Increased Concentration of Occupations, Outsourcing, and Growing Wage Inequality in the United States

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February 20, 2015

We are grateful to seminar participants at the American Economic Association 2014 Annual Meetings, the University of Maryland, the Economic Policy Institute, the Bureau of Labor Statistics, the Michigan Labor Lunch, the Upjohn Institute, the NBER Summer Institute, George Washington University, the Society of Government Economists meetings, the Society of Labor Economists meetings, the Berkeley Labor Lunch, and the Center for Economic Studies at the Census Bureau for comments on earlier versions of this work, with special thanks to Katherine Abraham, David Card, Erica Groshen, John Haltiwanger, David Levine, and Anne Polivka for particularly helpful comments. All views expressed in this paper are those of the authors and do not necessarily reflect the views or policies of the U.S. Bureau of Labor Statistics or the U.S. Census Bureau.

I. Introduction

Growing inequality—of incomes, compensation, and wages—has been one of the dominant features of the US labor market over the last several decades. An enormous and growing literature has documented and attempted to explain this growing inequality and its many sources. We examine an additional source of growing wage inequality: the changing distribution of occupations between establishments as employers retain certain types of work and outsource other work.

We know that establishments play an important role in determining individual wages, beyond the role of individual characteristics (Groshen, 1991a, 1991b, Bronars and Famulari, 1997, Abowd, Kramarz, and Margolis, 1999, Lane, Salmon, and Spletzer, 2007, Card, Heining, and Kline, 2013). Several authors have used employer microdata to study growing variability in earnings in the U.S. from the mid-1970s to the early 2000s, and have found that the increasing variability is due more to variation between establishments than to variation within establishments (Davis and Haltiwanger, 1991, Dunne, Foster, Haltiwanger, and Troske, 2004, and Barth, Bryson, Davis, and Freeman, 2014).[1] The results in this paper show that growth in outsourcing is a key explanation for the growth in the between establishment component of wage inequality: a growing trend of low-wage workers and high-wage workers employed at different employers, exacerbating differences in their pay.

The intersection of growing underlying wage inequality and the business environment in the United States can make it profitable for employers to focus on employing either low or high wage workers. This underlying wage inequality among workers arises from such sources as the changing composition of the workforce and changing returns to education and experience (Bound and Johnson, 1992, Katz and Murphy, 1992, Lemieux, 2006), the growing inequality within education and skill groups (Juhn, Murphy, and Pierce, 1993, Katz and Autor, 1999), and the differential impact of technology on differing portions of the worker skill distribution (Juhn, Murphy, and Pierce, 1993, Acemoglu, 2002, Autor, Katz, and Kearney 2006, 2008). As wages for different kinds of work become less equal, employers operate within the framework of regulations requiring nondiscrimination across employees in the coverage of pension plans, and sometimes also in the coverage of health insurance benefit plans (EBRI, 2009, Perun, 2010),[2] increasing incentives to contract out work that pays very different wages from the work of other employees. Moreover, social norms may make it more acceptable for employers to contract out work rather than pay very different wages to employees doing different kinds of work.

There are many potential reasons for businesses to outsource work, in addition to avoiding paying efficiency wages or rents when market wages are low for particular types of low-skill work—and there is no single straightforward measure of outsourcing, for any reason. Other motivations for businesses to outsource work identified by Abraham and

[1] There is a large and growing literature on wage inequality growth in Europe, based on employee-employer linked data, most notably Card, Heining, and Kline (2013), who emphasize the role of increased worker sorting between employers in explaining wage inequality growth in Germany.

[2] Perun (2010) lists a variety of employment benefits which receive favorable tax treatment and are required to be available to low-wage as well as high-wage employees of each employer.

Taylor(1996) include increased ability to smooth workload for regular work force employees, and 'the existence of scale economies accruing to specialized providers of particular services.' Dey, Houseman, and Polivka (2010) show a marked increase in various measures of outsourcing in recent years, but no clearly defined sector to which jobs are outsourced. The closest such industries are "employment services," "professional employer organizations," and "temporary help," and estimates from several sources show these industries roughly doubling in size from 1992 to 2002. However, not all outsourcing is the movement of jobs to these particular industries, or even to the more general "business services" sector.[3]

In this paper, we use the concentration of employment by occupation as a measure of outsourcing, allowing us to distinguish different types of outsourcing and the impacts of these different types of outsourcing on wage inequality. When businesses are outsourcing work to avoid monitoring, hiring, or other costs for occupations in which they have less expertise, we will observe less variety in the number of occupations they employ. However, when businesses are outsourcing work to narrow the wage distribution of their employees, we will observe increases in the fraction of their employees that do low wage work, or the fraction of their employees that do high wage work. We also compare the impact of these changes in occupation concentration with the impact of other changes in employer characteristics (industry, size, and location) on the overall distribution of wages.

We have three major findings. First, we find that wages are related to the occupational concentration of workers within establishments. Workers in establishments that are more concentrated in occupations (except those concentrated in typically high-wage occupations) are paid lower wages. This relationship holds even after controlling for workers' own occupations and the sizes and industries of their employers, and has been increasing somewhat during 2000-2011. Second, during this period, there has been an increase in the concentration of occupations within establishments, particularly in the fraction of workers who are employed in very highly occupationally concentrated establishments. This increase is consistent with an increase in outsourcing of particularly low and high wage occupations into separate establishments. Third, this increase in occupational concentration can explain a substantial amount of the increase in private-sector wage inequality observed in our data over the 2000-2011 time period. Including these measures of occupational concentration, we can explain as much as 52% of overall wage inequality growth (63% of wage inequality growth between employers), while changes in the distributions of occupations, industries, establishment sizes, and the geography of employers can explain no more than 36% of overall wage inequality growth (46% of wage inequality growth between employers).

II. The Microdata of the Occupational Employment Statistics Survey

We use the Occupational Employment Statistics (OES) Survey microdata. This survey is designed to measure occupational employment and wages in the United States by geography and industry, and is the only such survey of its size and scope. The OES covers all

[3] As examples, Dey, Houseman, and Polivka show large increases in the fractions of school bus drivers employed by bus services companies (rather than by schools) and truck drivers in transportation industries (rather than by other industries).

establishments in the United States except for those in agriculture, private households, and unincorporated self-employed workers without employees. Every year, approximately 400,000 private and local government establishments are asked to report the number of employees in each occupation paid within specific wage intervals.[4]

An abridged version of an OES survey form is shown in Figure 1. This survey form is a matrix, with occupations on the rows and wage intervals on the columns. For large establishments, the survey form lists 50 to 225 detailed occupations; these occupations pre-printed on the survey form are selected based on the industry and the size of the establishment. Small establishments receive a blank survey form and write in descriptions of the work done by their employees. These employer-provided descriptions are coded into occupations by staff in state labor agencies (as part of the OES Federal-State partnership). Wage intervals on the OES survey form are given in both hourly and annual nominal dollars, with annual earnings being 2080 times the hourly wage rates. To calculate average wages, the OES program obtains the mean of each wage interval every year from the National Compensation Survey (NCS). These mean wages are then assigned to all employees in that wage interval.

The OES *cannot* measure inequality in the top percentiles of the wage distribution. Earnings of individuals at the very top of the wage distribution are topcoded in the OES -- the uppermost interval in the recent OES surveys is "$166,400 and over" (the ranges of the intervals vary by year – see Handwerker and Spletzer (2014) for more information). Averaged across all years, the uppermost interval contains roughly 1.3 percent of employment.

In our earlier work (Handwerker & Spletzer, 2014), we compare wage data in the OES with wage data from the outgoing rotation groups of the CPS, and have two main findings. First, we show that the interval nature of wage collection in the OES has essentially no impact on measures of overall wage inequality trends; we put the CPS wage data through the "filter" of the OES wage intervals, and the continuous CPS wage data and the intervalized CPS wage data show extremely similar wage inequality trends. Second, we show that the reweighted OES data can be used to broadly replicate basic CPS wage inequality trends, beginning in 1998. Overall wage distributions in each year are similar, as well as overall variance trends, variance trends by sector, industry groups, and occupation groups. In both the OES and the CPS, industry groups alone explain 15-17% of wage variation, although industry groups explain slightly more of the variation in the (employer-reported) OES than in the (employee-reported) CPS. Occupational groups alone explain more of the variation in wages in the OES (about 40%) than these same variables explain in the CPS (about 30%). This phenomenon was also noted by Abraham and Spletzer (2009), who attribute it to more accurate reporting of occupation by employers who answer the OES than by individuals who answer the CPS. We

[4] In the early years of our panel, the OES data were collected in October, November, and December. Starting in November 2002, data collection for 200,000 establishments occurs in November and data collection for 200,000 establishments occurs in May. The OES survey is not designed to produce time series statistics. We use the methodology described in Abraham and Spletzer (2010) to reweight the data to November or May benchmarks of total employment by detailed industry and by broad industry and establishment size groups from the Quarterly Census of Employment and Wages (QCEW).

also find that the amount of wage variance explained by occupation is growing more quickly in the OES than in the CPS.

Figure 2 shows the decomposition of the total wage variance in the OES into its within-establishment and between establishment components. Over the period of 1998 through November 2011, 55% of wage variance is between establishments, while 74% of the growth in overall wage variance from Fall 1998 to November 2011 is between establishments. These findings broadly replicate findings from the literature on the role of establishments in overall wage inequality. Bronars and Famulari (1997), using data from a supplement to the 1989 and 1990 White Collar Pay survey, found that 45 percent of variance is between establishments. Barth, Bryson, Davis, and Freeman (2014) use individual data from the 1977-2002 CPS and establishment data from the 1977-2002 Census Bureau's Longitudinal Business Database (LBD), and find that 55-70 percent of the variance in log earnings is between establishments, with growth in the between-establishment variance at least as large as the growth in overall wage dispersion between individuals.[5]

III. Occupational Concentration, its relationship with wages, and its time trends

IIIa: Our measures

We examine two forms of occupational concentration within establishments—more general occupational concentration across all occupations, and the specific type of occupational concentration for particularly high and low-paid occupations:

We measure general occupational concentration across all occupations with a Herfindahl index. We compute two Herfindahl indices:

$$(1a) \qquad H = \sum_{k=1}^{829} \left(\frac{Employment\ in\ Detailed\ Occupation_k}{Total\ Employment} \right)^2$$

$$(1b) \qquad H = \sum_{k=1}^{22} \left(\frac{Employment\ in\ Occupation\ Category_k}{Total\ Employment} \right)^2 ,$$

The first index uses all 829 detailed occupations at the 6-digit level of the Standard Occupational Classification system. This index varies from 1/829 (equal representation of all

[5] Other authors of related studies have focused on wages within manufacturing industries, and here also we find broadly consistent results. Davis and Haltiwanger (1991), find that 50 to 58 percent of wage variance in manufacturing is between plants, and 48 percent of variance growth in manufacturing is between plants. Dunne, Foster, Haltiwanger, and Troske (2004) find that 53 to 69 percent of wage variance in manufacturing is between establishments, and 90 percent of variance growth in manufacturing is between establishments. Barth, Bryson, Davis, and Freeman (2014) find that on average 62 percent of variance in manufacturing is between establishments, and 27 percent (.034/.125 in Table 2) of variance growth in manufacturing is between establishments. We find in the OES data from 1998-2011 that on average 47% of manufacturing wage variance is between establishments, while 63% of the growth in manufacturing wage variance is between establishments.

occupations) to 1 (perfect concentration). The second index uses the 22 major occupational categories at the 2-digit level of the Standard Occupational Classification system included in the OES. This index varies from 1/22 (equal representation of all categories) to 1 (perfect concentration).

Increased occupational concentration, as measured in these indices, is a general indication that employers are becoming more specialized, and are outsourcing work to other employers. We use two different aggregations of occupations to measure general occupational concentration at different levels of the Standard Occupational Classification System. The categories of occupations that are separated in definition 1a and conflated in definition 1b include occupations that perform related tasks, but can be paid very different wage levels. For example, dentists (occupation 29-1020) and dental hygienists (occupation 29-2021) are in the same broad occupational category. Observing increases in both broad and detailed occupational concentration would be an indication that employers are outsourcing particular types of work, whether it is low or high paying). In contrast, observing increases in detailed occupational concentration without similar increases in broad occupational concentration would be an indication that employers are outsourcing specific occupations, perhaps those that differ most in pay from other employees.

We are especially interested in measuring the outsourcing of work that pays particularly high or low wages. Thus, we also measure a specific type of occupational concentration, the fraction of workers with reported occupations that are typically high or low paid occupations. For each establishment, we calculate:

(2a) The fraction of workers who are classified in minor occupation categories (3-digit SOC levels) in which mean wages in 1999 were below the 30th percentile of the overall wage distribution.[6] These occupations are shown in Appendix A.

We selected the 30th percentile of the overall wage distribution to classify occupations as "typically low-wage" because classifications at the 25th percentile or lower select largely workers with occupations involving food and beverages, and we are interested in a measure of low-wage workers that might apply to a broad group of industries.

(2b) The fraction of workers who are classified in minor occupational categories (3-digit SOC levels) in which mean wages in 1999 were above the 70th percentile of the overall wage distribution (chosen for symmetry with the 30th percentile cut-off above). These occupations are shown in Appendix B.

[6] The OES began collecting data using the Standard Occupational Classification System in 1999. In order to use the 1998 data in making multi-year estimates, OES staff converted the 1998 data to the SOC, but many occupations were converted only at the 2-digit level. Thus, we cannot use 1998 data for our high-paid and low-paid occupational concentration measures. The OES data also had a change of industry classification systems soon thereafter. Beginning with the 2002 OES survey, establishments were classified by 6 digit NAICS codes, and the OES staff recoded much of the 2000 and 2001 OES microdata to use NAICS as well. In order to be able to use consistent industry controls in our work, we begin our analyses with the OES microdata from 2000.

IIIb: Relationships between Occupational Concentration Measures and Wages

All four of our Occupational Concentration measures are strongly and significantly related to wages. We document this with the regression:

$$Ln(wage) = \alpha OccupationalConcentration + \delta X + \varepsilon$$

where X includes the survey date, occupation fixed effects, industry fixed effects, state fixed effects, and establishment size (we use fixed effects for establishment size classes as well as a continuous measure of establishment size).

These relationships between wages and our four measures of occupational concentration are shown graphically in Figure 3, where we round each Occupational Concentration variable to the nearest hundredth and plot the set of α coefficients for wages in each hundredth-group. The top panel of Figure 3 is the raw data (no controls for establishment characteristics X), and the bottom panel of Figure 3 shows the wages for each group after controlling for observable characteristics. Both figures clearly show that increasing Herfindahl indices of occupational concentration and increasing fractions of low wage workers in an establishment are associated with lower wages, while increasing fractions of high wage workers in an establishment are associated with higher wages. All of these relationships remain (although they are lessened) when we control for observable characteristics.[7]

The data also show that the relationship between wages and occupational concentration is getting stronger over time. This is documented in Table 1, where the underlying regressions are of the form

$$Ln(wage) = \alpha OccupationalConcentration + \beta OccupationalConcentration * Date + \delta X + \varepsilon .$$

Estimates of the coefficients α from these regressions without the X variables show that increased occupational concentration is associated with lower wages (except for increased concentration of typically high-wage occupations). Estimates of the coefficients β (shown here in decade units of time) show that all these relationships have quite significantly strengthened over time. Each addition of more detailed controls ameliorates the strength of the relationship between occupational concentration and wages, but all of these relationships remain very significant. With two exceptions, these relationships have unchanged signs.[8]

The strength and direction of the relationships between occupational concentration and wages is not constant across the occupational distribution, as we show in Tables 1a – 1c,

[7] It is possible that the particularly low and high values of occupational concentration in Figure 3 are due to the absence of occupational heterogeneity in small establishments. However, the changes in slope at the extremes of the horizontal axis in Figure 3 remain when we drop small establishments from our estimating regressions.

[8] The exceptions are the change over time in the relationship between the Herfindahl of major occupational categories and wages and the change over time in the relationship between the fraction of the establishment in typically low-wage occupations age wages. Both signs reverse when we add detailed occupational controls.

discussed below. This means that changes in occupational concentration have different impacts on wages for different groups of workers.

Table 1a shows the wage-concentration relationships for workers in typically high-wage occupations only. For these workers, the relationship between wages and the fraction of the establishment in typically-high wage occupations is only positive when we control for occupation. Moreover, after controlling for occupation, the relationship between the wages for these workers and the fraction of workers in typically-low wage workers is much stronger than it is for the full set of workers (although this relationship has been weakening over time). However, the relationships between the other measures of occupational concentration and wages are much weaker for this group of workers. After including the full set of controls, for these workers, there appears to be a positive relationship between Herfindahl indices of occupational concentration and their wages.

Table 1b shows the wage-concentration relationships for workers in neither typically high-wage nor typically low-wage occupations. For these workers, the relationships between wages and the fraction of the establishment in either typically-high wage or typically low-wage occupations have signs that vary by the set of controls we include.

Table 1c shows the wage-concentration relationships for workers in typically low-wage occupations only. For these workers, the estimates α of the relationships between wages and all measures of occupational concentration are particularly strong, both as raw relationships and as relationships after we include controls for occupations, industry, firm size, and state. However, for these workers, the estimates β have opposite sign from the estimates of α, indicating that all of these relationships have been weakening over time.

In combination, these results show that there are very strong relationships between occupational concentration—by both of our measures—and wages. Overall, these relationships are only partially explained by occupation and employer characteristics, and they have been strengthening over time. Tables 1a-1c further show that occupational concentration is a particularly important determinant of wages for low-wage workers. For workers in typically high-wage occupations, by contrast, the only one of our measures of occupational concentration that appears to play a significant role in wage determination is the presence of large numbers of workers in typically low-wage occupations.

IIIc: Trends in Occupational Concentration measures

The mean values for our measures of occupational concentration by survey date are shown in the upper panels of Figure 4. Overall, mean values have been increasing over time, particularly for the fractions of employees in either lower or higher-wage occupations, with a great deal of variability from survey date to survey date. In the lower panels of figure 4, we plot coefficients α from regressions of the form

$$OccupationalConcentration = \delta X + \varepsilon .$$

These figures show that after controlling for occupation, detailed industry, size class, and state, the mean fraction of workers in higher-wage occupations has steadily risen over time, but other measures of occupational concentration have no clear time trend in mean values. Raw and regression adjusted differences in the means of our measures of Occupational Concentration over time are also shown in Table 2.

We are concerned not only with changes in the means of these occupational concentration measures, but also with changes in their overall distributions. The lower panel of Table 2 shows the fraction of workers whose establishments are extremely concentrated in occupation, having Herfindahl indices of .85 or higher, or fractions of employment in typically high or low-wage occupations of .85 or higher. We run regressions of the form

$$I(OccupationalConcentration > .85) = \delta X + \varepsilon .$$

and find that there are substantial increases in the fraction of observations with measures of occupational concentration above .85—for all our measures—even after controlling for changes in detailed industries, occupations, firm sizes, and geography. We have repeated this exercise using cut-off values for "extreme concentration" of .8, .9, and .95, and results are quite similar to those shown in Table 2.

Overall, we find evidence that the mean occupational concentration of establishments has been increasing over time. For the fraction establishment-level employment in typically high-wage occupations, this increase cannot be explained by changing occupation and establishment characteristics. There is stronger evidence of an increase in highly concentrated establishments, with particularly high values of occupational concentration, although for some measures of occupational concentration this increase is sensitive to the time period chosen. Again, the clearest evidence of an increase in high-levels of establishment-level occupational concentration is for the fraction of employment in typically high-wage occupations.

This set of trends—raw increases in the establishement-level fraction of employees in typically low-wage occupations, which can be explained by changing occupation and establishment characteristics, and raw increases in the establishment-level fraction of employees in typically high-wage occupations, which cannot be so explained—fit together. These are the trends we would observe if employers of high-wage occupations, in a variety of industries, are outsourcing typically low-wage work to specialty employers. For example, if employers in a variety of industries that employ higher-paid occupations increasingly outsource janitorial work to janitorial services companies, we would observe (1) an increase in the fraction of the (original) establishment in typically higher-paid occupations, which would not be explained by occupation or employer characteristics and (2) an increase in the overall fraction of the (janitorial) establishment in typically lower-paid occupations, which would be explained by being typical of the janitorial services industry.

IIId: Variation in these results by state-level unionization rates

The OES does not collect information on unionization patterns by employer, but we do know the state of location for each establishment, and unionization rates vary strongly by state. In results not shown, we split the data into highly unionized states (those with 17-26% of employed workers unionized), middle, and low unionized states (those with 3-9.3% of employed workers unionzed), based on published tables from the Current Population Survey. We examined occupational concentration trends and relationships between occupations and wages within each group. We find that the relationship between occupational concentration and wages differs between states with high and low unionization rates. In states with higher unionization rates, occupational concentration measures have *larger* impacts on wages than in states with lower unionization rates, with and without controlling for occupation and employer characteristics. However, raw occupational concentration level and occupational concentration trends do not differ much between groups of states with high and low unionization rates.

IIIe: Robustness of the above results to EIN-level measures of employers

Some of the reasons for employers to outsource work to other establishments are also reasons to outsource work to other employers entirely. It may be more efficient for even multi-establishment employers to specialize in particular areas of work. Regulatory incentives for multi-establishment employers to specialize in employing workers in a particular part of the wage distribution are less clear. ERISA laws define employers as "controlled groups of corporations" and "entities under common control" in requiring common levels of pension and welfare benefits among most employees in exchange for favorable tax treatment (Perun, 2010), and the Affordable Care Act of 2010 extended these provisions by requiring common levels of health care benefits among most employees of businesses with a common owner. However, as Perun notes, "Employers often invent new organizational structures and worker classifications designed to limit participation to favored employees… Regulatory authorities in turn develop complicated rules and regulations designed to prevent this."

Our work has focused on measures of occupational concentration at the establishment level, because establishments are the sampling units of the OES. However, the OES does contain EIN (tax-ID) numbers for these establishments. As discussed extensively in Handwerker and Mason (2013), very large firms may use multiple EINs in BLS data, and there is no easy way to link together all of the establishments in BLS data for very large firms. Thus, recalculating our measures of occupational concentration at the EIN level is only a partial step towards true firm-level measures. Nonetheless, we examine the relationship between wages and EIN-level occupational concentration and we also examine time trends in EIN-level occupational concentration.

With this measure of employers, we examine the relationship between EIN-level occupational concentration and wages, and we find very similar results to those found above—except for the Herfindahl index at the broad-occupation level. This one measure

switches sign from that found above, showing higher wages for EIN-level employers which have a greater concentration of occupational categories, with and without employer and occupation controls. At the EIN level, greater concentrations of low wage workers or of individual occupations are associated with lower wages, as at the establishment level, but greater concentrations of occupational categories are associated with higher wages. Multi-establishment employers that concentrate in particular occupational categories pay higher wages than those that employ a wide variety of occupational categories.

Results for time trends with EIN-level occupational concentration are weaker. We find a significant time trend only in the fraction of employees in typically-high wage occupations, and that relationship is significantly increasing over time only as a raw relationship. That the time trends in occupational concentration are much stronger at the establishment level than at the EIN level suggests that over this time period, multi-establishment employers are segregating different occupations into different establishments. Perhaps the trends in occupational concentration we observed at the establishment level are not driven by employee benefits regulations at all, or perhaps these regulations are not binding at the EIN level.

IV. Occupational Concentration and Wage Inequality Growth

The combination of strong relationships between establishment-level occupational concentration and wages (particularly for workers in typically low-wage occupations) and growth in establishment-level occupational concentration over time suggests that changes in occupational concentration over time may explain some of the growth in wage inequality. In this section, we conduct a reweighting exercise in order to understand how much of increasing wage inequality in the OES from Fall 2000 to November 2011 can be attributed to changes in the employment composition of observable characteristics such as industry, establishment size, geography, and occupation, as well as our measures of occupational concentration. We use the method of DiNardo, Fortin, and Lemieux, 1996 (DFL)[9] to calculate counterfactual wage distributions based on the OES wage intervals, as well as counterfactual variance estimates. This allows us to observe which parts of the wage distribution are affected by changes in each observable characteristic.

An example may illustrate what we hope to learn from this reweighting exercise. We know that there has been employment polarization during the last 10-20 years: see Autor, Katz, and Kearney (2006), Goos and Manning (2007), Goos, Manning, and Salomons (2009), and Abraham and Spletzer (2010). Using the OES data, and defining "jobs" by industry and occupation, Abraham and Spletzer show that the share of both low-wage and high-wage jobs has risen from 1996 to 2004, whereas the share of middle-wage jobs has fallen (employment growth has polarized). These changes in the distribution of occupations should lead to

[9] The DiNardo, Fortin, and Lemieux (1996) methodology of creating counterfactual distributions for a later year if observable characteristics were held fixed at their distribution in an earlier year is to (1) combine the data for the earlier and later years and run a probit regression of the probability that an observation with a particular set of observable characteristics came from the earlier year and then (2) use the predicted values from this probit regression to create new weights for each observation in the later year.

increased wage inequality. The reweighting exercise allows us to hold constant the employment composition of occupations and industries at their 2000 values when calculating the variance of log real hourly wages in 2011, and the resulting counterfactual wage variance quantifies the magnitude of polarized employment growth on the increasing wage variance, as well as showing where in the wage distribution this explained increase in variance appears.

We run DFL-type reweightings for the observable characteristics of detailed industry (at the 4-digit NAICS level), state, employer size, occupation (at the 3-digit SOC code level), and all four of our measures of occupational concentration. We run these reweightings for all possible sub-sets of these 8 variables—a total of 255 possible combinations. Results of reweightings for each observable characteristic alone are shown in Table 3, and results of reweightings for selected combinations of observable characteristics are shown in Table 4.

As shown in Table 3, occupation (at the 3-digit SOC level), and the fraction of employees in each establishment in typically high-wage occupations are the variables which alone explain the largest amount of overall wage variance growth from Fall 2000 to November 2011. Reweighting observations in November 2011 to the Fall 2000 distribution of the fraction of employees in each establishment in typically high-wage occupations would reduce overall ln wage variance in 2011 from the measured variance of .4018 to .3865 (the final row of Table 3). This decrease represents 31% of all ln wage variance growth from Fall 2000 to November 2011. It represents 26% of ln wage variance growth between establishments, and 53% of ln wage variance growth within establishments. Similarly, reweighting observations in November 2011 to the Fall 2000 distribution of occupations explains 33% of the growth in overall ln wage variance, and 41% of ln wage variance growth between establishments.

In Table 3a, we see that reweighting the November 2011 data to the Fall 2000 distribution of the fraction of employees in each establishment in typically high-wage occupations increases employment in the lower portions of the wage distribution and decreases employment in the middle portions of the wage distribution, but also decreases employment in the upper portion of the wage distribution. Reweighting the November 2011 data to the Fall 2000 distribution of occupations decreases employment in both the upper and lower portions of the wage distribution, while increasing employment in the lower-middle.

Changes in the distributions of employment by detailed industries and states can also explain some of overall ln wage variance growth. Occupation is the single variable that alone explains the greatest amount of between-establishment wage variance growth. Changes in the distributions of employment by size classes and by other measures of occupational concentration do not explain any of overall ln wage variance growth, although (except for changes in the employer size distribution) they do explain some of the growth of wage variance between establishments, and (except for changes in the employer state distribution) of the increase in employment in the lower tail of the wage distribution.

In Table 4, we show reweightings for selected combinations of observable characteristics. The largest amount of overall wage variance growth explained (52%) can be explained by four different combinations of observable characteristics, labeled (1) - (4). All

four of these combinations contain the observable characteristics of industry, state, the fraction of establishments' employment in typically high-wage occupations, and the fraction of establishments in typically low-wage occupations—they differ only in whether or not they include the Herfindahl indices of occupational concentration within establishments. Adding in additional reweighting variables does not always increase the amount of wage variance explained—using all of our possible reweighting variables, as in line (8), results in much less overall variance explained than in combinations (1)-(4).

Table 4a shows that reweightings by these 4 combinations of characteristics moves the distribution of employment from both the upper and lower tails to the center of the distribution. Specifically, for reweighting combinations (1)-(4), we show in Table 4a, that if industry, state, and occupational concentration patterns in 2011 mirrored the distributions of these variables in 2000, there would be 3-4% less employment in the lowest wage interval, 3-4% less employment in the 7th wage interval, 7% less employment in the 8th wage interval, 9-10% less in the 9th, 11-12% less in the 10th, 12-13% less in the 11th, and 13-14% less employment in the 12th wage interval, with commensurate increases in employment in the remaining wage intervals. The impact of reweighting (2) on the overall wage distribution is shown graphically in Figure 6.

Table 4 also shows that the largest amount of wage variance growth (63%) between establishments can be explained by the combination of observable characteristics labeled (5). The largest amount of wage variance growth (60%) within establishments can be explained by the combination of observable characteristics labeled (6). This combination includes only state, and the fraction of establishments' employment in typically high-wage occupations. We think it notable that only one of the "best" combinations of reweightings labeled (1) - (6) includes occupation as one of the reweighting variables: although occupation alone is the best single-variable explanation for the growth in wage variance, as shown in Table 3, the impact of changes in this variable on the wage distribution are completely captured by the combined impact of changes in the distribution of employment by state, sometimes industry, and our measures of occupational concentration.

The combination of observable characteristics that best explains overall wage inequality growth without any of our measures of occupational concentration is shown in line (7) of Table 4. This combination is industry, state, and 3-digit occupation, which coincidentally are variables available in household surveys such as the CPS. This combination explains 36% of overall wage variance growth—a difference of 16% from combinations (1) – (4). This same combination of variables also gives the best explanation of between-establishment wage inequality growth without our measures of occupational concentration. This combination explains 46% of between-establishment wage variance growth—a difference of 17% from combination (5).

V. Discussion and Conclusion—What do these results tell us about the role of outsourcing in increased wage inequality growth?

In this paper, we believe we are the first to examine the concentration of occupations within establishments, the relationship between occupational concentration and wages, changes in occupational concentration over time, and the impact of changes in occupational concentration on wage inequality growth. In section III, we defined four measures of occupational concentration for an establishment—two Herfindahl indices measuring occupational concentration across all occupations, and two more specific measures of the concentration of typically low-wage workers and typically high-wage workers. We showed that all four of these measures were strongly and significantly related to wages, particularly for low-wage workers, even after controlling for the occupations of employees and various observable characteristics of their employers. We also showed that these measures of occupational concentration show increased concentration over time, in a pattern consistent with ideas that companies are "de-verticalizing" by outsourcing functions that are not integral to employers' missions, particularly if these outsourced tasks are done by workers paid lower wages than the "core workers" in the establishment. In our data, we find that the increased concentration of typically low-wage occupations over time can be explained by changes in the characteristics of establishments employing these occupations, but the increased concentration of typically high-wage occupations over time cannot be explained by these establishment characteristics. This is consistent with the movement of low-wage work to specialty low-wage employers.

We showed that changes in one of our measures of occupational concentration (the fraction of workers in each establishment in typically high-wage occupations) were responsible for about a third of the increased wage variance growth measured in our data during the Fall 2000 – November 2011 time period. Combining our measures of occupational concentration with industry and geographic information, we can explain more than half of measured increased wage variance growth, and we capture all of the increased wage variation that could otherwise be explained by occupation. In these reweightings, the fraction of workers in each establishment in typically high-wage occupations (and, somewhat less strongly, the fraction of workers in each establishment in typically low-wage occupations) appears to be a key variable in explaining wage inequality growth, as it is present in all combinations of variables with the greatest power to explain wage inequality growth. This variable was designed to capture a particular form of outsourcing—the concentration of establishment-level employment in occupations in the upper part of the wage distribution. Its power in explaining wage inequality growth suggests that this particular form of outsourcing has a profound impact on overall wage inequality growth.

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Appendix A: "Typically low-wage Occupations"

3-digit SOC code	*Minor Occupational Category*
353	Food and Beverage Serving Workers
359	Other Food Preparation and Serving Related Workers
393	Entertainment Attendants and Related Workers
352	Cooks and Food Preparation Workers
412	Retail Sales Workers
372	Building Cleaning and Pest Control Workers
536	Other Transportation Workers
452	Agricultural Workers
399	Other Personal Care and Service Workers
311	Nursing, Psychiatric, and Home Health Aides
392	Animal Care and Service Workers
516	Textile, Apparel, and Furnishings Workers
395	Personal Appearance Workers
259	Other Education, Training, and Library Occupations
339	Other Protective Service Workers
373	Grounds Maintenance Workers
394	Funeral Service Workers
537	Material Moving Workers
513	Food Processing Workers
379	Other Building and Grounds Cleaning and Maintenance Occs

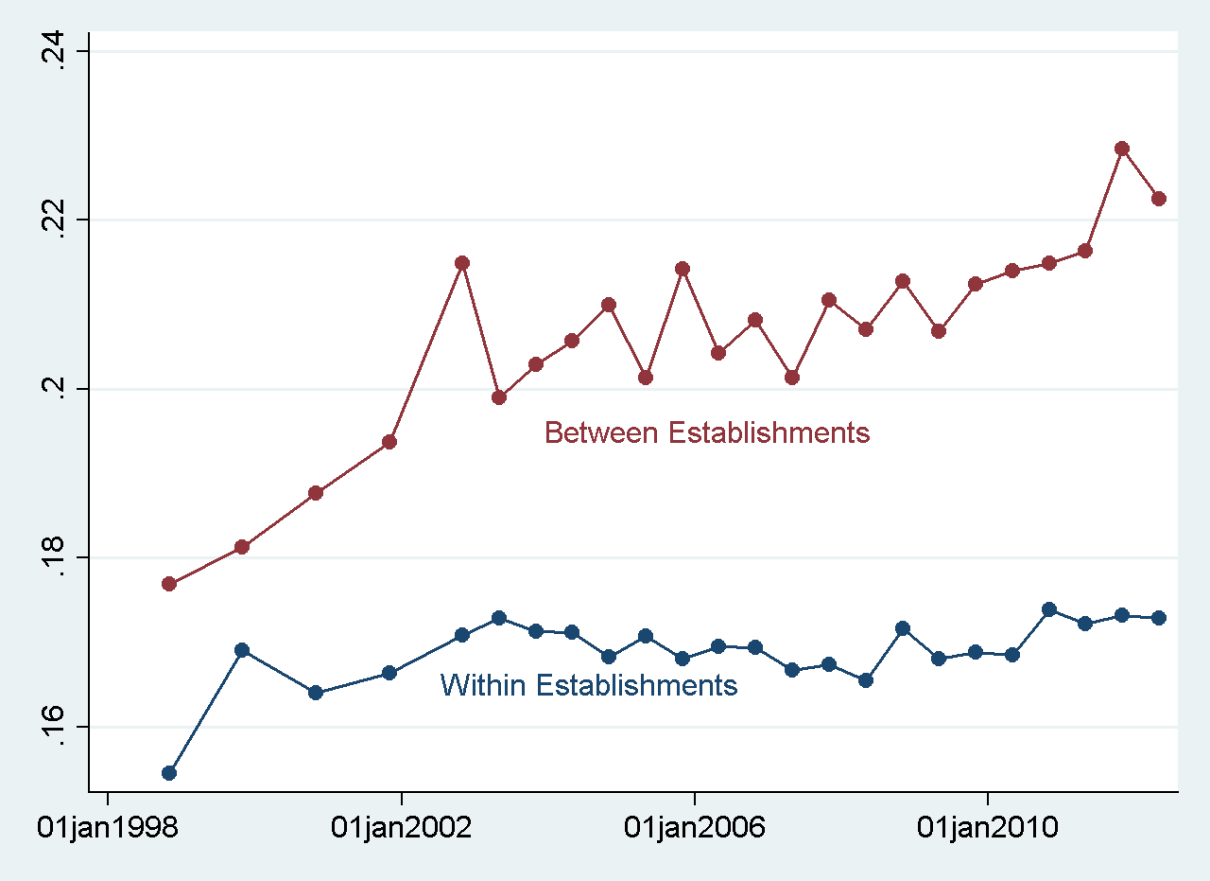
Appendix B: "Typically high-wage Occupations"

3-digit SOC code	*Minor Occupational Category*
231	Lawyers, Judges, and Related Workers
532	Air Transportation Workers
112	Advertising, Marketing, PR, and Sales Managers
111	Top Executives
172	Engineers
113	Operations Specialties Managers
291	Health Diagnosing and Treating Practitioners
151	Computer Specialists
152	Mathematical Science Occupations
192	Physical Scientists
159	Other Computer and Mathematical Occupations
119	Other Management Occupations
191	Life Scientists
153	Other Computer and Mathematical Occupations
193	Social Scientists and Related Workers
251	Postsecondary Teachers
331	First-line Supervisors/Managers, Protective Service Workers
131	Business Operations Specialists
471	Supervisors, Construction and Extraction Workers
414	Sales Representatives, Wholesale and Manufacturing
132	Financial Specialists
491	Supervisors of Installation, Maintenance, and Repair Workers
171	Architects, Surveyors, and Cartographers
413	Sales Representatives, Services
511	Supervisors, Production Workers
173	Drafters, Engineering, and Mapping Technicians
252	Primary, Secondary, and Special Education School Teachers
518	Plant and System Operators
531	Supervisors, Transportation and Material Moving Workers
431	Supervisors, Office and Administrative Support Workers
333	Law Enforcement Workers
273	Media and Communication Workers
451	Supervisors, Farming, Fishing, and Forestry Workers
272	Entertainers and Performers, Sports and Related Workers
194	Life, Physical, and Social Science Technicians
492	Electrical and Electronic Equipment Mechanics, Installers, and Repairers
239	Legal Occupations, Not Elsewhere Classified
232	Legal Support Workers

Figure 1: OES Survey Form (abridged)

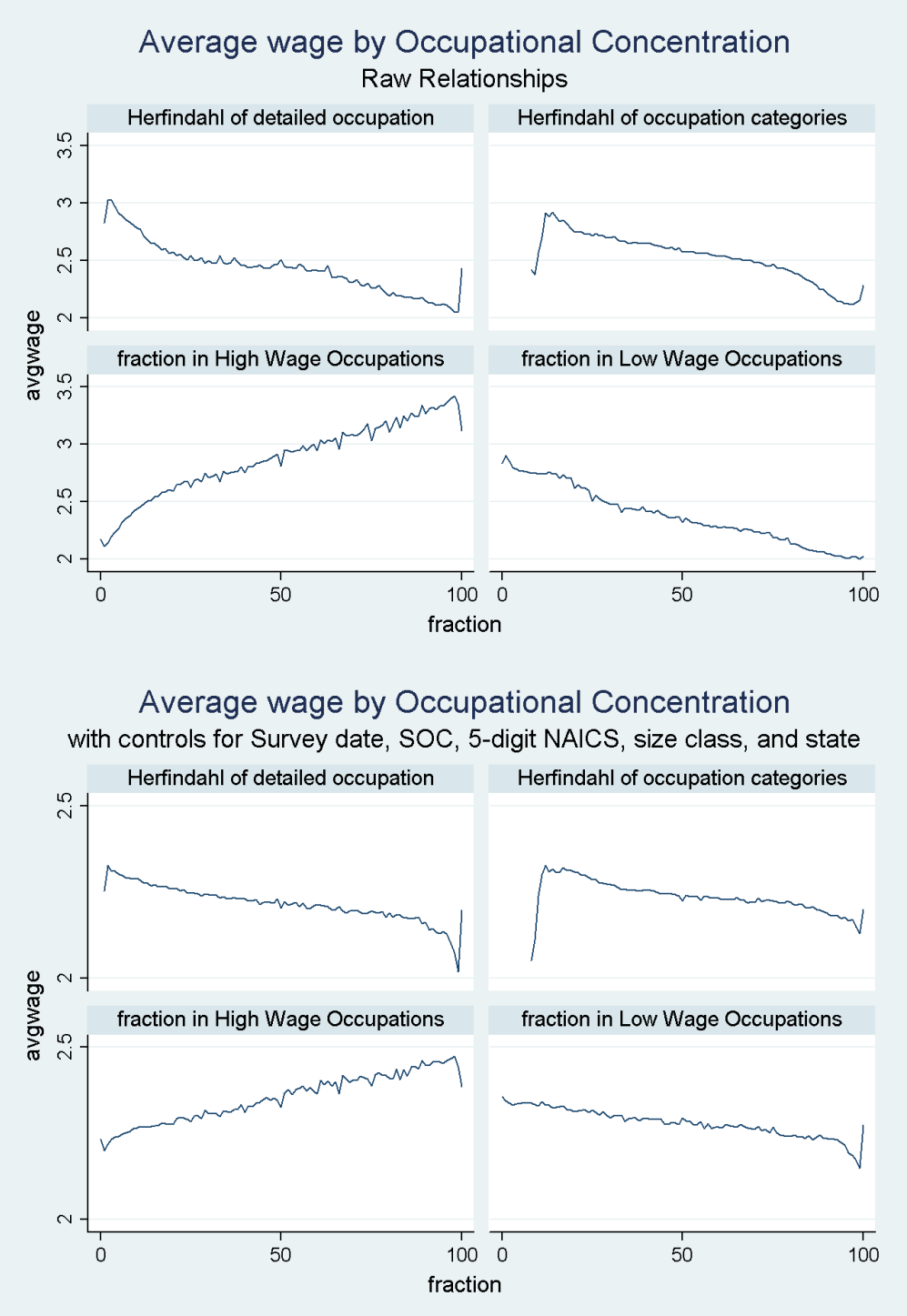
OCCUPATIONAL TITLE AND DESCRIPTION OF DUTIES	NUMBER OF EMPLOYEES IN SELECTED WAGE RANGES (Report Part-time Workers According to an Hourly Rate)												
	A	B	C	D	E	F	G	H	I	J	K	L	T
Hourly (part-time or full-time)	under $7.50	$7.50–9.49	$9.50–11.99	$12.00–15.24	$15.25–19.24	$19.25–24.49	$24.50–30.99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

Figure 2: Private Sector Variance Between and Within Establishments in the OES



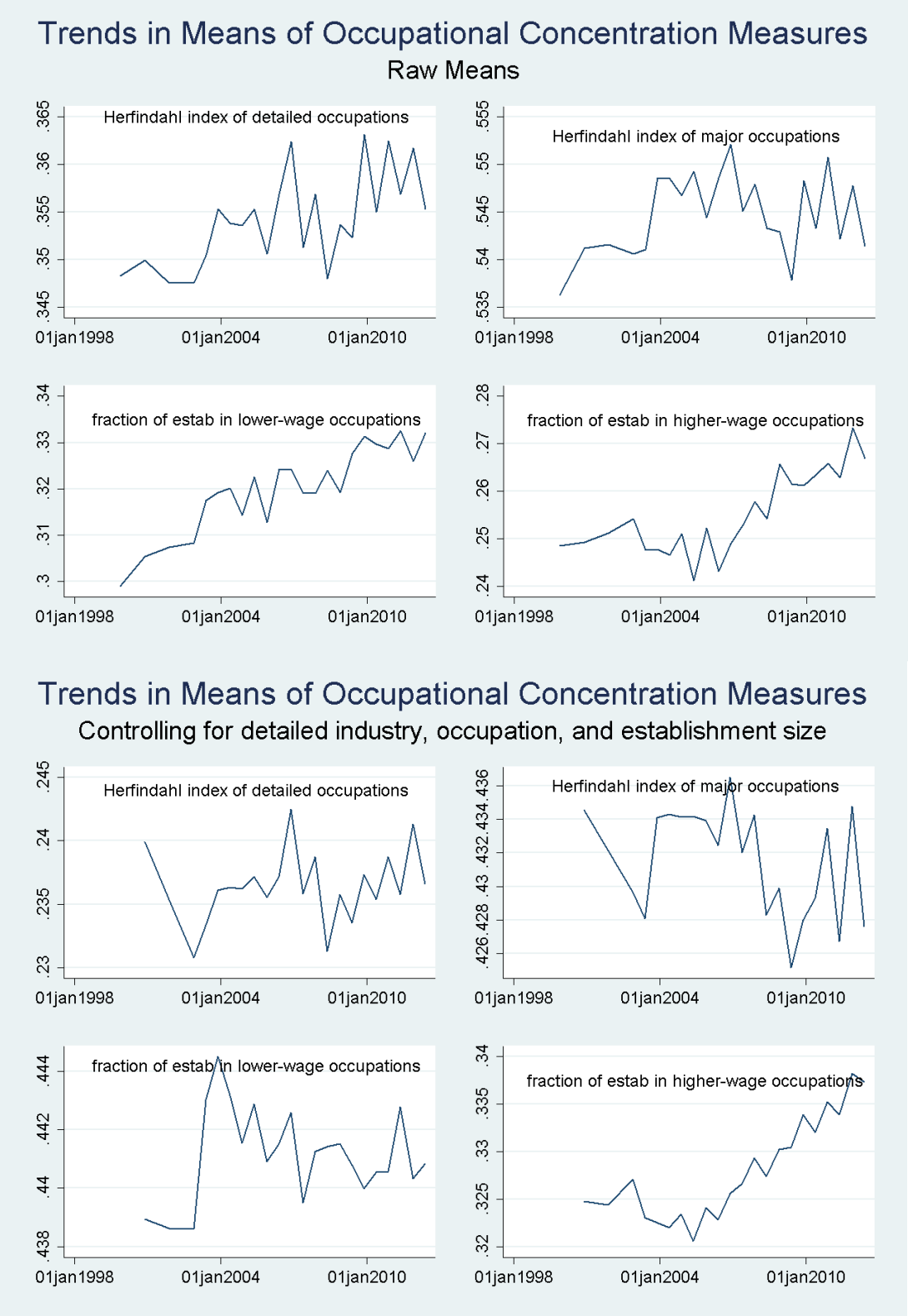
Notes: Figure computed from the combined 1998-May 2012 panels of the Occupational Employment Survey.

Figure 3: Relationships between Wages and Occupational Concentration



Notes: the "avgwage" coefficients plotted here are the set of α coefficients from regressions of the form $Ln(wage) = \alpha OccConcenGroup$ (top panel), where Occupation Concentration Groups are formed by rounding each Occupation Concentration variable to the nearest hundredth, and $Ln(wage) = \alpha OccConcenGroup + \chi Survey\ date\ \ fixed\ \ effects + \delta X$ where X includes dummy variables for each detailed occupation in the OES, 5 digit employer NAICS codes, states, and employer size classes (bottom panel).

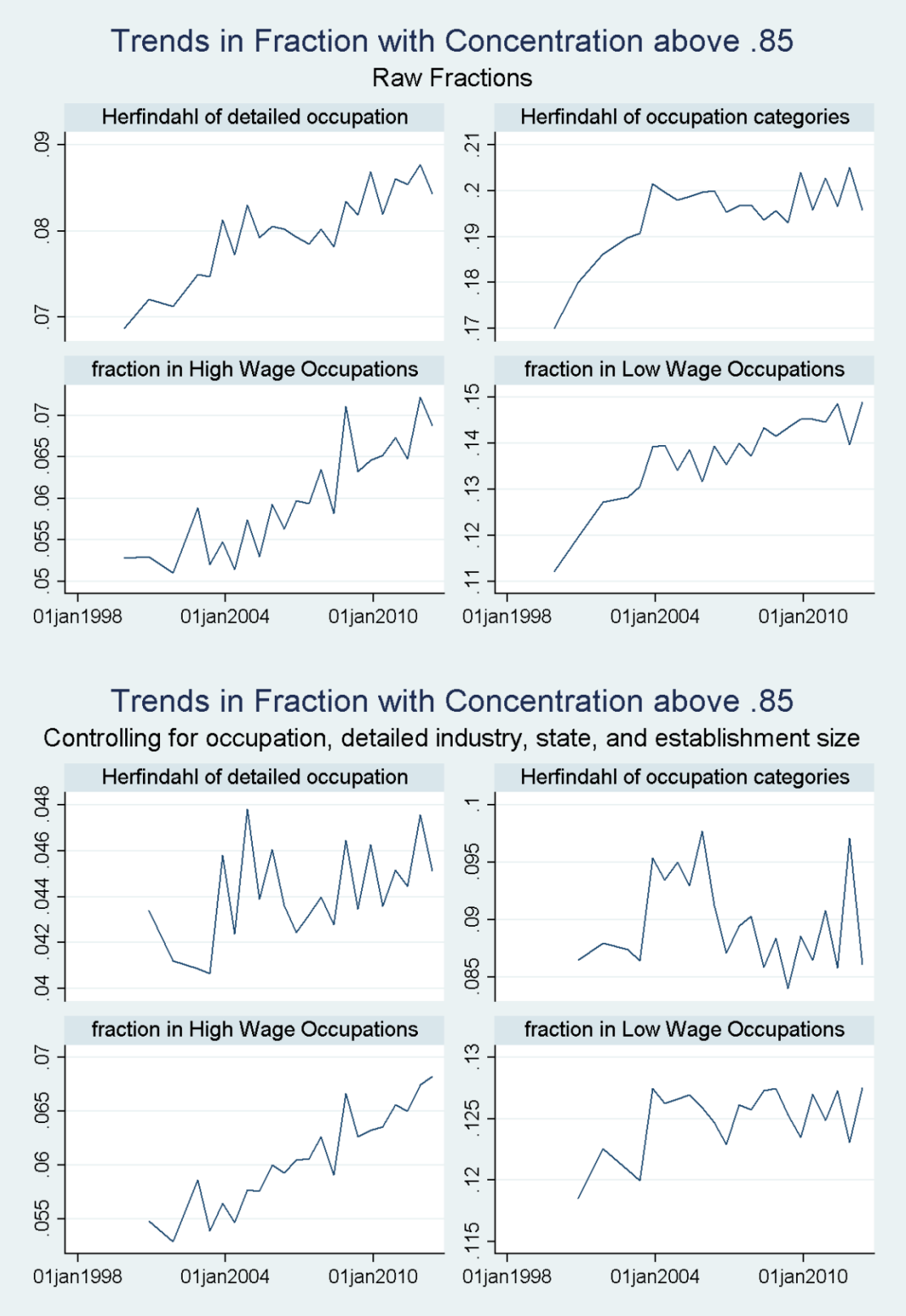
Figure 4: Trends in Means of Occupational Concentration



Note: These are plots of coefficients α from regressions

$$OccConcen = \alpha Survey\ date + \beta DetailedOcc + \chi Industry + \delta SizeClass + \varepsilon Size + \phi State\ .$$

Figure 5: Trends in in Fraction with Occupational Concentration values above .85



Note: These are plots of coefficients α from regressions

$$I(OccConcen > .85) = \alpha Survey\ Date + \beta DetailedOcc + \chi Industry + \delta SizeClass + \varepsilon Size + \phi State$$

Figure 6: OES Wage distributions in Fall 2000, November 2011, and November 2011 with the "nearly best" reweighting to Fall 2000 characteristics

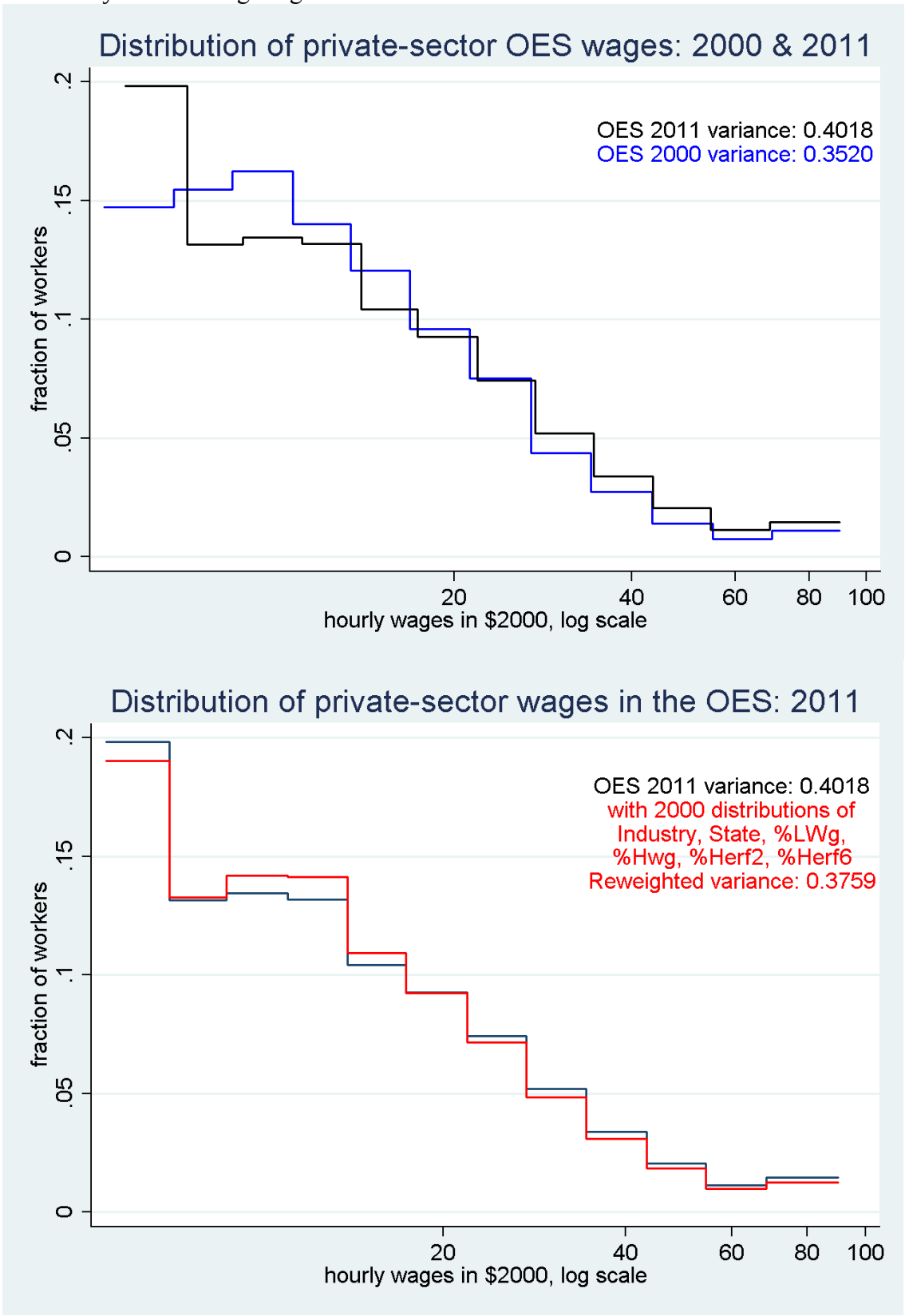


Table 1: Regressions of log wages on measures of Occupational Concentration

All unimputed OES private-sector data from Fall 2000-May 2012

Occupational Concentration Variable	Herfindahl of occupational concentration of the establishment at the detailed-occupation level	Herfindahl of occupational concentration of the establishment at the broad-occupation level	fraction of the establishment in typically low wage occupations	fraction of the establishment in typically high wage occupations
With survey-date fixed effects				
Coefficient on OccConcen	-0.336	-0.611	-0.670	0.739
t-stat	-65.04	-119.03	-199.22	175.17
Coefficient on OccConcen * Date	-0.045	-0.009	-0.042	0.093
t-stat	-41.21	-8.44	-58.32	104.01
With survey-date and 6-digit occupation fixed effects				
Coefficient on OccConcen	-0.217	-0.299	-0.329	0.154
t-stat	-67.27	-92.21	-137.62	49.36
Coefficient on OccConcen * Date	-0.003	0.017	0.010	0.042
t-stat	-3.89	25.14	19.78	64.21
With survey-date, 6-digit occupation, 5-digit NAICS, size class, & state fixed effects, and continuous size				
Coefficient on OccConcen	-0.101	-0.180	-0.119	0.006
t-stat	-33.51	-58.17	-51.23	2.03
Coefficient on OccConcen * Date	-0.004	0.013	0.000	0.044
t-stat	-5.98	19.63	0.42	70.89

Notes: These regressions are of the form $Ln(wage) = \alpha OccConcen + \beta OccConcen * Date + \chi Survey\ date\ \ fixed\ \ effects + \delta X$, where X includes occupation fixed effects, detailed industry fixed effects (broad industry groups are available across all years, but detailed NAICS codes are only available from 2000 forwards[10]), state fixed effects, and establishment size (we use fixed effects for establishment size classes as well as a continuous measure of establishment size).

[10] Beginning with the 2002 OES survey, establishments were classified by 6 digit NAICS, and the OES staff converted much of the previous years' samples from SIC to 6 digit NAICS codes as well.

Table 1a

Workers in typically high-wage ocupations only

Occupational Concentration Variable	Herfindahl of occupational concentration of the establishment at the detailed-occupation level	Herfindahl of occupational concentration of the establishment at the broad-occupation level	fraction of the establishment in typically low wage occupations	fraction of the establishment in typically high wage occupations
With survey-date fixed effects				
Coefficient on OccConcen	-0.424	-0.597	-0.460	-0.403
t-stat	-48.93	-64.67	-42.48	-55.65
Coefficient on OccConcen * Date	0.009	0.043	0.000	0.121
t-stat	4.96	22.20	-0.09	79.00
With survey-date and 6-digit occupation fixed effects				
Coefficient on OccConcen	-0.043	-0.166	-0.631	0.027
t-stat	-6.01	-22.15	-71.85	4.63
Coefficient on OccConcen * Date	-0.036	-0.008	0.051	0.047
t-stat	-23.82	-5.04	27.17	37.79
With survey-date, 6-digit occupation, 5-digit NAICS, size class, & state fixed effects, and continuous size				
Coefficient on OccConcen	0.102	-0.001	-0.406	0.010
t-stat	15.37	-0.15	-47.79	1.86
Coefficient on OccConcen * Date	-0.042	-0.020	0.045	0.028
t-stat	-29.92	-13.20	24.98	23.45

Table 1b:

Workers in neither typically high-wage nor typically low-wage occupations only

Occupational Concentration Variable	Herfindahl of occupational concentration of the establishment at the detailed-occupation level	Herfindahl of occupational concentration of the establishment at the broad-occupation level	fraction of the establishment in typically low wage occupations	fraction of the establishment in typically high wage occupations
With survey-date fixed effects				
Coefficient on OccConcen	-0.086	-0.153	-0.085	-0.012
t-stat	-14.55	-25.24	-14.22	-1.75
Coefficient on OccConcen * Date	-0.016	0.004	-0.034	0.090
t-stat	-12.98	2.76	-26.47	60.52
With survey-date and 6-digit occupation fixed effects				
Coefficient on OccConcen	-0.226	-0.216	-0.167	0.151
t-stat	-45.62	-42.12	-32.54	25.28
Coefficient on OccConcen * Date	-0.002	0.001	-0.005	0.056
t-stat	-1.60	0.72	-4.41	44.13
With survey-date, 6-digit occupation, 5-digit NAICS, size class, & state fixed effects, and continuous size				
Coefficient on OccConcen	-0.116	-0.130	0.059	-0.018
t-stat	-25.72	-27.88	12.40	-3.30
Coefficient on OccConcen * Date	0.002	0.004	-0.023	0.056
t-stat	2.04	4.33	-22.50	48.11

Table 1c:

Workers in typically low-wage occupations only

Occupational Concentration Variable	Herfindahl of occupational concentration of the establishment at the detailed-occupation level	Herfindahl of occupational concentration of the establishment at the broad-occupation level	fraction of the establishment in typically low wage occupations	fraction of the establishment in typically high wage occupations
With survey-date fixed effects				
Coefficient on OccConcen	-0.408	-0.676	-0.925	0.966
t-stat	-61.55	-104.81	-122.48	61.05
Coefficient on OccConcen * Date	0.041	0.082	0.105	-0.050
t-stat	28.93	59.94	65.48	-15.10
With survey-date and 6-digit occupation fixed effects				
Coefficient on OccConcen	-0.354	-0.529	-0.684	0.706
t-stat	-59.24	-89.10	-97.40	48.09
Coefficient on OccConcen * Date	0.025	0.063	0.078	-0.032
t-stat	19.91	50.38	52.23	-10.49
With survey-date, 6-digit occupation, 5-digit NAICS, size class, & state fixed effects, and continuous size				
Coefficient on OccConcen	-0.253	-0.396	-0.464	0.435
t-stat	-46.53	-71.10	-70.72	32.49
Coefficient on OccConcen * Date	0.025	0.053	0.062	-0.021
t-stat	21.41	45.26	45.04	-7.38

Table 2: Changes in Occupational Concentration over time

All unimputed OES private-sector data from Fall 2000-May 2012

Occupational Concentration Variable	Herfindahl of occupational concentration of the establishment at the detailed-occupation level	Herfindahl of occupational concentration of the establishment at the broad-occupation level	fraction of the establishment in typically low wage occupations	fraction of the establishment in typically high wage occupations
Mean values				
in Fall 2000	0.350	0.541	0.305	0.249
in Nov 2011	0.362	0.548	0.326	0.273
growth	3.4%	1.2%	6.7%	9.7%
Regression-adjusted Mean values, controlling for 6-digit occupation				
in Fall 2000	0.345	0.531	0.500	0.146
in Nov 2011	0.354	0.537	0.502	0.159
growth	2.5%	1.2%	0.5%	8.9%
Regression-adjusted Mean values, controlling for 6-digit occupation, 4-digit NAICS codes, size class, size, & state				
in Fall 2000	0.240	0.435	0.439	0.325
in Nov 2011	0.241	0.435	0.440	0.339
growth	0.6%	0.0%	0.3%	4.3%
Fraction with values greater than or equal to .85				
in Fall 2000	0.072	0.180	0.120	0.053
in Nov 2011	0.088	0.205	0.140	0.072
growth	21.7%	13.8%	16.7%	36.3%
Regression-adjusted fraction with values greater than or equal to .85, controlling for 6-digit occupation				
in Fall 2000	0.077	0.151	0.173	-0.002
in Nov 2011	0.089	0.170	0.178	0.010
growth	14.8%	12.6%	3.2%	-598.4%
Regression-adjusted fraction with values greater than or equal to .85, controlling for 6-digit occupation, 4-digit NAICS codes, size class, size, & state				
in Fall 2000	0.043	0.086	0.119	0.055
in Nov 2011	0.048	0.097	0.123	0.067
growth	9.6%	12.2%	3.8%	23.0%

Note: These are coefficients α from regressions of the form $OccConcen = \alpha Survey\ date + \beta DetailedOcc + \chi Industry + \delta SizeClass + \varepsilon Size + \phi State$. (top panel), and of the form $I(OccConcen > .85) = \alpha Survey\ Date + \beta DetailedOcc + \chi Industry + \delta SizeClass + \varepsilon Size + \phi State$ (bottom panel).

Table 3: Results for 2011 Variances of DFL-style reweightings by one observable characteristic at a time

2000 ln wage variance:	0.3520	2000 Btw estab variance:	0.1884	2000 Wtn estab variance:	0.1637
2011 ln wage variance:	0.4018	2011 Btw estab variance:	0.2288	2011 Wtn estab variance:	0.1729
Increase:	0.0497	Increase:	0.0405	Increase:	0.0093

Variances after reweighting 2011 data to 2000 characteristics:								Overall		Between Estabs		Within Estabs	
Indus	State	Size	Occup	herf6	herf2	%LWg	%HWg	Var	Explained	Var	Explained	Var	Explained
Y								0.3915	21%	0.2192	24%	0.1723	7%
	Y							0.3985	7%	0.2267	5%	0.1718	12%
		Y						0.4050	-7%	0.2299	-3%	0.1751	-24%
			Y					0.3853	33%	0.2123	41%	0.1731	-2%
				Y				0.4031	-3%	0.2273	4%	0.1758	-31%
					Y			0.4029	-2%	0.2276	3%	0.1752	-25%
						Y		0.4042	-5%	0.2284	1%	0.1757	-30%
							Y	0.3865	31%	0.2184	26%	0.1681	53%

Table 3a: Results for the OES Wage Distribution in 2011 of DFL-style reweightings by one observable characteristic at a time

	Employment change for each of the 12 OES wage intervals in 2011											
	< $9.25	to $11.49	to $14.49	to $18.24	to $22.74	to $28.74	to $35.99	to $45.24	to $56.99	to $71.49	to $89.99	$90 +
Baseline	21,714,038	14,398,175	14,725,048	14,418,431	11,415,070	10,138,683	8,123,080	5,683,268	3,719,482	2,267,495	1,241,866	1,590,526
Industry	-5%	-2%	3%	5%	4%	1%	0%	-1%	-1%	-2%	-2%	-4%
State	1%	1%	0%	0%	0%	0%	-1%	-1%	-2%	-2%	-3%	-2%
Size class	-2%	-1%	-1%	0%	0%	1%	2%	3%	4%	4%	3%	1%
3-digit Occup	-3%	1%	4%	6%	3%	-1%	-4%	-7%	-8%	-7%	-4%	-5%
detailed Herf	-2%	-1%	0%	0%	1%	1%	1%	2%	2%	2%	2%	1%
category Herf	-2%	-1%	0%	0%	1%	1%	1%	2%	2%	2%	2%	1%
% in LWg Occs	-5%	-3%	0%	1%	2%	3%	3%	4%	4%	4%	4%	4%
% in HWg Occs	6%	5%	2%	1%	-2%	-4%	-6%	-8%	-10%	-11%	-12%	-11%

Table 3b: Results for percentiles of the OES Wage Distribution in 2011 of DFL-style reweightings by one observable characteristic at a time

	Percentiles of the wage distribution under each reweighting, assuming uniform distribution of wages within intervals				
	10th	25th	50th	75th	90th
Industry	6.49	8.29	12.49	20.31	32.30
State	6.27	7.68	11.71	19.55	31.48
Size class	6.30	7.76	11.93	20.02	32.16
3-digit Occup	6.31	7.78	11.71	19.09	30.78
detailed Herf	6.30	7.77	11.91	19.91	32.02
category Herf	6.29	7.76	11.89	19.88	31.98
% in LWg Occs	6.32	7.86	12.07	20.13	32.28
% in HWg Occs	6.23	7.52	11.31	18.73	30.23

Table 4: Results for 2011 Variances of DFL-style reweightings by selected combinations of observable characteristics

2000 ln wage variance:	0.3520	2000 Btw estab variance:	0.1884	2000 Wtn estab variance:	0.1637
2011 ln wage variance:	0.4018	2011 Btw estab variance:	0.2288	2011 Wtn estab variance:	0.1729
Increase:	0.0497	Increase:	0.0405	Increase:	0.0093

Variances after reweighting 2011 data to 2000 characteristics:									Overall		Between Estabs		Within Estabs	
	NAICS4	fips	sizecls	Occup	herf6	herf2	%lwg	%hwg	Var	Explained	Var	Explained	Var	Explained
(1)	Y	Y					Y	Y	0.3758	52%	0.2068	54%	0.1689	43%
(2)	Y	Y			Y	Y	Y	Y	0.3759	52%	0.2041	61%	0.1718	13%
(3)	Y	Y			Y		Y	Y	0.3759	52%	0.2041	61%	0.1717	13%
(4)	Y	Y				Y	Y	Y	0.3760	52%	0.2048	59%	0.1711	19%
(5)	Y	Y		Y	Y			Y	0.3804	43%	0.2032	63%	0.1772	-46%
(6)		Y						Y	0.3847	34%	0.2173	28%	0.1674	60%
(7)	Y	Y		Y					0.3841	36%	0.2102	46%	0.1739	-10%
(8)	Y	Y	Y	Y	Y	Y	Y	Y	0.3849	34%	0.2063	56%	0.1787	-62%

Table 4a: Results for the OES Wage Distribution in 2011 of DFL-style reweightings by selected combinations of observable characteristics

	Employment change for each of the 12 OES wage intervals in 2011											
	< $9.25	to $11.49	to $14.49	to $18.24	to $22.74	to $28.74	to $35.99	to $45.24	to $56.99	to $71.49	to $89.99	$90 +
Baseline	21,714,038	14,398,175	14,725,048	14,418,431	11,415,070	10,138,683	8,123,080	5,683,268	3,719,482	2,267,495	1,241,866	1,590,526
(1)	-3%	1%	5%	7%	4%	-1%	-4%	-7%	-10%	-12%	-13%	-14%
(2)	-4%	1%	6%	7%	5%	0%	-3%	-7%	-9%	-11%	-12%	-13%
(3)	-4%	1%	6%	7%	5%	0%	-3%	-7%	-9%	-11%	-12%	-13%
(4)	-4%	1%	5%	7%	5%	0%	-4%	-7%	-10%	-12%	-12%	-13%
(5)	-4%	1%	6%	7%	4%	-1%	-5%	-8%	-10%	-9%	-7%	-8%
(6)	7%	5%	3%	1%	-1%	-4%	-6%	-9%	-11%	-12%	-13%	-12%
(7)	-4%	1%	5%	7%	4%	-1%	-5%	-8%	-9%	-7%	-4%	-5%
(8)	-6%	0%	4%	7%	4%	-1%	-4%	-7%	-7%	-6%	-3%	-5%

Table 4b: Results for percentiles of the OES Wage Distribution in 2011 of DFL-style reweightings by selected combinations of observable characteristics

									Percentiles of the wage distribution under each reweighting, assuming uniform distribution of wages within intervals				
	NAICS4	fips	sizecls	Occup	herf6	herf2	%lwg	%hwg	10th	25th	50th	75th	90th
(1)	Y	Y					Y	Y	6.46	8.19	12.20	19.56	30.96
(2)	Y	Y			Y	Y	Y	Y	6.47	8.22	12.24	19.63	31.07
(3)	Y	Y			Y		Y	Y	6.47	8.22	12.24	19.63	31.07
(4)	Y	Y				Y	Y	Y	6.46	8.21	12.22	19.60	31.02
(5)	Y	Y		Y	Y			Y	6.47	8.22	12.23	19.64	31.30
(6)		Y						Y	6.23	7.51	11.28	18.66	30.08
(7)	Y	Y		Y					6.47	8.22	12.25	19.70	31.52
(8)	Y	Y	Y	Y	Y	Y	Y	Y	6.48	8.25	12.31	19.83	31.67