left(\bar{X}_{2L} - \bar{X}_{1L}\right)(\bar{\beta}_L - \bar{\beta}_S)$$

where $\bar{X}_L$ and $\bar{X}_S$ represent the average of the early and late values for large and small firm characteristics; and $\bar{\beta}_L$ and $\bar{\beta}_S$ represent the average of the early and late period coefficients for the large and small firms. In the above decompositions, all of the coefficients are estimated using regressions that adjust for sampling weights and all of the means reflect weighted means. [7]

The first term (A) represents the change in the size premium due to convergence in the returns to characteristics across firm size over time. For example, if the returns to education become more similar at large and small firms over time, the size premium would shrink.

[7] The combination of weighted regressions with weighted means assures that the "weighted regression passes through the weighted sample mean" allowing the decomposition methods to be applied to changes in the weighted means. Appendix 2 provides detail on the decomposition.

The second term (B) represents the change in the size premium due to a convergence in worker characteristics across firm size over time. For example, if educational attainment at small and large firms converges over time, the size premium would decrease.

The third term (C) captures any change in the size premium that results if the rewards to characteristics more common at large firm changes over time. For example, if large firms have more educated workers than small firms and the returns to education at large firms rise over time, the size premium would increase.

The final term (D) captures any change in the premium that occurs if the characteristics rewarded more highly at large firms become more common at large firms over time. For example, if large firms pay a higher return to education than small firms and the average level of education at large firms grows over time, the size premium would increase.

As noted by Jones (1983) and more recently Oaxaca and Ransom (1999), a decomposition of the above parts that involves the gap in coefficients (e.g. parts A, C and D) into the share caused by changes in the return to a specific characteristic is not sensible because the results vary depending upon the reference group chosen. That is, for example, it is not possible to determine how much of the change in the size premium is due to changes in the returns to education across time at small versus large firms. The results of any such decomposition will vary depending upon which education group is chosen as the reference group. The same logic applies to continuous variables where the results will for alternative normalizations of a variable.

The portion of the decomposition that is due to differences in observed characteristics (B) can be further decomposed to reveal the effect of a specific variable. For example, it is possible to determine how much of the change in the size premium is due to changes in the educational mix of workers at large and small firms. However, the effect of categorical variables like the education dummies must be aggregated across dummy variables for a given characteristic. That

is, for example, the amount due to changes in the mix of workers across education groups must be added across all the education dummies. Otherwise, the results are sensitive to the choice of reference group.

Table 3 presents the means of the control variables by time period and firm size. The last column represents the change in the size-gap for each variable. For example, the "change in gap" value of -0.06 for union membership indicates that the difference between the percentage of workers who are unionized at large versus small firms decreased by .06 between the 1988-92 and 2003-07 sample periods. That is, unionism became relatively less common at large firms over time.

The changing gap in characteristics over time points to several possible explanations for the declining size premium. First, union membership declined at a faster rate among large than small firms.[8] Since unions are associated with higher wages, this should contribute to a decline in the size premium. Second, since the underrepresentation of women at large firms disappeared over time and women earn less than men, the size premium should shrink.

The average worker's education increased at both small and large firms over time, but the increase has been more pronounced at large firms. The more rapid increase in education at large firms should lead to a larger size premium over time. Finally, there have been significant changes in the distribution of employment across industries, but measuring the effect of the changing industrial structure requires knowledge of how the size premium varies across industries.

Estimates of the log of hourly wage equations are presented in table 4. To emphasize size-difference in returns, we present the coefficients on each of the characteristics along with

[8] Union membership is matched to the March CPS from the March to June Outgoing Rotation Group CPS files. While the earnings measure is for earnings in the prior year, the union status variable corresponds to the worker's union status in the reference week in the relevant outgoing rotation group file. Estimates of the size premium change only slightly if the sample is expanded to include observations with missing data on union membership.

interaction terms between a large firm size dummy and each of the characteristics. The coefficients on the interaction terms reveal how the returns to that characteristic differ for large and small firms and the t-statistics reveal whether the effect of a variable is statistically different at large and small firms. The log-wage regressions include controls for age, education, union membership, industry, occupation, sex, and race.

The coefficients on the interaction terms between characteristics and the dummy for large firm size suggest several important determinants of the size premium. First, in both 1988-92 and 2003-07, the size premium rises significantly with age. This has been noted in other studies and may reflect a greater proclivity to invest in specific training at large firms or greater reliance on deferred pay to reduce monitoring or turnover costs.[9] Second, the size premium is larger among non-union workers in the 1988-92 sample, but the effect is statistically insignificant in 2003-07. The larger size-premium among non-union workers is consistent with the hypothesis that larger nonunion firms increase earnings in response to union threat effects.[10] The fact that the size premium is not statistically different for union and non-union firms in the 2003-07 sample could reflect a reduction in union threat effects. Third, while returns to education are similar at small and large firms in the 1988-92 sample, the returns are significantly higher at large firms in the late period. Finally, the size premium varies substantially across industry. In the 2003-2007 period, the size premia are especially large in durable and nondurable manufacturing, and communications. In a few industries, the size premium is actually negative in 2003-2007 (i.e. large employers paid less than small employers). This includes retail trade, hospitals, non-hospital medical services, and social services.

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[9] Oi and Idson (1999) discuss several studies that find steeper age-earnings profiles at large firms, but note a couple of exceptions to these findings.

[10] See Brown and Medoff (1989).

Consequently, a shift of workers across industries has the potential to substantially alter the size premium.

The decomposition of the change in the firm size premium in hourly wages is presented in table 5. The decomposition is performed for all workers, and then for each of the four education groups.[11] For all workers, the size premium in hourly wages decreased by 10.0 log points between 1990 and 2005. Of this decline, 5.1 log points are due to the returns to characteristics converging across time at small and large firms. The obvious question is why the returns to worker characteristics converged over time. Possible explanations can be drawn from the theoretical explanations for the size premium that are not controlled for in our regression and potentially correlated with the included regressors. For example, if large firms are more likely to pay efficiency wages than small firms because of greater monitoring costs, any reduction in monitoring costs that is greater at large firms will result in a convergence in returns to characteristics. Alternatively, suppose large firms use more advanced technology (or more capital) than small firms and extract greater effort to improve the return on the expensive technology. If the size-gap in technology is reduced, the return to characteristics would converge at small and large firms. While there are numerous potential explanations for the size-gap in returns to characteristics, sorting out these effects requires more data than is available in the CPS.

The other major source of the decline in the size premium is that the characteristics of the workers at small and large firms converged over time. This led to a decline of 4.4 log points in the size premium between the 1988-92 and 2003-07 period. The bottom of table 5 provides a further breakdown of this part of the decomposition and shows that 1.2 log points of the decline

[11] For the decompositions by education group, a separate log-wage equation is estimated for each education group using the same controls as in table 3 except the education dummies are dropped.

in the size premium occurred because union membership fell faster at large than small firms. Another 1.0 log points of the decline occurred because the share of employees that are women has been rising faster at large than small firms. This contributes to a decline in the size premium because women are paid less than men, even after controlling for other observed characteristics.

The distribution of workers across industries changed substantially over time, and the employment shifts differed for large and small firms. For example, the share of workers in durable or non-durable manufacturing dropped by 12 percentage points among large employers, whereas the share in manufacturing was virtually unchanged among small employers (see table 3). At the same time, the share of workers in retail trade rose 5 percentage points among large employers while it dropped by 2 percentage points among small employers. Since the size premium in 2003-07 for the durable and nondurable manufacturing industry is positive whereas it is essentially zero in retail trade (see table 4), this reduces the size premium. Overall, the redistribution of workers across industries is estimated to have caused a decline of 2.2 log-points in the size premium.

Decomposition by Education Group.

The rate of decline in the size premium is much greater among less educated workers. To explore this, decompositions of the change in the size premium for the four separate education groups are presented in the last four columns of table 5. The decompositions are performed by estimating a separate regression equation for each education group. The results imply that the convergence in the returns to characteristics among small and large firms had the greatest effect among those with less than a high school degree. Holding observable characteristics constant, small and large firms have become much more similar in terms of how they reward their

workers, especially the least skilled group. Existing theories of the size premium provide some interesting hypotheses about why this may have occurred. For example, based upon the monitoring theory of the size-premium, if technological advances have improved the ability of large firms to monitor workers – particularly less skilled workers – the size premium would shrink most for the least educated workers.

Another important conclusion to be drawn from the analysis by education group is that worker characteristics are converging in all four education groups – but the effects of convergence are greatest among the least educated. Convergence of characteristics explains 11.9 and 4.3 log-points of the decline in the size premium for the least and most educated groups respectively. Analysis of the decomposition by characteristic suggests that the more rapid rate of decline in unionism at the large firms and the changing distribution of employment across industries contributed to a substantial decline in the premium among less educated workers. The magnitude of these effects is smaller or non-existent among the more educated workers.

Robustness of Results

This section examines the sensitivity of our earlier results to alternative decomposition methods and construction of the size-premium. One alternative to the decomposition described in equations (6)-(9) is as follows:

$$(10)\ A2 = \bar{X}_L \Delta\beta gap$$

$$(11)\ B2 = \Delta X gap \bar{\beta}_L$$

$$(12)\ \mathrm{C2} = (\bar{X}_L - \bar{X}_S) * (\beta_{2S} - \beta_{1S})$$

$$(13)\ D2 = \left(\bar{X}_{2S} - \bar{X}_{1S}\right)(\bar{\beta}_L - \bar{\beta}_S)$$

This alternative decomposition substitutes large for small firm characteristics in evaluating the importance of convergence in the returns to characteristics (i.e., replaces $\bar{X}_S$ with $\bar{X}_L$ in computing A). It also substitutes the returns to characteristics at large firms for returns at small firms ($\bar{\beta}_S$) in evaluating the importance of convergence of characteristics (i.e., $\bar{\beta}_L$ replaces $\bar{\beta}_S$ in calculation of B.). The terms C and D are similarly adjusted to assure that the decomposition adds up to the total change in the premium.

The results of the alternative decomposition, presented in table 6, show that the alternative decomposition slightly amplifies the portion of the decline in the size premium accounted for by a convergence of characteristics in each of the education groups as well as the sample of all workers. However, the changes are relatively modest and the earlier conclusions regarding the relative importance of converging characteristics are unchanged. As with the earlier decomposition, convergence of worker characteristics at small and large firms had the largest effect on the size-premium for the least educated workers. Also, the increasing similarity of small and large firms in terms of unionism, industrial composition, and gender remain important reasons for the decline in the size premium.

Another potential concern with our analysis is that it relies on a very specific definition of the size-premium – the gap in log-wages between workers at firms with 500 or more workers versus firms with less than 25 workers. In table 7, we provide the decomposition for an alternative measure of the premium by defining "small" firms as those with less than 100 workers.[12] This alternative definition reduces the rate of decline in the size-premium slightly, but most of the results change only slightly. For example, the decline in the size-premium is

[12] The decomposition used in table 6 is described in equations (6)-(9).

still greatest among the least educated workers. Also, convergence in unionism, industrial composition and gender are the most important reasons that the size premium fell.

We also considered decompositions that used either the early or late period coefficients and characteristics in the calculation of the portions due to convergence of returns (A) and convergence in characteristics (B). Using the coefficients from the late period slightly reduces the portion of the decline in the size premium that can be attributed to convergence of characteristics. The conclusion that convergence in unionism, industrial composition, and gender are the three most important sources of the declining size premium is unaltered.

Fringe Benefits

Since workers at large firms are more likely to have pension and health insurance, the size premium in hourly compensation (wages plus the hourly value of fringe benefits) is greater than the size premium in wages. Our analysis of the data reveals that the cost of pension and health insurance benefits rose more rapidly at large than small firms – primarily because large firms are more likely to offer such benefits. For example, in the 1988-92 period, health insurance coverage rates were 32.4% and 74.0% at small and large firms; pension coverage rates were 14.1% and 61.0%. The growth between 1988-92 and 2003-07 in the real hourly cost (in 2007 dollars) at small and large firms was $.43 and $.89 for health insurance, and $.18 and $.62 for pensions. Consequently, the size premium in hourly compensation (wages plus fringe benefits) fell less than the size premium in wages over our sample period (see table 1).

Given the potential importance of fringe benefits in the measure of the size premium, we reexamine trends in the size-premium using hourly compensation instead of hourly earnings. The results, provided in table 8, can be compared with those in table 5 to determine the extent to

which our earlier conclusions remain intact. As was the case for the size-premium in hourly wages, the size gap in hourly compensation fell over time and the decline in the size premium was greatest for the least educated population. Also, including the value of fringe benefits does not substantially alter the main conclusions drawn from the earlier decompositions. For each education group, approximately one-half of the decline in the size premium is due to increased similarity of workers at small and large firms in terms of unionism, industry, and gender composition.

5. Summary and Conclusions.

Our study documents a significant decline in the wage premium paid by large employers over the past 20 years. In the aggregate, the gap in the log-wage paid by large (500+ employees) and small (<25 employees) fell from .44 to .34. The decline in the size premium has been particularly pronounced among less educated workers. Among workers with less than 12 years of education, the size premium fell by nearly two-thirds over the past 20 years.

About one-half of the decline in the size premium in hourly wages can be accounted for by the fact that small and large firms have become more similar in terms of the types of employees and jobs – particularly in terms of unionization rates, gender, and industry of employment. Another important reason that the size premium has been falling is that there has been a pronounced convergence in the returns to characteristics at small and large firms – particularly for the least educated work force. Our empirical analysis shows that these conclusions are robust to alternative decomposition methods and the use of different ways of measuring the size premium.

The fact that the returns to characteristics are rapidly converging at small and large firms presents several questions for future research. For example, is the convergence in pay structure at large and small firms because they are adopting more similar technology? Is it because large and small firms have become more similar in terms of the unobservable skills of workers that they attract? Have working conditions, or other non-pecuniary aspects of the jobs at large and small firms become more similar? Or did increased competition from globalization reduce the ability of large firms to share rents with their workers? This study leaves these questions unanswered but provides the groundwork for future research on the topic.

While there has been a substantial decline in the size premium over the past two decades, a significant premium remains. Controlling for worker characteristics, the most recent data suggests that workers at large firms still earn approximately 20 percent more than those at a small firm, controlling for observable worker characteristics. To put this in perspective, this is similar to the difference in log-wages between a college and high school graduate. Consequently, while the size premium has been shrinking, it is still a very important determinant of pay structure in the U.S. economy.

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Table 1
Means of Log Wages and Compensation by Firm Size and Time Period[a]

	1988 to 1992			2003 to 2007			
	1 to 24 Workers	500+ Workers	Gap	1 to 24 Workers	500+ Workers	Gap	Change in Gap
All workers							
Log Real Hourly Wage	2.48	2.92	0.44	2.62	2.96	0.34	-0.10
Log Real Hourly Compensation	2.54	3.06	0.52	2.71	3.15	0.44	-0.08
High School Dropouts							
Log Real Hourly Wage	2.21	2.59	0.38	2.25	2.40	0.15	-0.23
Log Real Hourly Compensation	2.25	2.73	0.48	2.31	2.57	0.26	-0.21
High School Graduates							
Log Real Hourly Wage	2.41	2.77	0.36	2.51	2.72	0.21	-0.15
Log Real Hourly Compensation	2.47	2.91	0.44	2.60	2.92	0.32	-0.12
Some College							
Log Real Hourly Wage	2.53	2.91	0.37	2.62	2.87	0.25	-0.13
Log Real Hourly Compensation	2.60	3.04	0.44	2.71	3.05	0.34	-0.10
College Graduates							
Log Real Hourly Wage	2.82	3.27	0.45	2.98	3.34	0.36	-0.09
Log Real Hourly Compensation	2.89	3.39	0.50	3.08	3.51	0.43	-0.07
Sample Size	32,579	67,229		33,310	60,787		

[a] Note: Log hourly compensation includes the dollar value of health insurance and pension benefits. Wage estimates are for private sector workers aged 21-64.

Table 2
Estimates of Size-Premium in Log(Wage)[a]

	1988 to 1992		2003 to 2007	
Variable	No Controls	With Controls	No Controls	With Controls
Firm Size:				
25 to 99 Workers	0.197	0.105	0.169	0.0950
	(30.7)	(19.7)	(23.2)	(15.2)
100 to 499 Workers	0.282	0.150	0.251	0.133
	(45.7)	(28.5)	(35.1)	(21.6)
500+ Workers	0.445	0.249	0.344	0.198
	(88.4)	(53.6)	(59.9)	(37.8)
Observations	147,382	147,382	138,099	138,099
R-Squared	0.08	0.44	0.04	0.39

[a] The dependent variable is the natural log of the real hourly wage. The column labeled "With Controls" also includes controls for gender, education (5), union status, age (4) central city status (2), industry (18), occupation (12), state (50), and race (2). T-statistics are in parentheses and are calculated using robust standard errors.

Table 3
Sample Characteristics by Size and Time Period

	1988 to 1992			2003 to 2007			
	1 to 24 Workers	500+ Workers	Gap	1 to 24 Workers	500+ Workers	Gap	Change in Gap
Female	0.49	0.46	-0.04	0.47	0.48	0.01	0.05
Age	37.15	38.28	1.13	40.13	40.93	0.80	-0.32
Union Member	0.05	0.19	0.14	0.04	0.12	0.08	-0.06
Years of Schooling	12.67	13.41	0.74	13.08	13.94	0.85	0.11
Industry:							
Construction	0.12	0.02	-0.10	0.14	0.02	-0.11	-0.01
Durable Manufacturing	0.05	0.20	0.15	0.05	0.12	0.07	-0.08
Non-Durable Manuf.	0.04	0.13	0.09	0.03	0.08	0.05	-0.04
Wholesale Trade	0.06	0.04	-0.02	0.04	0.03	-0.01	0.02
Retail Trade	0.21	0.17	-0.04	0.19	0.22	0.03	0.07
Personal Services	0.07	0.02	-0.05	0.06	0.02	-0.04	0.01
Entertainment	0.01	0.01	-0.01	0.02	0.02	0.00	0.01
Non-Hospital Medical	0.08	0.02	-0.06	0.08	0.04	-0.04	0.02
Other Industries	0.37	0.41	0.04	0.40	0.45	0.05	0.01
Occupation:							
Managers	0.11	0.14	0.03	0.12	0.17	0.05	0.02
Professionals	0.08	0.13	0.05	0.10	0.17	0.06	0.01
Technicians	0.03	0.05	0.02	0.04	0.04	0.01	-0.01
Sales	0.13	0.13	0.00	0.12	0.15	0.03	0.03
Administrative Support	0.16	0.18	0.02	0.14	0.14	0.01	-0.02
Private Household	0.02	0.00	-0.02	0.01	0.00	-0.01	0.02
Precision Production	0.16	0.12	-0.04	0.15	0.09	-0.07	-0.03
Operators	0.04	0.09	0.05	0.04	0.06	0.02	-0.03
Other Occupations	0.27	0.16	-0.10	0.28	0.18	-0.10	0.01
Sample Size	32,579	67,229		33,310	60,787		

Sample includes private sector workers aged 21-64.

Table 4
Regressions used for Log-Wage Decompositions[a]

	1988 to 1992		2003 to 2007	
Variable	Characteristic	Characteristic * Large	Characteristic	Characteristic * Large
Female	-0.209	-0.0466	-0.185	-0.000610
	(-19.2)	(-3.91)	(-16.9)	(-0.049)
Education (elementary school omitted):				
High School Dropout	0.113	-0.0337	0.127	0.0397
	(5.80)	(-1.38)	(4.60)	(1.12)
High School Graduate	0.219	-0.0113	0.282	0.0550
	(12.8)	(-0.53)	(11.2)	(1.76)
Some College	0.309	-0.0107	0.371	0.0649
	(17.2)	(-0.48)	(14.5)	(2.03)
College Graduate	0.451	0.00472	0.528	0.123
	(21.4)	(0.19)	(19.3)	(3.66)
Graduate School	0.593	-0.00226	0.742	0.110
	(21.3)	(-0.070)	(22.1)	(2.75)
Union Member	0.222	-0.0737	0.170	-0.0207
	(13.6)	(-4.29)	(8.14)	(-0.94)
Age (age 18 to 24 omitted):				
25 to 34	0.206	0.0204	0.176	0.0796
	(17.1)	(1.41)	(11.6)	(4.28)
35 to 44	0.278	0.0971	0.276	0.161
	(22.4)	(6.56)	(18.7)	(8.82)
45 to 54	0.287	0.135	0.295	0.184
	(21.1)	(8.37)	(19.0)	(9.77)
55 to 64	0.243	0.152	0.307	0.148
	(15.5)	(8.20)	(18.2)	(7.23)
Industry (agriculture omitted)				
Mining	0.447	-0.101	0.283	0.0722
	(7.28)	(-1.25)	(4.85)	(1.04)
Construction	0.241	-0.0366	0.178	0.0619
	(7.33)	(-0.58)	(4.94)	(1.26)
Durable Manufacturing	0.217	-0.0138	0.136	0.0927
	(6.45)	(-0.22)	(3.72)	(1.94)
Nondurable Manufacturing	0.134	0.0309	0.0269	0.157
	(3.74)	(0.49)	(0.61)	(2.90)
Transportation	0.113	0.129	0.0595	0.0935
	(3.17)	(2.03)	(1.47)	(1.82)

Communications	0.113	0.163	0.0577	0.147
	(2.17)	(2.23)	(0.73)	(1.70)
Utilities	0.377	-0.0853	0.281	0.0593
	(7.22)	(-1.16)	(4.23)	(0.80)
Wholesale Trade	0.201	-0.0303	0.150	0.00815
	(5.95)	(-0.49)	(3.73)	(0.16)
Retail Trade	-0.0626	-0.113	-0.120	-0.0321
	(-1.96)	(-1.86)	(-3.38)	(-0.69)
Finance, Insurance, and Real Estate	0.194	-0.0479	0.205	-0.000802
	(5.76)	(-0.78)	(5.43)	(-0.016)
Business/Repair Services	0.125	-0.0633	0.104	0.0244
	(3.81)	(-1.03)	(2.91)	(0.51)
Personal Services	-0.0334	-0.0941	-0.0638	0.00402
	(-0.86)	(-1.43)	(-1.63)	(0.077)
Entertainment	-0.0130	-0.0250	-0.0510	0.00771
	(-0.31)	(-0.35)	(-1.11)	(0.13)
Hospitals	0.352	-0.227	0.223	-0.0925
	(5.72)	(-2.82)	(3.69)	(-1.36)
Non-Hospital Medical	0.235	-0.217	0.210	-0.164
	(7.16)	(-3.43)	(5.84)	(-3.39)
Education	-0.169	-0.00119	-0.202	-0.00881
	(-3.87)	(-0.017)	(-4.33)	(-0.15)
Social Services	-0.233	-0.116	-0.181	-0.132
	(-5.96)	(-1.52)	(-4.34)	(-2.18)
Other Services	0.132	-0.161	0.00742	0.0855
	(3.97)	(-2.51)	(0.20)	(1.66)
Constant	2.220	0.241	2.294	-0.00750
	(46.5)	(3.28)	(45.2)	(-0.12)
Observations	99,808		94,097	
R-squared	0.47		0.41	

[a] The dependent variable is the natural log of the real hourly wage. The column labeled "characteristic*large" contains the estimated coefficients for interactions between a dummy variable for large firm size and the respective characteristics. The regressions also include controls for central city status (2), occupation (12), state (50), and race (2) and interactions of these variables with the large firm dummy. T-statistics are in parentheses and are calculated using robust standard errors.

Table 5
Decomposition of the Change in Firm Size Premium
for Log Real Hourly Wage[a]

	All	Dropout	HS Grad	Some College	College
Change in size premium	-0.100	-0.228	-0.151	-0.127	-0.092
Portion of change due to:					
A. Convergence of returns at large and small firms	-0.051	-0.103	-0.054	-0.050	-0.051
B. Convergence of characteristics of workers at large and small firms.	-0.044	-0.119	-0.071	-0.045	-0.043
C. Differential reward to characteristics more common at large firms changes over time	-0.004	0.033	-0.012	-0.031	-0.011
D. Changing returns for characteristics particularly common at large firms	-0.001	-0.039	-0.014	-0.001	0.013
Decomposition of (B)					
Female	-0.010	-0.012	-0.011	-0.007	-0.015
Education	0.007	0.000	0.000	0.000	0.000
Union	-0.012	-0.041	-0.019	-0.008	0.001
Age	-0.007	-0.007	-0.007	-0.011	-0.003
Race	0.000	-0.003	0.001	0.002	0.001
Central City	-0.003	-0.006	-0.004	-0.001	-0.005
Industry	-0.022	-0.040	-0.029	-0.019	-0.017
Occupation	0.003	-0.011	-0.001	-0.002	0.001
State	-0.001	-0.001	-0.001	0.001	-0.005

[a] The firm size premium is the log-hourly wage premium for firms with 500+ workers relative to those with 1-24 workers. The change in size-premium is measured between the 1988-92 and the 2003-2007 periods.

Table 6
Alternative Decomposition of the Change in Firm Size Premium for Log Real Hourly Wage[a]

	All	Dropout	HS Grad	Some College	College
Change in size premium	-0.100	-0.228	-0.151	-0.127	-0.092
Portion of change due to:					
A. Convergence of returns at large and small firms	-0.053	-0.092	-0.057	-0.064	-0.044
B. Convergence of characteristics of workers at large and small firms.	-0.065	-0.150	-0.109	-0.066	-0.054
C. Differential reward to characteristics more common at large firms changes over time	-0.003	0.021	-0.010	-0.017	-0.018
D. Changing returns for characteristics particularly common at large firms	0.020	-0.007	0.024	0.020	0.024
Decomposition of (B)					
Female	-0.011	-0.016	-0.013	-0.008	-0.013
Education	0.008	0.000	0.000	0.000	0.000
Union	-0.009	-0.034	-0.015	-0.006	0.000
Age	-0.011	-0.013	-0.011	-0.015	-0.006
Race	0.000	-0.002	0.000	0.001	0.001
Central City	-0.003	-0.003	-0.003	-0.001	-0.005
Industry	-0.042	-0.070	-0.054	-0.033	-0.031
Occupation	0.003	-0.012	-0.014	-0.006	0.004
State	-0.001	0.000	0.000	0.000	-0.005

[a] The firm size premium is the log-hourly wage premium for firms with 500+ workers relative to those with 1-24 workers. The change in the size-premium is measured between the 1988-92 and the 2003-2007 periods.

Table 7
Alternative Size Definition Decomposition of the Change in Firm Size Premium for Log Real Hourly Wage[a]

	All	Dropout	HS Grad	Some College	College
Change in size premium	-0.085	-0.201	-0.118	-0.125	-0.068
Portion of change due to:					
A. Convergence of returns at large and small firms	-0.042	-0.098	-0.037	-0.054	-0.036
B. Convergence of characteristics of workers at large and small firms.	-0.040	-0.105	-0.062	-0.045	-0.038
C. Differential reward to characteristics more common at large firms changes over time	0.000	0.038	-0.005	-0.023	-0.011
D. Changing returns for characteristics particularly common at large firms	-0.003	-0.036	-0.013	-0.003	0.017
Decomposition of (B)					
Female	-0.008	-0.013	-0.010	-0.006	-0.012
Education	0.005	0.000	0.000	0.000	0.000
Union	-0.010	-0.036	-0.017	-0.007	0.000
Age	-0.008	-0.008	-0.008	-0.014	-0.001
Race	-0.001	-0.001	0.000	0.001	-0.001
Central City	-0.002	-0.005	-0.002	0.001	-0.004
Industry	-0.020	-0.038	-0.026	-0.018	-0.018
Occupation	0.003	-0.006	0.001	-0.003	0.000
State	0.000	0.001	0.000	0.002	-0.001

[a] The firm size premium is the log-hourly wage premium for firms with 500+ workers relative to those with 1-99 workers. The change in the size-premium is measured between the 1988-92 and the 2003-2007 periods.

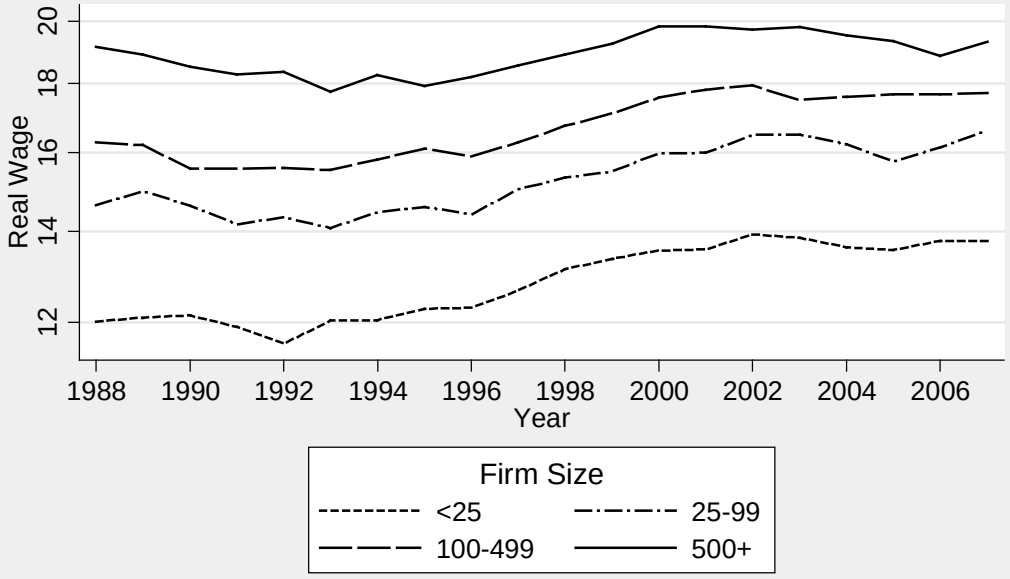
Table 8
Decomposition of the Change in Firm Size Premium
for Log Real Hourly Compensation[a]

	All	Dropout	HS Grad	Some College	College
Change in size premium	-0.078	-0.212	-0.123	-0.102	-0.074
Portion of change due to:					
A. Convergence of returns at large and small firms	-0.027	-0.094	-0.026	-0.024	-0.034
B. Convergence of characteristics of workers at large and small firms.	-0.049	-0.132	-0.079	-0.049	-0.044
C. Differential reward to characteristics more common at large firms changes over time	-0.001	0.056	-0.009	-0.029	-0.010
D. Changing returns for characteristics particularly common at large firms	-0.001	-0.041	-0.009	0.001	0.015
Decomposition of (B)					
Female	-0.010	-0.013	-0.012	-0.007	-0.016
Education	0.008	0.000	0.000	0.000	0.000
Union	-0.014	-0.048	-0.023	-0.010	0.001
Age	-0.007	-0.007	-0.007	-0.012	-0.003
Race	0.000	-0.002	0.001	0.002	0.001
Central City	-0.003	-0.006	-0.004	-0.001	-0.005
Industry	-0.024	-0.043	-0.032	-0.019	-0.019
Occupation	0.003	-0.012	-0.003	-0.003	0.001
State	-0.001	-0.001	0.000	0.000	-0.004

[a] The firm size premium is the log-hourly compensation premium for firms with 500+ workers relative to those with 1-24 workers. Log hourly compensation includes the hourly value of wages, health insurance and pension benefits. The change in the size-premium is measured between the 1988-92 and the 2003-2007 periods.

Figure 1.

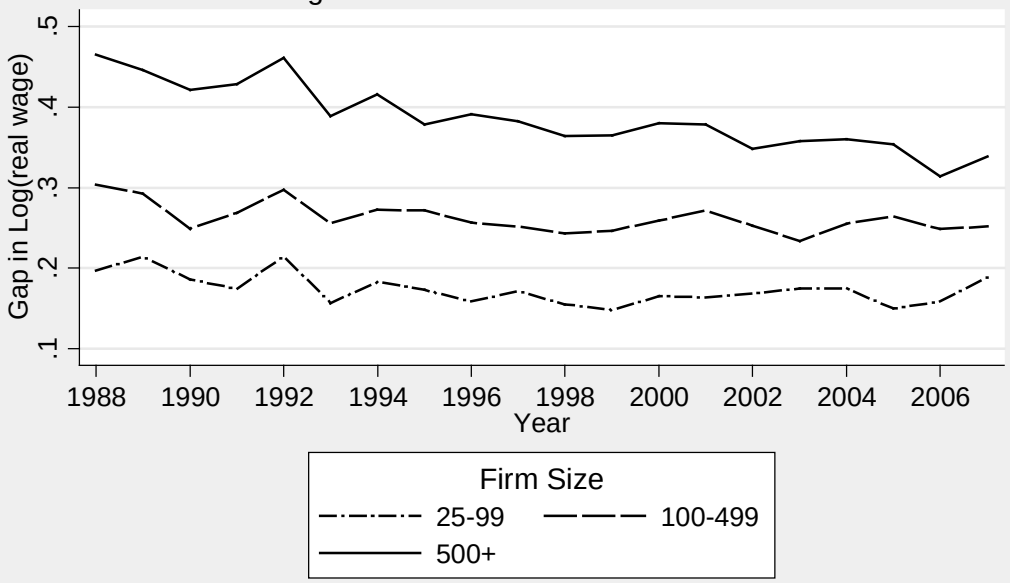
Real Wages by Firm Size



Wage estimates are for private-sector workers aged 21-64, measured in 2007 dollars, and calculated using sample weights.

Figure 2.

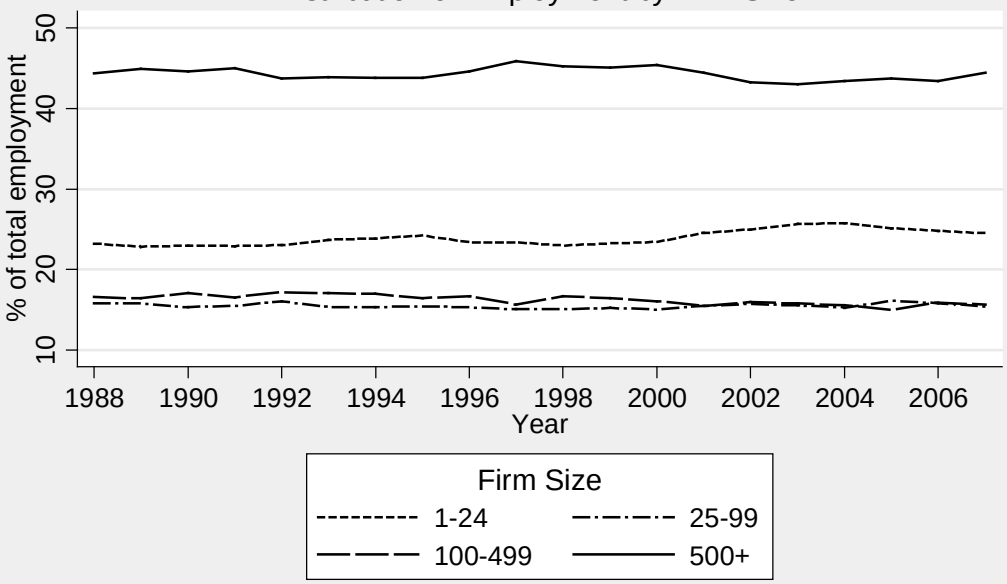
Wage Premium Relative to Smallest Firms



Wage estimates are for private-sector workers aged 21-64, measured in 2007 dollars, and calculated using sample weights. Size premium is computed relative to firms with 1-24 employees.

Figure 3.

Distribution of Employment by Firm Size



Sample includes private-sector workers aged 21 to 64. Employment shares are calculated using sample weights.

Appendix 1: Calculation of Hourly Value of Fringe Benefits

The Current Population Survey indicates whether workers have health insurance or pension coverage, but does not provide any information on the hourly cost of those benefits. The following process was used to estimate the hourly value of fringe benefits. First, the employer cost of health insurance and pensions was obtained by employer size from the *Employer Expenditures for Employee Compensation* (http://www.bls.gov/ncs/ect/). This data includes assigns a cost of 0 for those not covered by health insurance or pensions. This data is provided annually by establishment size for private-sector workers from 1990 forward (ftp://ftp.bls.gov/pub/special.requests/ocwc/ect/ececchist.txt and ftp://ftp.bls.gov/pub/special.requests/ocwc/ect/ececqrt.txt). The data for establishments with 1 to 99 employees was merged to workers in CPS employed at firms with 1 to 24 workers and the data for establishments with 100 and more employees was used for firms with 500 or more workers.

Second, the reported hourly benefit costs obtained from the prior step were divided by the coverage rate for health insurance and pensions to obtain the hourly employer cost for those covered. The coverage rates for pensions and health insurance at establishments with 1 to 99 employees was obtained from *Employee Benefits in Small Private Industry Establishments* (1992, 1994, 1996) (http://www.bls.gov/schedule/archives/all_nr.htm#EBS) and *Employee Benefits Survey* (1999, 2000, 2003, 2004, 2005, 2006, 2008) (http://www.bls.gov/ncs/ebs/) . The coverage rates for pensions and health insurance at establishments with 100 or employees was obtained from *Employee Benefits in Medium and Large Establishments* (1991, 1993, 1995, 1997) (http://www.bls.gov/schedule/archives/all_nr.htm#EBS3D) and *Employee Benefits Survey* (1999,

2000, 2003, 2004, 2005, 2006, 2008). Interpolation was used for years for which coverage rates were not available.

Third, the hourly costs for years 1988 to 1990 was obtained by scaling the 1991 hourly cost figures by the rate of increase in employer cost of health insurance and pensions in *Employer Expenditures for Employee Compensation.*

Table A-1 summarizes fringe benefit coverage and costs (in 2007 dollars) by firm size for the early (1988-92) and late (2003-07) time periods. Both health insurance and pension coverage are more common at large than small firms, though the size-gap in coverage diminished slightly over time. The employer contributions for fringe benefits are greater at large than small firms because coverage rates are higher and the cost per hour given coverage is higher. Even though the percentage of workers covered by health insurance and pensions fell at large firms, the average hourly cost (including those without coverage) rose at large firms relative to small firms over time.

Table A-1
Means of Employer Fringe Benefit Costs by Firm Size and Time Period

	1988 to 1992			2003 to 2007			
	1 to 24 Workers	500+ Workers	Gap	1 to 24 Workers	500+ Workers	Gap	Change in Gap
Health Insurance Coverage	32.4%	74.0%	41.6%	33.8%	70.0%	36.2%	-5.4%
Health insurance hourly cost given coverage	$1.76	$2.20	$0.45	$2.96	$3.59	$0.63	$0.19
Health Insurance Hourly Cost	$0.57	$1.63	$1.06	$1.00	$2.52	$1.51	$0.45
Pension Coverage	14.1%	61.0%	46.9%	20.4%	59.6%	39.2%	-7.8%
Pension Hourly Cost given coverage	$1.84	$1.66	-$0.18	$2.14	$2.74	$0.60	$0.78
Pension Hourly Cost	$0.26	$1.01	$0.76	$0.44	$1.63	$1.20	$0.44

Appendix 2: Decomposition of the Change in the Firm Size Wage Premium

The change in the size premium can be written as:

(1) $\Delta premium = \ (\bar{w}_{2L} - \bar{w}_{2S}) - (\bar{w}_{1L} - \bar{w}_{1S})$

where $\bar{w}_{ij}$ represents the mean wage at large (j=L) and small (j=S) firms at the ending (i=2) and beginning (i=1) of the sample period under consideration. The Belman-Levine decomposition of the change in the size premium consists of four parts:

(2) $A = \bar{X}_S \, \Delta\beta gap$

(3) $B = \ \Delta X gap \bar{\beta}_S$

(4) $\mathrm{C} = \ (\bar{X}_L - \bar{X}_S) * (\beta_{2L} - \beta_{1L})$

(5) $D = \ \left(\bar{X}_{2L} - \bar{X}_{1L}\right)(\bar{\beta}_L \ - \bar{\beta}_S \,)$

where

(6) $\Delta X gap = (\bar{X}_{2L} \ - \bar{X}_{2S}) - (\bar{X}_{1L} \ - \bar{X}_{1S})$

(7) $\Delta\beta gap = (\beta_{2L} \ - \beta_{2S}) - (\beta_{1L} \ - \beta_{1S})$

(8) $\bar{X}_j = .5\left(\bar{X}_{2\mathrm{j}} + \bar{X}_{1\mathrm{j}}\right), \ \mathrm{j=L,S}$

(9) $\bar{\beta}_j \ = .5(\beta_{2\mathrm{j}} \ + \ \beta_{1\mathrm{j}}, \ \mathrm{j} = \mathrm{L}, \mathrm{S}$

Adding the four components together and collapsing terms yields:

(10) A+B+C+D = $(\bar{X}_{2L}\beta_{2\mathrm{L}} - \bar{X}_{2S} * \beta_{2s}) - (\bar{X}_{1L} * \beta_{1\mathrm{L}} - \bar{X}_{1S} * \beta_{1S})$

$= \left(\bar{w}_{2L} - \bar{w}_{2S}\right) - \left(\bar{w}_{1L} - \bar{w}_{1S}\right)$

Where the second equality is based upon the fact that OLS regression estimators always pass through the mean so that $\bar{w}_{\mathrm{ij}} = \bar{X}_{\mathrm{ij}}\beta_{\mathrm{ij}}$ for $\mathrm{i} = 1,2; \mathrm{j} = \mathrm{L}, \mathrm{S}$.

An alternative decomposition uses similar logic but switches the role of large and small coefficients in computing the effect of changing characteristics ($\Delta Xgap$) and changing coefficients ($\Delta\beta gap$). This alternative decomposition yields four different components:

(11) $A2 = \bar{X}_L\,\Delta\beta gap$

(12) $B2 = \Delta Xgap\bar{\beta}_L$

(13) $C2 = (\bar{X}_L - \bar{X}_S) * (\beta_{2S} - \beta_{1S})$

(14) $D2 = (\bar{X}_{2S} - \bar{X}_{1S})(\bar{\beta}_L - \bar{\beta}_S)$

As with the first decomposition, the four components add to the total change in the firm size premium.

Since our regressions are weighted to correct for CPS sampling procedures and the omission of workers with imputed earnings or multiple employers (see text for details), the regression estimates will pass through the weighted means in the sample. [13] That is, for weighted regressions, it can be shown that $\bar{w}_{ij} = \bar{X}_{ij}\beta_{ij}$ where $\bar{w}_{ij}$ is the weighted mean of wages; $\bar{X}_{ij}$ is the weighted mean of the explanatory variables; and β_{ij} represents the coefficients from the weighted regression. Consequently, all of the logic presented above extends to the case where regressions are adjusted to reflect sampling weights and weighted means are used for the decomposition.

[13] To adjust for sampling weights in the OLS regressions, p-weights are used in Stata.