The Contribution of Dispersion across Plants to the Increase in US Earnings Dispersion [1]

Erling Barth (Institute for Social Research, ESOP, University of Oslo, and NBER)

Alex Bryson (National Institute of Economic and Social Research and CEP, LSE),

James C. Davis (U.S. Census Bureau and BRDC, NBER, Cambridge),

Richard Freeman (Harvard and NBER, Cambridge; CEP, LSE)

Abstract

Using an extensive set of establishment and individual data, we estimate the extent to which the variance of earnings among establishments increased in 1977-2002 and its contribution to the increased dispersion of US earnings among individuals. We find that more than 70 percent of the increase in the variance of earnings in this period occurred across establishments. More than two thirds of the growth in establishment wage dispersion arises from changes within detailed industry and region. Two industries contributed disproportionately to earnings inequality. Business services accounted for a growing *share* of the total variance in log earnings across plants, while the increased variance in earnings in finance, insurance, and real estate accounted for one-fifth of the *growth* in variance in the whole economy.

Decomposing the increase in earnings among establishments between rising inequality among existing establishments and changes in inequality due to the earnings of establishments that enter or exit the economy we find that the bulk of the increase occurred among existing establishments. We reject explanations that attribute the increase in the variance among establishments to increased returns to human capital or increased sorting of observable skills across plants. The factor most closely related to the increased dispersion in earnings across plants is the increase in the dispersion in labor productivity among plants. Evidence of rent sharing and of the growing importance of inter establishment wage dispersion run, given the declining strength of union, counter to the usual analysis of wage-setting in a competitive market.

JEL Codes: J3; J31; D3 Key Words: Wage inequality; productivity and wages

---

[1] Previous versions of this paper have been presented at the COST conference in Budapest, May 2009, the WEAI conference in Vancouver, June 2009, the ESOP seminar at the University of Oslo, March 2010, at the productivity lunch at NBER in April 2010 and at the EALE SOLE Conference in London, 2010. We thank the participants for their comments. This work has received support from the Norwegian Research Council (project 173591/S20 Barth and Bryson) and is part of the work at ESOP, Department of Economics, University of Oslo (Barth). ESOP is financed by the Norwegian Research Council. The work on this paper has been undertaken while Erling Barth visited NBER and the Labor and Worklife Program at Harvard University and he thanks both institutions for their generosity and hospitality. Any opinions and conclusions expressed herein are those of the authors and do not necessarily represent the views of the U.S. Census Bureau. All results have been reviewed to ensure that no confidential information is disclosed.

Most of the well-documented increase in earnings dispersion in the US has occurred among workers with the same personal attributes such as level of education, age and gender as opposed to occurring between workers with measurably different attributes (Autor, Katz and Kearney, 2008, Lemieux, 2006). What accounts for this increased variance of earnings among observationally similar workers? In this paper we examine an observable factor that previous work has largely ignored -- the establishments in which workers are employed – and find that increased variance in the average earnings among establishments accounts for the bulk of the growth of dispersion among workers in 1977-2002, a time when dispersion of earnings rose rapidly.

We examine two possible explanations for the increased dispersion of earnings among establishments: Increased concentration of workers with the same observable skills by establishments and increased productivity dispersion across establishments that through rent sharing distributed some of the productivity advance to workers. We find that differences in the growth of productivity dominate the rise in earnings dispersion. This finding supports a renewed focus on analyzing establishments' wage policies as a prime determinant of the wage distribution and has implications for the efficiency of resource allocation. In a world with heterogeneity in workplace productivity (see eg. Klette and Raknerud 2009 and Comin et al 2009), most non-competitive wage setting mechanisms, such as efficiency wages or dynamic monopsony with frictions or rent sharing for any other reason can affect both the allocation of labor, capital, and of innovations across plants (see eg. Grout 1984, Moene and Wallerstein, 1999).

We use the Longitudinal Employer Household Dynamics (LEHD) data, with linked individual and employer identifiers, to calculate directly the role of employers versus workers in shaping the wage distribution for a sub-set of states in the period 1992-2002. To assess the development for the whole US labor market, and for the extended period from 1977 to 2002, our analysis combines data on individual earnings from the Current Population Survey (CPS), which contains no information on establishment, with data on earnings at establishments from the Economic Census (EC), which contains no information on individuals. The analysis proceeds along lines set out by Davis and Haltiwanger (1991) and Dunne et al (2004) for manufacturing,[2]

[2] Dunne et al (2004) use establishment level data and find that the between-plant measures of wage and productivity increased substantially from 1975 to 1992. In related work Abowd et al (1999) examine individual versus firm specific effects in wage equations, and Abowd et al (2009) show that firm heterogeneity comprise a substantial part of the wage distribution. Lazear and Shaw (2009) provide international evidence of wage

but extends to the entire non-agriculture sector, which is critical in understanding dispersion of pay economy-wide since the manufacturing sector accounts for less than 10 percent of all earnings inequality (see below).

We link the LEHD data to the internal Census CPS files to derive measures of segregation of observable skills across establishments, and assess the role of rent-sharing by relating the growth of sales and value added per worker to the growth of weekly earnings per worker among establishments.[3]

Section 1 documents the phenomenon to explain – the trends in dispersion of earnings among individuals from 1975 to 2005. Section 2 describes the establishment data and methodology we use to combine the dispersion of wages among establishments with the dispersion of wages among individuals to assess the contribution of increased dispersion at the establishment level to increased dispersion among individuals. Section 3 compares the pattern of earnings and productivity across plants. Section 4 assesses the skills concentration and rent sharing explanations for the increased dispersion among establishments. Section 5 concludes.

1. Wage and earnings inequality among workers: CPS

To measure the dispersion of earnings among individuals we use the internal Census version of the March Current Population Survey (CPS). The internal Census CPS top codes income at a much higher level than the publicly available file. This is important for accurately representing the top end of the income distribution. We focus on log weekly earnings (annual earnings divided by weeks worked in the previous year) because weekly earnings is the earnings measure most comparable to the establishment earnings that we use later. But as figure 1, shows the variance of log weekly earnings closely resembles that of the variance of log hourly earnings on which most earlier work has focused.

Figure 1 displays the change in the variance of log wages in the internal March CPS

---

heterogeneity across plants.

[3] Workplace earnings are linked to workplace productivity. Recently, Faggio, Salvanes and Van Reenen (2007) and Comin et al (2006) present evidence of increasing productivity differences in the UK. Foster, Haltiwanger and Krizan (2001) and Haltiwanger, Lane and Spletzer (2007) show that firms are very heterogeneous and that much change occurs because of the reallocation of labor across firms. NBER volumes by Bender et al (2008) and Lazear and Shaw (2009) provide evidence of wage dispersion across plants, the heterogeneity in workplace practices, and the organization of production. Arai (2003), Margolis et al (2001), Martins (2009), and Card et al (2010) estimate the causal impact of productivity on wages.

files[4]. The two solid lines show the development of the variance for log weekly earnings and log hourly earnings. The variance of log weekly earnings is about two log points greater than the variance of log hourly earnings but the pattern of change in the two variables is similar. The variance of both measures of earnings increased by about 0.1 log points from 1977 to 2002.

[Figure 1 in around here]

The dotted lines show the development of the variance of residual log earnings estimated from a simple OLS regression including age, age squared and four educational groups, all interacted with gender. It grows at a similar rate of growth as the variance of log earnings. The bottom dashed lines show the development of the variance in the "human capital component" of earnings as measured by the predicted earnings from the regressions over the same period. The variance of the human capital component grew moderately over these 25 years[5]. Thus, consistent with other studies, we find that almost all of the growth in the variance of log hourly earnings and log weekly earnings across individuals arise from growth in residual dispersion.

As noted, the CPS does not have establishment identifiers but it does contain industry codes that provide some clues as to the impact of establishments on earnings. Figure 2 shows that the variance in log earnings rose in all industries but personal services in 1977-2002. The increase was most rapid in finance, insurance and real estate (FIRE), business services and media and communications. The variance of the human capital component is more stable than the residual dispersion in all industries. And, most important across industrial sectors as well as in the economy writ large, residual wage dispersion accounts for most or all of the rise in earnings inequality.

[Figure 2 in around here]

2. Establishment Data and Methodology

We use the Longitudinal Employment and Household Dynamics (LEHD) data to obtain direct

---

[4] The results are very similar to results run on public CPS files. See Burkhauser et. al. (2009) for a thorough comparison of inequality measures using the different sources of the CPS.

[5] In the appendix we show that the wage premiums associated with human capital, such as age and education, has risen steadily over these years. This increase must thus have been offset by a reduction in the variance of the human capital components themselves, such as age and education.

measures of wage dispersion within and between establishments. This data is limited to nine states with data back to the early 1990's, thus including 1992, 1997 and 2002. To obtain a similar decomposition for the full economy and for the extended period from 1977 to 2002, we use five-year data from the Economic Census (EC) of establishments and the Longitudinal Business Data base (LBD), in combination with individual data from the Current Population Survey (CPS).

The Longitudinal Employment and Household Dynamics (LEHD) are linked employer-employee data sourced from state unemployment insurance (UI) records, which are universe files of all workers within 22 covered U.S. states[6]. The data identifies the employer firm of all workers and the establishment location of the job for most workers. In cases of firms with multiple co-located establishments, probabilistic worker assignment by Census was necessary due to data availability in the UI files.

Using the LEHD Employee History Files (EHF), we construct the mean and variance of workers' wages at the reporting unit (establishment) level, and link these moments to the LBD and EC through the LEHD business register bridge. This provides comparable measures of wage dispersion, and adds to the establishment information the within establishment wage distribution. We focus primarily on the nine states with data back to the early 1990's, providing 3 years of overlap with the economic census, thus including 1992, 1997 and 2002. We use yearly earnings from the same establishment (sein-unit) for workers employed in all four quarters of the year. To examine the effect of establishment on the dispersion of earnings we examine three internal restricted use Census Bureau micro data sets, the Longitudinal Business Database, the Economic Census, and the Longitudinal Employment and Household Dynamics data.

The Longitudinal Business Database (LBD) is a longitudinal linked version of the Census business register, which is the basis for the Economic Census (EC) of establishments. We use the LBD and EC for the census years of 1977, 82, 87, 92, 97, and 2002 to obtain economy wide data on establishment level real earnings, sales, value added (for some sectors), age, industry, and firm affiliation. We use annual payroll before deductions, divided by the number of employees in the establishment as our measure of workplace earnings.

To investigate worker sorting by demographic characteristics of workers and to assess the importance of industry specific changes in skill composition and skills prices over time we

[6] The LEHD program at the Census Bureau now has agreements in place with 48 U.S states, however, data for all states is not currently available for researchers thgouth the Census Research Data Centers (RDC) network.

use a sample of CPS respondents for 1986-1997 that is linked to the LEHD Individual Characteristics File (ICF). The CPS provides information on individual characteristics while the LEHD links the individuals to the establishment.

The Appendix describes the data in greater detail.

Methodology of decomposition

Let $V(\ln w_i)$ be the variance of log weekly earnings for all individuals. A standard decomposition of the variance into a between-establishment and a within establishment component is given by:

$$(1)\quad V(\ln w_i) = V^w + V^b = V(\ln w_{if} - E\ \ln w_{if}) + V(E\ \ln w_{if})$$

where $E\ \ln w_{if}$ is the mean of the ln wage among individuals in establishment f and $\ln w_{if}$ is the ln wage of individuals in establishment f.

For the period 1992 to 2002 we have LEHD data for a subset of states that include individual and employer identifiers, which allows us to estimate all three components of (1) for those states and period. For the whole of the US and for the period 1977-2002 we use the CPS to measure the change in dispersion for individual workers and the LBD to measure the change in dispersion for establishments as described.

As noted, the March CPS provides data to calculate the level and increase in dispersion in ln earnings among individuals but lacks information on the dispersion of earnings among establishments. The establishment-based surveys provide information on the mean level of establishment earnings but not of the average *ln earnings* across establishments nor the variance of ln earnings of individuals within establishments. Thus, to use these data sets to decompose the variance of the ln earnings of workers from the CPS into the variance due to differences in the mean of ln earnings of workers in different establishments and to the dispersion of ln earnings within establishments, we need additional assumptions and/or evidence.

The March CPS provides measures of $V(\ln w_i)$. The EC file gives the wage bill and the number of employees that allows us to measure the mean of the absolute level of earnings in each establishment, $E(w_{if})$, and $\ln E(w_{if})$. This gives us a measure of the variance of the ln of mean wages across establishments. But $\ln E(w_f)$ is not the same as the $E\ \ln w_{if}$ – the average of ln(w) within each establishment – that enter the decomposition in (1). If wages are log normally

distributed within each establishment ($\ln(w) \sim N(\mu_f, \sigma_f^2)$) the log of the mean value of wages is equal to the mean value of ln wages plus one-half the variance of ln wages within the establishment[7].

Taking variances of both sides of (1) shows that the variance of the ln of the average wage across establishments, which we can calculate from the EC, consists of three components: the variance in ln establishment earnings across establishments, $V(\mu_f)$, which is what we need for the decomposition; the variance of the within-establishment variance σ_f^2 across establishments $V(\sigma_f^2)$; and the covariance between these components. If the within establishment variation is constant across plants in the cross section, the variance of the average ln(w) would be equal to $V(\mu_f)$ and we could simply use the observed variance of the ln of the average wage among establishments to measure the variance of the average ln wage in establishments. But there is no reason to expect constant within-establishment variations in wages.

For analyzing changes over time, however, what we need is not constancy in the within establishment variation in the cross section but similarity in changes over time so that the distortion created by across plant variation in σ_f^2 is constant. Then the variance decomposition may be used to decompose the change in variation over time into the contribution from changes in the between and within establishment components. In fact, we shall see that in the LEHD data the within establishment variance $V(\sigma_f^2)$ is small in magnitude, and does not increase over time.

A related problem is that the CPS and LBD measure earnings differently. We present some robustness checks on the LEHD sample to show how the measures generally compare. Again since our goal is to assess the impact of changes in the within and between components on the overall development of V(ln w), differences in measurement between the two data sources are swept out as long as they remain relatively constant over time.

Human capital and the segregation of observable skills

While the variance of observable skills measured by the human capital components of the simple wage regression does not explain much of rising wage inequality, it is possible that human capital factors may underlie the increased dispersion of earnings among establishments. The way this could occur would be if workers with a given level of human capital became more

---

[7] Aitchison and Brown, chapter 2: $\ln E(w) = \mu_f + \sigma_f^2/2$, where σ_f^2 is the within-establishment variance of ln wages

concentrated among establishments. To assess how concentration of observable skills affects the decomposition of the wage variance into the within and between establishment components of equation (1), we consider the following simple log wage regression for any given time t:

$$(2) \qquad \ln w_{ip} = \alpha + X_{ip}\beta + \varphi_p + u_{ip} = \alpha + s_{ip} + \varphi_p + u_{ip},$$

where X represents the human capital variables, β the vector of within establishment returns to human capital, and s is a composite measure of observable skills (in dollars). φ is a measure of the establishment specific wage premium[8], and u is a stochastic error term with $E(u|X, \varphi)=0$.

The variance of ln w can be decomposed:

$$(3) \qquad V(\ln w) = V(s) + V(\varphi) + 2\,\mathrm{cov}(s, \varphi) + V(u)$$

and the within establishment part of the variance may be written as:

$$(4) \qquad V^w = V(s)(1- \rho) + V(u)$$

while the between component may be written as:

$$(5) \qquad V^b = V(s)\,(\rho + 2\,\rho_\varphi) + V(\varphi)$$

where $\rho = \mathrm{cov}(s, S)/V(s)$, where S is the establishment's average level of observable skills, is an index of worker-worker segregation across establishments[9]. With $\rho = 0$, individuals of different skills are allocated randomly across establishments, whereas with $\rho = 1$, individuals are matched with individuals of their own skill only. $\rho_\varphi = \mathrm{cov}(s, \varphi)/V(s)$ is a similar measure of the level of worker-plant assortative matching (high skilled workers with high wage plants).

We notice that increased variance of observable skills, V(s), for instance from increased returns to education, will tend to increase both the within and the between component of wage

---

[8] With no subscript on β, and no subscript i on φ we have made the assumptions of equal within-establishment return to human capital and no match specific effects. All heterogeneity in β across establishments and heterogeneity in φ across individuals within the same firm are defined as parts of u

[9] ρ is actually the measure of segregation by skills suggested by Kremer and Maskin (1996).

dispersion, with the relative impact determined by the index of segregation. Since as we saw this component has not been rising over the last decades, even though the returns to education have risen notably (see the appendix), we focus on the other terms of equations (4) and (5).

The worker-worker segregation index, ρ tends to shift the amount of wage inequality towards the between establishment component, even if the variance of u and φ, and the covariance between skills and the establishment's wage premium remains constant. Intuitively, if all high skill individuals crowd in one establishment, while all low skilled individuals crowd in the other, all wage inequality would be picked up by looking at the wage differences across establishments, whereas if they were randomly allocated, the within establishment difference would reflect all wage inequality and we would not find any differences in average wages across establishments. A change in segregation does not, however, change the overall level of wage inequality[10]. Increased positive sorting of workers across high and low wage plants, ρ_Φ, also increases the between component of wage dispersion, while at the same time increases the overall level of wage inequality.

Identification of ρ and ρ_Φ poses a challenge in our data since we do not observe the average level of skills at each establishment nor the wage premium associated with that establishment. However, the link between CPS and LEHD provides us with a sample of observations with measures of both wages and experience and schooling at the individual level that can be linked to observations of plant specific average wages for *all* workers in the plant, obtained from the LEHD. In the following we spell out how we use this link to identify ρ and ρ_Φ in the data.

We use a simple measure of observable skills obtained as a weighted sum of the human capital components age and education, interacted with gender, where we use the within establishment coefficients from a log wage regression as weights. With a large sample of establishments with more than one observed individual, fixed establishment effect estimators provide consistent estimators of β for each year in our data, with asymptotic properties depending on the overall number of observations observed in establishments with more than one employee each observation year. This means that we can obtain our measure of observable skills for each individual by calculating $s\hat{} = X \hat{\beta}$, where $\hat{\beta}$ is year specific. This measure of

[10] Unless, of course, the change in segregation is associated with a change in prices β, as in Kremer and Maskin (1996), or in the distribution of any of the other parameters.

observable skills will be used for each individual in the empirical implementation below.

The challenge involved in obtaining estimates of ρ and ρ_Φ is that the asymptotic properties of estimators for establishment level variables rely on the number of observations *per* establishment. Since our data on observable skills is from CPS, the number of observations per establishment will be very few for most observations. This means that we are unable to obtain useful direct measures of the establishment specific variables, such as φ_p and S_p, to estimate the amount of sorting across establishments. But the LEHD data measures the average plant log wages based on *all* employees in the establishment. We merge this statistic into every CPS observation for which we know the establishment of the worker. We then utilize the difference between the correlation of own skills and own wage to the correlation of own skills and average plant wage to obtain the desired parameter. To see how, consider the following regression:

$$(6) \qquad s_{ip} = a + b(\ln w_{if} - \mu_f) + c\,\mu_f + v_{if}$$

In this regression we "explain" individual level of skill by the within and the between parts of earnings. Since the two parts are orthogonal, the estimators for b and c are given by: $b^{ols} = cov(s, \ln w_{if} - \mu_f)/V^w$ and $c^{ols} = cov(s, \mu_f)/V^b$. Inserted into the wage equation and algebraic manipulation gives:

$$(7) \qquad \rho = 1 - b^{ols}[V^w/V(s)] \text{ and } \rho_\Phi = [V^w b^{ols} + V^b c^{ols}]/\,V(s) \; - 1$$

Intuitively, if b is zero, i.e. given the establishment average wage, there is no extra information to determine an individual's skill from her relative wage within the establishment, so $\rho = 1$ (complete segregation). On the other hand, if $b = V(s)/V^w$ the covariance between s and S is zero, and consequently $\rho = 0$.

Unobserved individual skills may distort this picture. This would create a problem if there is a strong correlation between the establishment effect and unobserved individual skills. To deal with this properly requires more observations per establishment and of movers between establishments in the CSP-LEHD matched data, which we do not have. But we do not believe this poses a significant problem. To the extent that unobserved individual skills are positively correlated with observed individual skills, the fact that neither the variance of skills or the

covariance between skills and the establishment wage premium rise over time makes it unlikely that unobserved skills will change in ways that gainsay our conclusions about changes over time. Extant evidence supports our view. Using the LEHD data to estimate a two way fixed effect model of a similar wage regression including fixed individual effects, Abowd et al (2009) conclude that the correlations between firm and individual fixed effects in their log wage regressions are "generally small in absolute value" and take both negative and positive values. This clearly indicates that sorting on unobserved individual characteristics is a only a minor concern for the estimation of model (2). Thus our estimated covariances likely reflect true workplace heterogeneity of skills and wages.

3. The importance of establishment

To estimate earnings variance across establishments over time we use the Longitudinal Business Database (LBD) for 1977-2002, thus extending Dunne et al.'s (2004) analysis by 10 years and to the 90% of the economy outside of manufacturing. We calculate the variance of the ln of average earnings across establishments which are the basis for our decomposition.

Table 1 records measures of the variance of ln earnings among individuals from the CPS; measures of the variance of the ln of average wages across establishments and measures of the variance of log sales per worker across establishments for the entire US labor market from 1977 to 2002. The increase in the variance among individuals is 0.102 ln points. The increase in the variance of ln average earnings by establishments is slightly larger, 0.114 ln points, which would imply that to the extent that the trend in the variance of the ln average establishment earnings is a reasonable approximation of the trend in the average of ln earnings within establishments, essentially all of the rise in the dispersion of ln earnings over the period is due to the increased dispersion of earnings across establishments.

[Table 1 in around here]

To assess the accuracy of the approximation of the trend in the variance of the average of the log earnings by establishment for the trend in the variance of the log of the average earnings, we note that from equation 1, the difference between the two variances is attenuated by the variance of the within plant variance $V(\sigma_f^2/2)$, and by possible correlation between the within plant variance and the average plant wage, μ_f. Since we observe every worker in every plant in

the LEHD data, we can calculate the exact variance within establishments for a limited number of states and time periods. Table 2 shows the variance and covariance of the within establishment variance and the establishment average wages. We use these numbers to correct the numbers produced from the log of average wages from the LBD for the period 1992-2002. We estimate $V(\sigma_f^2)$ to be 0.042 and the covariance between μ_f and σ_f^2 to be .019 in 2002. This suggests that the above numbers are attenuated by 0.03, so that the true variance of the log establishment wage in 2002 is 0.416 rather than 0.446 as obtained from using lnE(w) instead of E(ln w). The corrected LBD numbers are slightly smaller (in the order of 0.026-0.030) than the ones calculated directly on the LBD data, which does no harm to the interpretations of the results in table 1. Furthermore, these calculations show that the variation in within establishment variance has been declining over time and thus cannot account for the growth in the between establishment variance. In su, these calculations suggest that the variance across firms accounts for about two thirds of the inequality across individuals, and that *growth* in the between establishment variance accounts for more than 70 percent of all *growth* in inequality across individuals over these 25 years.

Full decomposition using LEHD data

In the LEHD data we observed wages of every worker and what employer they work for[11]. Having access to the LEHD data thus allows us to calculate an exact decomposition of the variance across and within establishments for this sub sample of states and years. This is done in Table 2 for the years 1992, 1997 and 2002 for the 9 states where we have data all three years.[12] The top panel of the table provides a full decomposition of wage variance for all full-year workers. Within-establishment variance amounts to almost 55 percent of all wage variance across individuals in 2002, while between establishment variance amounts to 45 percent. This number is smaller than the two thirds that we estimated for between establishment variance using the corrected LBD numbers compared to the variance among individuals using the CPS. This difference may be due to the difference in definitions of earnings and observations between the data sets. The advantage of the LEHD estimate is that they calculate the same measures of wages

[11] The data identifies the employer firm of all workers and the establishment location. For multi-plant employers, the Census allocates workers to plants by an algorithm that combines information on worker home location and plant location, see documentation.

[12] The nine states are CO, ID, IL, MD, NC, OR, WA, WI and CA.

for the same set of jobs (i.e. combinations of individuals and establishments). The disadvantage is that we have the observations cover 10 years and 9 states only.

The key finding, which is consistent with the combined observations from LBD and CPS, is that almost all growth in variance in earnings across individuals in the LEHD data may be attributed to growth in the between rather than the within establishment variance. In the decade from 1992 to 2002, 81 percent of all growth in the variance of individuals' log earnings may be attributed to growth in the between establishment component of the variance.

[Table 2 in around here]

We use the full year workers in order to have as good a measure of earnings as possible. However, when we limit ourselves to full year workers, we lose the transitory jobs, new jobs and jobs that are dissolved during the year. To show that our results are robust to the inclusion of more transitory jobs, the next panel shows the variance of the same earnings measure, i.e. quarterly earnings as measured by annual earnings divided by the numbers of quarter in the data, for all individuals that were employed in the 2nd quarter. This sample thus also includes transitory jobs that may have started sometime during the first two quarters, or that was dissolved during the last two quarters. We find a higher variance, in particular within establishments, but still, 73 percent of the growth in the variance of log quarterly earnings is due to increases in between establishment wage inequality.

The next panel uses the original LEHD units as the measure of establishment, rather than the LBD unit. We find somewhat lower estimated variance overall, but again, variation between establishments accounts for almost 3/4th of the growth in total variance across individuals over this time.

Appendix table A replicates the analysis in tables 1 and 2 for each industrial sector separately [numbers to be revised]. The table shows some heterogeneity at the broad industry level. The variance in the log of workplace mean earnings rises in six of the eight industries, the exceptions being Personal Services and Health etc. It rises fastest in FIRE and Communications. Comparing the growth in total variance of log earnings from the CPS with the growth in between plant growth from the LBD, we find that there has been growth in the within establishment component of wage dispersion in Manufacturing, Business services and Health, while in FIRE

and Communication, the between plant component is dominant. To drill down further, we examined the change in the real earnings of the top and bottom decile of plant earnings within industry. For the whole economy, real earnings fell for the mean and median plant after 1977, only achieving comparable real earnings to the 1977 level by 2002.

Plant earnings have fanned out in much the same way as individual earnings have in the CPS. For the lowest decile, real earnings had declined by around 20 percentage points by 1992 and, although they had recovered somewhat by 2002 they remained 10 percentage points below their 1977 levels. Mean plant earnings for the top decile grew by over 10 percentage points. However, when we ran the same charts by industry it was clear that this pattern was only replicated in FIRE, Business Services, and Communications. Appendix table A shows the development of real wages for each of the three deciles for each broad industry. In FIRE, Business Services and Communications there was rising inequality in mean workplace earnings in the top and the bottom of the workplace mean earnings distribution. In comparison the increase in plant-level wage inequality in Mining and Manufacturing was modest. Retail and Wholesale experienced a big growth in earnings inequality between the workplaces in the top half of the earnings distribution (the 90:50 ratio), but not in the bottom half. Growth in earnings inequality across Health etc and Personal Services workplaces was confined to those plants in the bottom half of the earnings distribution and, in the case of Health etc., was offset by a similar decline in across-plant mean earnings inequality in the top half of the distribution.

Decomposing Variance in Plant-level Weekly Earnings

[figures to be updated] In decomposing variance in plant-level weekly earnings we must also account for changes in the share of employment by industry. Table 2A and shows a dramatic decline in Manufacturing - typical of all advanced OECD countries - and a rise in the share accounted for by Business Services and FIRE. Figure 3 brings together the information on variance in plant yearly earnings and industry shares in employment to show the contribution of plants in each industry to overall log earnings variation. Retail has traditionally accounted for the largest part of establishment log earnings variation. Its contribution to total variance has dropped a little due to lower employment shares, not lower variance. The contribution of Business Services has grown considerably due to its sustained high variance and increasing employment share. Together Retail and Business Services account for almost half (46 percent) of

all employment weighted variation in log earnings across establishments. Manufacturing has contributed less over time, falling from 14 percent to 6 percent of total earning variation.

The bulk of the growth in log yearly earnings between plants is accounted for by within industry change in variance. The within industry component can be further decomposed into one part due to changes in the variance within industries and a compositional factor arising from changing employment shares of the different industries. Compositional change within industries accounts for some of the growth whereas structural change across industries does very little to change the between-industry component of the variance. The growth in earnings inequality across establishments in FIRE is clearly the largest contributor to overall growth in earnings inequality. Next is Retail trade, partly as a result of its large employment share. By 2002, Business Services was the third largest contributor.

The figure shows the cumulated growth in variance of log establishment average wages and three underlying components: 1) Within industry which shows $\Sigma n\Delta V(.)$, or the contribution from changes in within industry variance, 2) Compositional within industry which shows $\Sigma\Delta nV(.)$, or the change in employment across industries with different within industry variances. 1) and 2) sum up to total change in within industry variation. More than 90 percent of the change in variance comes from total change in within industry variation. 3) The between industry component shows the contribution from changes in wage differences across industries and their employment share. Figure 8 shows the contribution from each industry to component 1) $\Sigma n\Delta V(.)$; the change in variance across establishments within industries is weighted by its employment share. FIRE is the industry which has contributed most to the overall growth in variance in plant level wages. The contribution from FIRE to total growth in plant-level wage is 0.025, thus contributing one-fifth of total wage inequality growth.

Increased dispersion between establishments occurs within region and detailed industry

In table 3 we report some figures from regression analyses done on a two percent sample of US plants where we have observations of both region (a combination of SMSA and rural state dummies) and detailed industry (sic3 and naics4). The dependent variable is ln average wage of the establishment, and the regressions included regional and industry dummies only. The first line of the table shows the growth in the employment weighted variance of ln wages from 1977 to 2002 in this sample. The second line shows the employment weighted variance of the regional

dummies. We note that the variance across space has not changed at all from 1977 to 2002. Next, we find that the employment weighted variance of the industry dummies have grown by 0.03. However, the bulk of the change in wage dispersion across establishments has occurred within region and industry: The residual wage dispersion has increased by 0.075 which is two thirds of the total growth of 0.112. This table clearly shows that most of the large increase in wage dispersion over these 25 years has occurred within industry and regions.

4. Increased Dispersion from Turnover of Establishments or Concentration of Observable Skills

We can identify which plants are new to the Census having been absent five years previously ('entrants'), those that were present in one year but absent five years later ('exiters') and those plants that were present in consecutive Censuses ('stayers'). Comparing over two time points one can distinguish two sets of stayers: those who were present in the previous period (stayers (p)), and those present now who go on to be present in the next period (stayers (f)). Thus plants that are observed in 1977 that are also observed in 1982 are stayers 'f' in 1977 and stayers 'p' in 1982. (There are no stayers 'p' in 1977 because we do not observe any plants prior to 1977, and similarly there are no stayers 'f' in 2002, because we do not go on to observe plants after 2002 in our current data). The stayers provide insights into the wage dynamics among surviving plants while the entrants and exiters give insights into wage dynamics associated with compositional change in workplaces.

Table 4 gives the results of this analysis. Throughout the period, the variance in log establishment mean wages were higher among exiters and entrants than they were among stayers. Throughout the period, the bulk of growth in wage dispersion has occurred within the group of stayers as well as within the group of entrants and exiters. In figure 4 we illustrate this development. The upper line shows the development of wage dispersion across plants from table 1. The lower broken line shows the development of wage dispersion for stayers between each subsequent five year period. We find that stayers experience growth in dispersion in all five years intervals where wage inequality grew significantly, whereas it dropped in the two five years intervals with low growth (87-92 and 97-02). In every period the stock of stayers is has a higher level of wage dispersion than the stock of stayers in the previous period, reflecting the fact that entrants in any given period are more dispersed than the exiters from the previous period.

The employment share of entrants and exiters grew a little over the period at the expense of the share of employment going to stayers. The bottom of table 4 decomposes the change in variance in log establishment average earnings into the contribution accounted for by stayers, the contribution accounted for by entry and exit, and finally the contribution from the remaining terms, what we term 'reallocation'. At time t the variance of earnings may be decomposed into: $V_t = n_t V_t(s) + (1-n_t)V_t(entry) + n(1-n)V(b)_t$,where $V_t(s)$ is the variance among stayers from period t-1 to t, measured in time t, n is the share of these stayers in period t, V(entry) is the variance among those present in period t, but not in t-1 and V(b) is the squared difference between the average log earnings level in these two groups. At time t-1, we measure the variance among the stayers from t-1 to t again, and decompose the variance into: $V_{t-1} = n_{t-1} V_{t-1}(s) + (1-n_{t-1}) V_{t-1}(exit) + n(1-n)V(b')_{t-1}$,where $V_{t-1}(s)$ is the variance among stayers from period t-1 to t, measured at time t-1, V(exit) is the variance at t-1 of the establishments present in t-1 but not in t, and V(b') is the squared difference between the average log earnings level in these two groups. Changes in variance may thus be decomposed in the following way: $\Delta V = n_{t-1} \Delta V(s) + (1-n_{t-1})(V(ent)-V(exit)) + \Delta n V_{t-1}(s) + \Delta (1-n)V_{t-1}(exit) + \Delta[n(1-n)V(b)]$, where the first term represents the contribution from stayers, the second term represents the contribution from entry and exit, and the remaining terms may be summed up as "reallocation".

Cumulatively across the period we find that increased variance among stayers amounts to more than half of all the growth in variance, whereas compositional changes through entry and exits amounts to about 30 percent of the growth. The remaining 19 percent is due to reallocation.

Increased segregation or sorting of human capital across plants?

As noted earlier, an increase in segregation across establishments of workers of different skills will lead to an increase in wage dispersion across plants and a decrease in wage dispersion within plants. Similarly, an increased sorting of human capital across plants will give rise to higher between plant wage dispersion, but in this case it will not be matched by lower wage dispersion within plants.

To illustrate the potential magnitudes of these effects, consider the following simple example. Consider a two firm, two skill economy with 200 workers, 100 of each skill and 100 in each firm. The individual's wage is given by the following equation: $w_{if} = 100 + 10X_{if} + 10 F_f + u_{if}$, where X is a dummy taking the value 1 for high skill workers, and F a dummy taking the

value of 1 for high wage firms. We assume that wage inequality within group is V(u)=25. V(X)=V(F)=0.25 since the share of worker of each group is 0.5, and accordingly V(s) = V(Φ)=25 as s=10X and Φ=10F.

Table 5 illustrates three cases. In case A workers are distributed 50/50 on each firm. The variance of wages is the sum of within group inequality, the inequality of skills and the inequality of firm's wage policies; V(u) + V(s) + V(Φ). In the two next cases, panels B and C, the workers are segregated with 75 percent of the high skill workers in one firm, and 75 percent of the low skilled workers the other. The segregation coefficient is in this case 0.5, since cov(s,S)=12.5 and V(s)=25. The effect of segregation is to reduce the within firm variation in wages, since workers within firms are now more equal, from 50 to 37.5. Consequently, between firm variance is increased from 25 to 37.5 since the difference between average wages between the two firms has gone up.

But this is not the only effect on between firm inequality; the full effect depends on the sorting of workers as well: Are high skilled workers concentrating in high wage or low wage firms? In panel B there is positive assortative matching: high skill workers are more likely to be in high pay firms. In addition to the effect of segregation, wage inequality between firms goes up, since in this case cov(s,Φ)=12.5, and $\rho_\Phi = 0.5$. Overall wage inequality has increased from 75 to 87.5. In panel C the sorting is negative, low skill workers are concentrated in high wage firms. Consquently, $\rho_\Phi = -0.5$, and the sorting of workers compensates for the effect of segregation. All in all, wage inequality is lower in this case, since within firm inequality has gone down and the effects on between inequality cancel each other out.

The main point in this story is that within group variance V(u), the variance of skills V(s), the variance of firms pay premiums V(Φ), as well as the prices reflected in the wage function are all constant across the cases; it is only differences in sorting across firms that generate the difference in total variance and in the decomposition of the variance within and between firms. We want to find out to what extent our empirical results for the US economy arise from changes in the wage structure or just from this type of changes in worker-worker segregation, ρ, or worker-plant sorting, ρ_Φ, across firms.

Table 6 provides the results for the key parameters from the LEHD data from 1992, 1997 and 2002. The upper panel shows the results from a regression of the individual level of skill, s_i (= $X_i \beta$), on the two orthogonal parts of the wage, the difference from the establishment mean

(within establishment difference, with coefficient b) and the establishment mean (with coefficient c).

The next panel shows the overall variance of $s=X\beta$ in the labor market. As noted earlier, we find no growth in the overall variance of the value of observed skills in the labor market, on the contrary, in this sample we find a drop of about .015 log points from 1992 to 2002.

The lower panel shows the estimated segregation indexes for worker-worker sorting and worker-employee sorting. We find that the segregation index, measuring to what extent high skilled workers are matched with high skilled workers in the labor market, is about 0.12 in 2002 when measured among full year employees and about .21 when measured among all employees. The worker-worker sorting index has dropped by 0.03-0.05, depending on the sample of workers. The index of sorting, measuring to what extent high skilled workers are matched with high paying establishments (assortative matching), is between .4 and .5 and highest for full year employees. This type of sorting is increasing by .08-0.09 depending on sample. The bottom panel shows the contribution of these two factors on the between establishment part of the wage distribution. We find that the impact is small and declining for both types of sorting, partly because of the drop in worker worker sorting and partly as a result of the overall drop in the variance of the value of observable skills. Changes in segregation and sorting of observable skills are thus clearly not the reasons behind the increase in wage dispersion across plants.

5. Potential causal effect of productivity on wages and Rent sharing

Productivity and wages are intrinsically related. Any theory of labor demand suggests that higher wages should lead to higher observed marginal productivity, simply through the adjustment of labor. In addition there may be important efficiency, or incentive, wage effects which give higher productivity from higher wages. When we want to explain wages with productivity we thus need to use instrumental variables to provide exogenous variation in productivity. We estimate different versions of the following model:

$$7)\ \ln w_{pir} = a + b\, p_{pir} + c\, \mu_{ir} + d\, s_I + v_{pir}$$

where p is sales per worker or value added per worker in establishment p, industry i and region r, μ_{ir} is the alternative wage measured by the average wage of industry i in region r, and s_I is a

composite observable skills measure at detailed industry level. We address the direct endogeneity problem of the average industry wage by excluding establishment p from the calculation of the industry average in the region for each p.

The endogeneity problem related to p poses more of a challenge. Following Card et al (2010) we use the average productivity per worker in the detailed industry (SIC4 and Naics6) in regions outside of the region in which establishment p resides as an instrument[13].In our regressions using sales per worker we use sales per worker outside own region as instrument, and in regressions using value added for observations where we have information on value added, we use both sales per worker and material costs per workers outside own region as instruments for value added. The identifying restriction is that, conditional on regional average wages of the industry, a boost in national demand (sales per workers outside own region) in the industry affects own wages only through own sales per workers. Similarly, cost shock to the industry (say increased input trade with China, or changes in oil prices) that influences material costs, affects wages only through value added per worker of own plant, conditional on average industry wages in the region. Having two instruments, we could also hope for an over identification test of our model. The idea is that firms are hit by national, industry specific shocks that translate into wage changes only through changes in value added. Changes in value added or sales per worker that are potentially induced by changes in wages are not used for identification. Note that we control for a skills measure at the industry level as well[14], in order to tackle the potential concern that an industry wide skills upgrading would affect both our instrument and plant wages. Our identifying assumption is thus that an industry wide shock, conditional on the skill level of the industry and local alternative wages, affects revenue per worker in the plant, but is otherwise unrelated to their average wage. In addition we experiment using previous R&D investments at the firm level as instruments in some specifications.

We have information on sales per worker for US workers in the EC files from 1977 to 2002. We have information on value added for manufacturing, mining and construction from 1977 to 2002 and sample survey information on value added for selected services from 1992 to

---

[13] An alternative would be to take a more structural approach and estimate the extent of rent sharing from the derived f.o.c's from profit maximization for both materials and labor. See Dobbelaere and Mairesse (2008) who provides results from both types of approaches and reach comparable results.

[14] The skills measure is the average predicted xb from the Mincer equations described in section 1 on the yearly CPS files, where x includes education and age interacted with gender. This predicted "human capital component" is then averaged by detailed industry using the unicon definition of ind50 from the IPUMs to match each year to sic3 and naics4. See data section for details.

2002. We thus run different specifications for different cuts of the data. We use both real sales per worker per establishment and value added per workers as measures of labor productivity. The productivity measures are deflated by CPI, which also makes it clear that we are not measuring productivity in physical units, but rather in units of dollar value.

Table 7 reports the variance of log sales per worker and log wage for each main sector. The variance of log sales per worker grew by 0.17 from 1977 to 2002[15], whereas the variance of log wage grew by 0.112.

Table 8 presents regressions of log average establishment wage on log sales per worker. The first model gives a rent sharing parameter of 0.356, controlling for age of plant, year and industry dummies as well as our measure of alternative wage and skills. Alternative wage is measured as average wage in own region within the same industry sector and skills is measured as the predicted "human capital component", estimated on the CPS as in section1, averaged over each sic3 (naics4) industry *x* year cell. The fixed establishment effect estimator gives a slightly lower coefficient of 0.299. Following Card, Devicienti, and Maida (2010) we use detailed industry level demand, calculated among all establishments outside of the region of the observed plant, as an instrument in a model including fixed establishment controls. Instrumenting sales per worker in the fixed effects model gives a coefficient of 0.147. This number is close to what is found by Card et al (2010) on Italian data.

In the last column we report results from a fixed establishment model where we have added lagged R&D expenditures (the average expenditure of the prior four years) to the set of instruments. This exercise is done on establishments in the sample of firms participating in the NSF Industrial R&D survey only. To control for the potential direct effect of R&D on wages, we control for the share of employment of scientists and engineers involved in R&D activity in this specification. This instrumental variable estimate, based on within establishment variation only, gives a rent sharing parameter of 0.118.

Most bargaining or rent sharing models would predict a relation between value added and wages rather than between sales per worker and wages. The next two tables provide results with productivity measured by value added per worker. Table 9 gives regressions results for manufacturing and table 10 for services. A value added sharing model would predict that once

[15] The scope of the Economic Census broadened somewhat during this period, so we also calculated the variance of sales per worker restricted to detailed industries where the census coverage was more than 90 percent of the LBD plants. In this restricted data set, growth from 1977 to 1997 was 0.166.

value added is included in the model, the use of material input should not matter. It turns out, however, that material inputs have a significant impact on wages, and should be included in the model as well. This also means that we cannot use material input in other regions as an additional instrument in order to provide a test of overidentification, and thus have to stick to an exactly identified model. By itself, the coefficient for value added is very close to the coefficient for sales per worker. (.23 in manufacturing and .36 in services). The IV models with fixed establishment effects provide coefficients of 0.186 and .177, and 0.184 and .194 when including R&D variables to the set of instruments.

In the last column, we use calculated establishment level tfp measure and industry price indexes as instruments for value added. The tfp measure is calculated as the "Solow residual" of each plantxyear, when using the cost share method of estimating industry elasticities of labor and capital (see Baily, Bartelsman and Haltiwanger (2001) for details.). This is thus a measure of value added that is rinsed for the effect of different levels of inputs of labor and capital across establishments. In this case we obtain measures of the rent sharing parameter of 0.134 and 0.194.

All in all, the various fixed effects estimates of the rent sharing parameter ranges from 0.134 to 0.186 in manufacturing, and from 0.177 to 0.194 in services when using several different combinations of samples and instruments.

6. Conclusion

Using the CPS, LBD and LEHD we have examined the growth in earnings variance from 1977 to 2002 for the whole US economy. The CPS data reveal the well-known growth in earnings dispersion across individuals and show that the growth occurs primarily in residual variance. Examining the LBD and LEHD, we find substantial variance in earnings across establishments that account for between 45 and 67 percent of the total variance across individuals, depending on the data source. Our data further show growing dispersion in plant earnings. From 1977 to 2002 the coefficient of variation of earnings between US establishments increased by 0.319 and the variance of ln average establishment earnings rose by 0.112 log points. The growth in earnings dispersion across plants is apparent in the bottom and the top halves of the workplace earnings distribution.

The growth in the variance of log establishment earnings across plants is as large as the growth in overall wage dispersion across individuals. Given the relative stability in the variation

of within-plant dispersion across plants over time, this indicates that most of the change in earnings variation occurred between plants rather than in changes within plant. Comparing changes in CPS wage dispersion to changes in wage dispersion across LBD establishments from 1977 to 2002 suggests that 71 percent of the increase in wage dispersion across individuals arise from increased wage dispersion across plants. Using LEHD data from 9 states from 1992 to 2002 to validate this result, we find that 73 to 81 percent of the increase in wage dispersion from 1992 to 2002 across workers arises between rather than within establishments.

It is possible that increased concentration of human capital across plants, due to high skilled workers increasingly working with high skilled workers, and low skilled workers working more with low skilled workers, accounts for some of the rising wage dispersion across establishments. Using matched CPS and LEHD data, we test for this possibility and find the opposite: reduced segregation of human capital across plants over the period 1992-2002. A similar concern could be raised with respect to an increased tendency for high skilled workers to be in high paying plants. Using the same data, we verify an increased level of this type of sorting from 1992 to 2002, but this is not sufficient to offset the effect of reduced segregation and variance of skills across plants. Changes in the sorting of observable skills across establishments do not explain the increase in wage dispersion between establishments.

Several industries with increased wage dispersion across plants also experienced increased productivity dispersion. Central Administrative Offices, which include headquarters, had the greatest increase in wage dispersion from 1992 to 2002, together with FIRE. However, central administrative offices employ too few workers to have a noticeable impact on overall wage dispersion. Business services and FIRE had increasing variations in sales per worker as well as in wages. The causal effects between sales per worker and earnings go both ways: different types of rent sharing models predict that higher sales per worker should add to earnings and at the same time, a higher earning level induces the firm to be more cautious in hiring labor and thus raises the bottom of the establishment distribution of productivity in an industry. Using an instrumental variable strategy, controlling for fixed establishment effects to estimate the extent of rent sharing, we obtain an average rent sharing parameter of between .13 to .19, depending on sample and specification. Even though this is a reasonably large sharing parameter, its size indicates that increased variance in productivity has a limited effect on the variance of wages since $\Delta V(\ln w) = b^2 \Delta V(\ln \text{prod})$. In our data, using an average rent sharing parameter of

about 0.16, growth in productivity dispersion across all establishments amounts to only between 4 to 8 percent of the change in wage dispersion from 1992 and 1977 to 2002 respectively.

All in all our results clearly point to a renewed focus on establishment wage policies and the role of inter establishment wage differences for labor market behavior and performance.

References

Abowd, John, John Haltiwanger, Julia Lane, Kevin L. McKinney, and Kristin Sandusky (2007), "Technology and the Demand for Skill: An analysis of within and between firm differences," NBER Working Paper 13043, April 2007.

Abowd, John M., Paul A. Lengermann, and Kevin L. McKinney (2003), "The Measurement of Human Capital in the U.S. Economy," U.S. Census Bureau, Technical Paper TP-2002-09, March 2003.

Andersson, Fredrik, Matthew Freedman, John C. Haltiwanger, Julia Lane, and Kathryn L. Shaw (2006), "Reaching for the Stars: Who Pays for Talent in Innovative Industries?" NBER Working Paper 12435, August 2006.

Andersson, Fredrik, Clair Brown, Benjamin Campbell, Hyowook Chiang, and Yooki Park (2008), "The Effects of HRM Practices and R&D Investment on Worker Productivity," in S. Bender, J. Lane, K.L. Shaw, F. Andersson, and T. von Wachter (eds.) *The Analysis of Firms and Employees: Quantitative and Qualitative Approaches*, University of Chicago Press.

Arai, Mahmood, (2003) "Wages, Profits and Capital Intensity: Evidence from Matched Worker-Firm Data", *Journal of Labor Economics*, vol 21, 2003.

Autor, David H., Lawrence F. Katz, and Melissa S. Kearney (2008), "Trends in U.S. Wage Inequality: Revising the Revisionists," *Review of Economics and Statistics*, 90(2), pages 300-323.

Baily, Martin Neil, Eric J. Bartelsman, John Haltiwanger (2001) "Labor Productivity: Structural Change and Cyclical Dynamics " *The Review of Economics and Statistics*, Vol. 83(3): pp. 420-433

Bender, Stefan, Julia Lane, Kathryn Shaw, Fredrik Andersson and Till von Wachter , eds. (2008) *The Analysis of Firms and Employees, Quantitative and Qualitative Approaches,* The University of Chicago Press.

Burkhauser, Richard V. Shuaizhang Feng, and Jeff Larrimore (2008), "Measuring Labor earnings inequality using public use march current population survery data: the value of including variances and cell means when imputing topcoded values. NBER working paper 14458.

Burkhauser, Richard V. Shuaizhang Feng, Stephen Jenkins, and Jeff Larrimore (2008), "Estimating trends in US income inequality using the current population survery data: the importance of controlling for censoring". NBER working paper 14247.

Card, David, Fransisco Devicienti, Agata Maida (2010), "Rent-sharing, holdup, and wages: Evidence from matched panel data". NBER working paper 16192.

Comin, Diego, Erica L. Groshen, Bess Rabin (2006) "Turbulent Firms, Trubulent Wages?" NBER Working paper #12032.

Davis, Steve J. and John Haltiwanger (1991), "Earnings dispersion between and within U.S. Manufacturing Plants, 1963-86," Brookings Papers on Economic Activity, Brookings Institution Press, vol.1991, pages 115-180.

Dobbelaaere, Sabien and Jacques Mairesse (2008) "Micro-evidence on rent sharing from different perspectives", working paper, CREST.

Dunne, Timothy, Lucia Foster, John Haltiwanger, and Kenneth R. Troske (2004) "Wage and Productivity Dispersion in U.S. Manufacturing: The role of computer investment." *Journal of Labor Economics*, University of Chicago Press, vol. 22(2), pages 397-430

Faggio, Giulia, Salvanes, Kjell and Van Reenen, John (2007) "The Evolution of Inequality in Productivity and Wages: Panel Data Evidence", NBER Working Paper #13351

Foster, Lucia, Haltiwanger, John and Krizan, C. J. (2002) "The Link Between Aggregate and Micro Productivity Growth: Evidence from Retail Trade", NBER Working Paper #9120

Freeman, Richard B., and Kleiner, Morris M. (2005) "The Last American Shoe Manufacturers. Decreasing Productivity and Increasing Profits in the Shift from Piece Rates to Continuous Flow Production", *Industrial Relations*, Vol. 44, No. 2, pp. 307-330

Goldin, Claudia and Lawrence Katz (2007) "Long Run Changes in the Wage Sturcutre: Narrowing, Widening, Polarizing" Brookings paper on economic activity 2:2007.

Grout (1984)

Haltiwanger, John C., Lane, Julia I., and Speltzer, James R. (2007) "Wages, Productivity, and the Dynamic Interaction of Businesses and Workers", *Labour Economics*, vol. 14(3), pages 575-602

Hellerstein, Judith K., David Neumark, and Kenneth R. Troske (1999), "Wages, Productivity, and Worker Characteristics: Evidence from Plant-Level Production Functions and Wage Equations," *Journal of Labor Economics*, 178(3):409-446.

Jarmin, Ron and Miranda, Javier (2002) The Longitudinal Business Database, 02-17, Center for Economic Studies, U.S. Census Bureau

Klette, Tore Jakob and Arvid Raknerud (2005) “Heterogeneity in firms”

Lane, Julia I., Laurie A. Salmon, and James R. Spletzer (2007), “Establishment wage differentials,” *Monthly Labor Review*, 130(4):3-17

Lazear, Edward and Kathryn Shaw, eds. (2009) *The Structure of Wages: An International Comparison*, The University of Chicago Press,

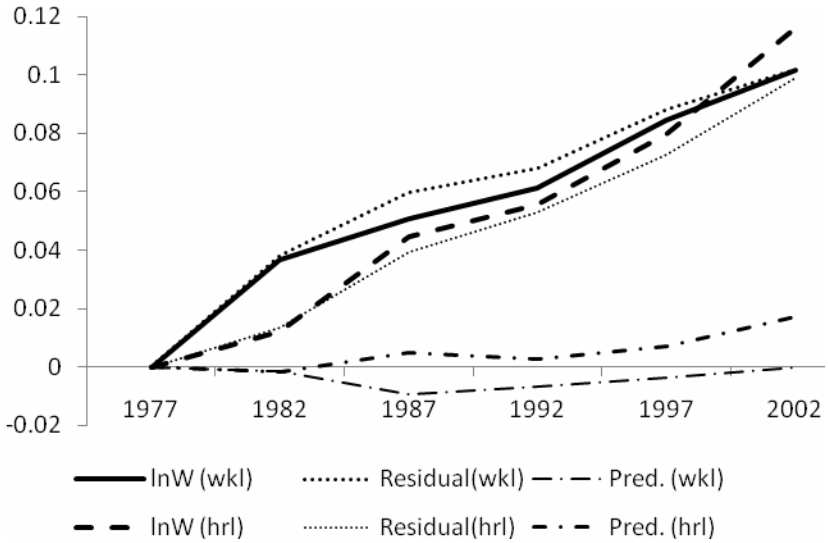
Lemieux, Thomas (2006) “Increasing Residual Wage Inequality: Composition Effects, Noisy Data, or Rising Demand for Skill?” American Economic Review vol 96(3):461-498

Margolis, David N. & Salvanes, Kjell G., 2001. "Do Firms Really Share Rents with Their Workers?," IZA Discussion Papers 330, Institute for the Study of Labor (IZA

Martins, Pedro (2009) "Rent sharing before and after the wage bill," Applied Economics, vol. 41(17), pages 2133-2151

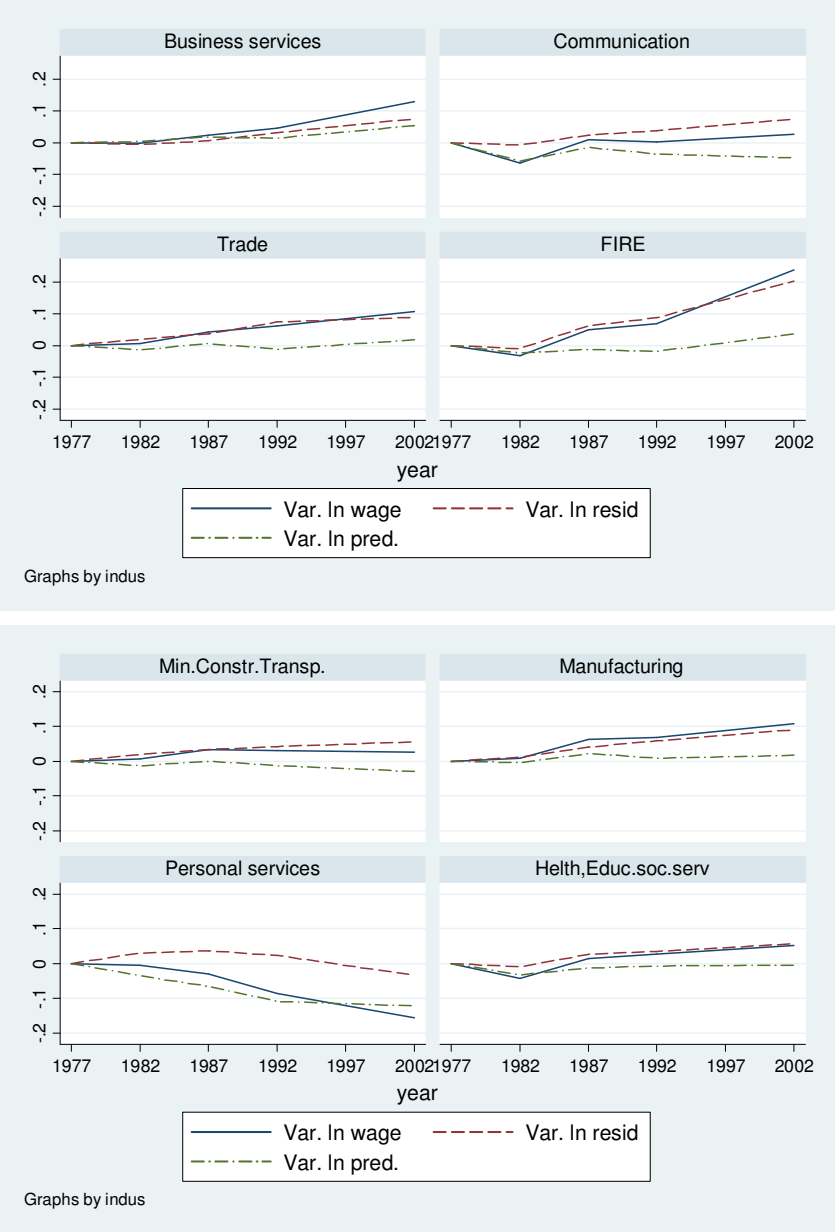
Moene, Karl Ove and Michael Wallerstein (1997) “Pay Inequality” *Journal of Labor Economics,* Vol 15(3):403-30.

Figure 1: Variances of Log Weekly and Log Hourly Earnings,
Difference from 1977-level



Note: The lines show the difference in the variance of the different measures from their variance in 1977. Log earnings is decomposed each year into a human capital component, consisting of Xβ from a simple human capital specification including age, age squared and five educational categories, all interacted by gender, and the residual from the same equation.

Figure 2: Variance of log earnings within sector. CPS data



Note: The variance of log weekly earnings is decomposed each year into a human capital component, consisting of Xβ from a simple human capital specification including age, age squared and five educational categories, all interacted by gender, and the variance of the residual from the same equation

Figure 3: Share of total variance in log yearly earnings, by industry, LBD

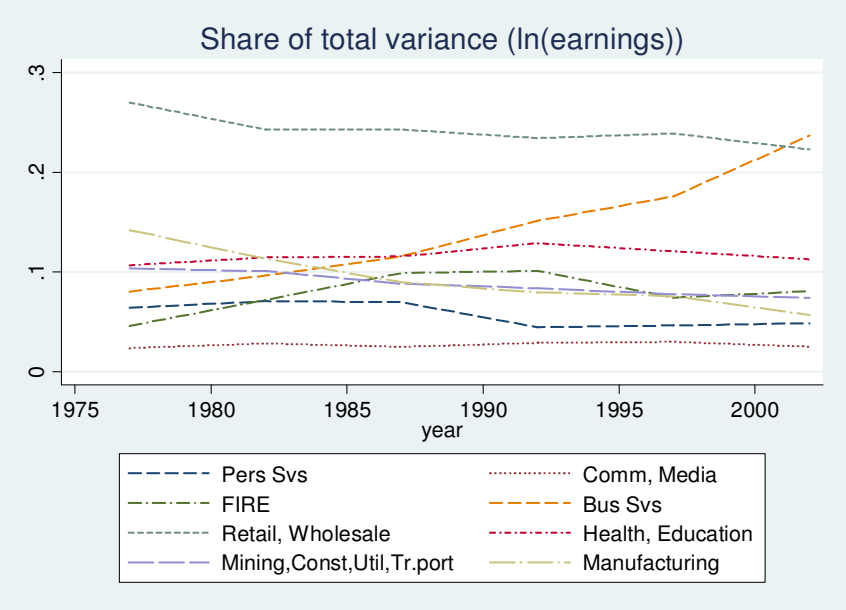
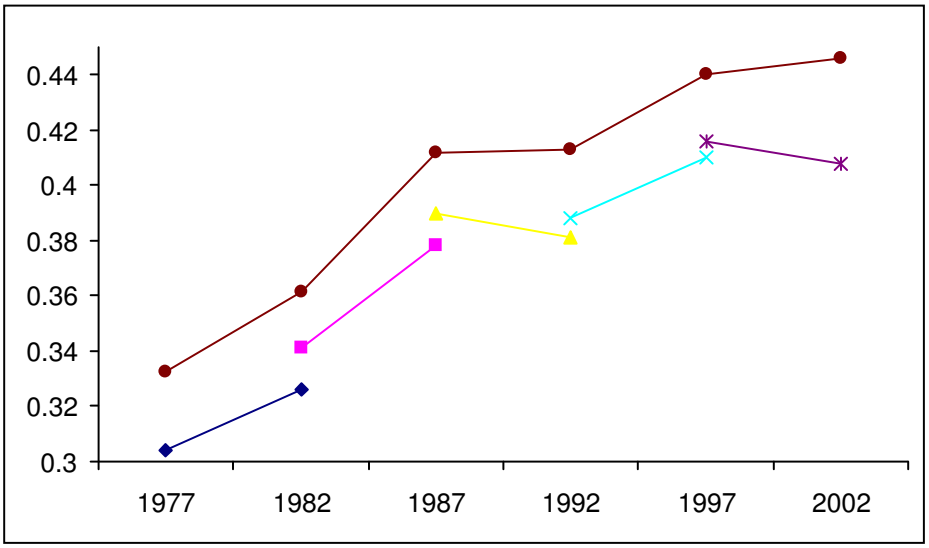


Figure 4: Variance log earnings, stayers and all, LBD



Note: The upper line shows the variance of log wages between all establishments each year. The broken line gives the variance of log wages for establishments that are observed in both years.

Table 1. Earnings Dispersion 1977-2002

	1977	1982	1987	1992	1997	2002	92-02	77-02
*Individual earnings CPS**								
Variance (lnw)	0.515	0.552	0.565	0.576	0.599	0.617	0.041	0.102
Establ. Avg. Earnings, LBD								
Variance (lnw)	0.332	0.362	0.412	0.413	0.443	0.446	0.033	0.114
Corrected LBD comparison								
Using LEHD data:								
Covariance (μ_f, σ_f)				0.014	0.019	0.019	0.005	
Variance (σ_f)				0.045	0.043	0.042	-0.003	
1/4*V (σ_f)+Cov (μ_f, σ_f)				0.026	0.029	0.030	0.004	
Variance (lnw) corrected				0.387	0.414	0.416	0.029	
Implied share between establishments				*0.671*	*0.691*	*0.674*	*0.707*	

Note: CPS earnings are weekly earnings for wage earners 16-64 of age calculated on the internal Census March, CPS files. LBD earnings are average wages per worker (annual earnings divided by March 12th employment). LEHD earnings is based on annual earnings for full year employees from the 9 LEHD(92) states, from quarterly earnings from the UI files and within establishment dispersion and means are calculated within sein-unit per statexyear using EH files and then aggregated, matched and disaggregated to the appropriate lbd-units in the LBD files, se data section for details. Establishment figures are employment weighted. See data section for details.

Table 2. Decomposition using the LEHD data. 1992-2002
Variance of log wages.

	1992	1997	2002	92-02
Full year /LBD plant				
Variance total	0.511	0.529	0.546	0.035
Variance within	0.294	0.298	0.300	0.007
Variance between	0.217	0.232	0.245	0.029
Share between	0.424	0.437	0.449	0.814
2nd Quarter /LBD plant				
Variance total	0.591	0.605	0.623	0.032
Variance within	0.368	0.373	0.377	0.009
Variance between	0.223	0.232	0.246	0.023
Share between	0.377	0.383	0.395	0.732
Full year /LEHD unit				
Variance total	0.461	0.481	0.509	0.048
Variance within	0.260	0.269	0.273	0.013
Variance between	0.201	0.212	0.237	0.036
Share between	0.436	0.441	0.465	0.740

Note: Wage measure is quarterly wage for individuals who are employed all four quarters of the year (Full year), or all individuals employed in second quarter (2^{nd} Quarter) obtained from the Economic History (EH) files of the LEHD program (see data section for details). The establishment unit is the LBD-unit (LBD plant), and Sein unit (LEHD unit). Within establishment dispersion and means are calculated within sein-unit per statexyear using the EH files, these figures are then aggregated, matched and disaggregated to the appropriate lbd-units in the LBD files, see data section for details. Establishment specific measures are employment weighted. The 9 LEHD states are listed in the appendix.

Table 3. Variance of log wages among establishments

							Difference	
	1977	1982	1987	1992	1997	2002	92-02	77-02
V(ln W)	0.362	0.371	0.419	0.436	0.453	0.474	0.038	0.112
V(Regional dummies)	0.023	0.016	0.024	0.022	0.024	0.021	0.000	-0.002
V(Industry dummies)	0.198	0.187	0.223	0.237	0.235	0.229	-0.008	0.031
Vr(residual)	0.143	0.170	0.173	0.177	0.190	0.217	0.040	0.075

Note: Based on yearly regressions on a sample of LBD data including industry (sic3 and Naics4) and regional (PMSA and BEA Areas for rural counties). All figures are employment weighted.

Table 4: Earnings Inequality Among Entrants, Exiters and Stayers, LBD

	1977	1982	1987	1992	1997	2002	1977-2002
Stayers (p)							
Var ln(estab av wage)		0.326	0.378	0.381	0.410	0.408	0.082
Employment share		0.757	0.723	0.759	0.774	0.753	-0.004
Stayers (f)							
Var ln(estab av wage)	0.304	0.341	0.390	0.388	0.416		0.112
Employment share	0.801	0.773	0.791	0.806	0.784		-0.017
Entrants							
Var ln(estab av wage)		0.431	0.472	0.477	0.509	0.551	0.120
Employment share		0.243	0.277	0.241	0.229	0.248	0.005
Exiters							
Var ln(estab av wage)	0.392	0.415	0.461	0.485	0.521		0.129
Employment share	0.201	0.227	0.209	0.194	0.220		0.019
Decomposition							
Total change (from table 1)		0.029	0.050	0.001	0.027	0.006	0.113
Stayers		0.020	0.030	-0.005	0.019	-0.006	0.057
Entry and exit		0.006	0.015	0.003	0.005	0.007	0.035
Employment reallocation		0.004	0.006	0.003	0.004	0.004	0.021

Note: The contribution of stayers and entry and exit are calculated using initial employment shares as weights, the employment reallocation term is calculated as the remaining difference.

Table 5. Segregation, sorting and wage inequality

		A Firm			B Firm			C Firm		
		Low pay	High pay	All W	Low pay	High pay	All W	Low pay	High pay	All W
Worker	Low skill	50	50	105	75	25	102.5	25	75	107.5
	High skill	50	50	115	25	75	117.5	75	25	112.5
	All W	105	115	110	102.5	117.5	110	107.5	112.5	110
	S	5	5		2.5	7.5		7.5	2.5	
V(u)				25			25			25
V(s)				25			25			25
V(Φ)				25			25			25
P				0			0.5			0.5
ρ_Φ				0			0.5			-0.5
Vw=V(u)+V(s)(1-ρ)				50			37.5			37.5
Vw=v(Φ)+V(s)(ρ+ρ_Φ)				25			50			25
V(w)=Vw+Vb				75			87.5			62.5

Table 6. Human Capital Segregation and Sorting, LEHD data**.**

	1992	1997	2002	92-02
b^{ols}				
Full year employees	0.229	0.206	0.174	
All employees	0.201	0.184	0.147	
CPS same year sample	0.195	0.184		
c^{ols}				
Full year employees	0.209	0.190	0.153	
All employees	0.204	0.186	0.145	
CPS same year sample	0.202	0.209		
V(s)				
Full year employees	0.069	0.063	0.055	-0.014
All employees	0.073	0.067	0.056	-0.017
CPS same year sample	0.071	0.065		
Worker-worker sorting index, ρ				
Full year employees	0.165	0.122	0.117	-0.048
All employees	0.240	0.204	0.206	-0.034
CPS same year sample	0.256	0.178		
Worker-estab. sorting index. ρ_{φ}				
Full year employees	0.412	0.451	0.499	0.087
All employees	0.323	0.368	0.402	0.079
CPS same year sample	0.310	0.492		
Worker-worker rel. contribution				
Full year employees	0.026	0.017	0.013	-0.013
All employees	0.037	0.028	0.022	-0.015
CPS same year sample	0.039	0.023		
Worker-estab. rel. contribution				
Full year employees	0.064	0.062	0.055	-0.009
All employees	0.049	0.050	0.042	-0.007
CPS same year sample	0.047	0.064		

Note: Estimated on a matched sample of LEHD workers, where education (and age, race and gender) are matched in from CPS, and wages and average establishment wages (across all workers of the plant) are taken from the Economic History files. CPS same year sample consists of observations from the CPS observation years only.

Table 7. Labor Productivity and Wage Dispersion 1977-2002

	1977	1982	1987	1992	1997	2002	92-02	77-02(1)
Var ln sales per worker								
All sectors	0.954	0.965	0.949	1.020	1.113	1.126	0.106	0.172
Mng. Util. Transp.			0.670	0.822	0.860	0.827	0.006	0.157
Manufacturing	0.593	0.633	0.638	0.656	0.686	0.646	-0.011	0.053
Trade	1.135	1.129	1.115	1.165	1.228	1.207	0.042	0.072
FIRE				1.075	1.244	1.190	0.115	0.115
Personal services	0.444	0.426	0.471	0.459	0.531	0.565	0.106	0.120
Business Services	0.878	0.852	0.914	0.923	1.083	1.089	0.166	0.211
Communication			0.522	0.748	0.718	0.736	-0.012	0.214
Healt, Educ. Soc.	0.316	0.559	0.390	0.402	0.448	0.567	0.165	0.251
Var. ln wage								
All sectors	0.332	0.362	0.412	0.413	0.443	0.446	0.033	0.113
Mng. Util. Transp.	0.302	0.317	0.328	0.327	0.323	0.313	-0.014	0.011
Manufacturing	0.187	0.204	0.220	0.218	0.234	0.226	0.008	0.039
Trade	0.340	0.353	0.388	0.390	0.415	0.413	0.024	0.073
FIRE	0.202	0.303	0.433	0.447	0.467	0.516	0.069	0.314
Personal services	0.364	0.386	0.408	0.296	0.321	0.338	0.042	-0.026
Business Services	0.478	0.506	0.551	0.547	0.581	0.582	0.035	0.104
Communication	0.214	0.269	0.299	0.355	0.383	0.474	0.119	0.260
Healt, Educ. Soc.	0.247	0.229	0.262	0.249	0.249	0.236	-0.013	-0.011
Centr. Admin. Office	0.228	0.283	0.305	0.281	0.399	0.431	0.150	0.203

Note: ln Sales per workers is taken from the Economic Census. ln Wage is taken from the Longitudinal Business Data base. Note that figures for all sectors from the Economic Census are based on the sectors available in the table every census year. The economic census expanded in scope over the 1977-2002 period, however the business register and LBD covered all industries throughout. As a check, we calculated the variance of sales per worker restricted to those industries where in each year total industry employment in the economic census is greater or equal 90% of total industry employment in the LBD. The variance trend is very similar, where for 1977 the variance is 0.945, for 1982 0.965, 1987 0.991, 1992 1.036, and 1997 1.111. (1) The difference is calculated from the first available year in the table.

Table 8 Rent sharing regressions, sales per worker
Dependent variable: ln(Average establishment wage)

	OLS	Fixed effect	Fixed eff. IV1	Fixed eff. IV2
Sample	Two pct	Two pct	Two pct	R&D survey
ln(Sales/empl)	0.356	0.299	0.147	0.118
	(0.001)	(0.001)	(0.007)	(0.006)
Alt. Wage	0.462	0.088	0.102	0.155
(sectorxregion)	(0.003)	(0.004)	(0.004)	(0.006)
Worker char.	0.939	0.029	0.079	0.682
(Industry 3dgt)	(0.005)	(0.010)	(0.010)	(0.013)
S&E				0.079
(share of empl)				(0.011)
Sector dummies	Y			
Est.dummies		Y	Y	Y
C-D f-value			1.10E+04	5039.531
Sargan p				0.0613
N	1104037	1003782	966907	552000

Note: Years of observation: 1977-2002. All models also include dummies for establishment age and year of observation. Alternative wage is defined as average wage outside of own establishment in the same sector and region. In the IV1 specification, ln(S/L) is instrumented by sales per worker in the same 3 digit industry averaged over all regions of the US outside of own region. In IV2, firm level r&d investment/sales is included as well.

Table 9 Rent sharing regressions, value added per worker. Manufacturing.
Dependent variable: ln(Average establishment wage)

	OLS	FE	FE IV1	FE IV1	FE IV1	FE IV1
ln(VA/emp)	0.231	0.123	0.186	0.186	0.184	0.134
	(0.003)	(0.004)	(0.061)	(0.061)	(0.062)	(0.002)
ln(Materials/emp)	0.194	0.214	0.045	0.045	0.045	0.034
	(0.002)	(0.003)	(0.022)	(0.022)	(0.022)	(0.005)
Alt. Wage	0.461	0.081	0.097	0.048	0.097	0.048
(sectorxregion)	(0.013)	(0.022)	(0.025)	(0.004)	(0.025)	(0.004)
Worker char.	0.752	0.161	0.207	0.138	0.206	0.138
(Industry 3dgt)	(0.022)	(0.043)	(0.047)	(0.011)	(0.047)	(0.011)
S&E					0.085	
(share of empl)					(0.086)	
R&D survey					0.009	
					(0.010)	
Est. dummies		Y	Y	Y	Y	Y
sarganp					36.2	2669.1
cdf					0.656	0.125
N	60965	43908	43680	43680	43663	964639

Note: Years of observation: 1977-2002. All models also include dummies for establishment age and year of observation. Alternative wage is defined as average wage outside of own establishment in the same sector and region. In the IV specifications, ln(S/L) is instrumented by sales per worker in the same 3 digit industry averaged over all regions of the US outside of own region

Table 10 Rent sharing regressions, value added per worker. Services.
Dependent variable: ln(Average establishment wage)

	OLS	OLS2	FE	FE IV	FE IV2
Sample	BES	BES	BES	BES	BES
Ln(Value added/L)	0.359	0.297	0.177	0.183	0.194
	(0.002)	(0.002)	(0.003)	(0.028)	(0.027)
Ln(Materials/L)		0.102	0.131	0.040	0.042
		(0.001)	(0.002)	(0.005)	(0.005)
Alternative wage	0.314	0.299	-0.268	0.009	0.003
(regionxsector)	(0.007)	(0.008)	(0.029)	(0.035)	(0.034)
Skills (industry sic3)	1.534	1.100	0.524	0.823	0.829
	(0.012)	(0.012)	(0.043)	(0.045)	(0.045)
S&E R&D empl					0.014
					(0.052)
R&D survey					-0.008
					(0.005)
Sargan p					0.105
C-D F-value				154.0	108.3
N	129326	121383	69941	69487	69487

Note: Years of observation: 1992-2002. All models also include dummies for establishment age and year of observation. Alternative wage is defined as average wage outside of own establishment in the same sector and region. In the IV specifications, ln(S/L) is instrumented by both sales and materials per worker in the same 3 digit industry averaged over all regions of the US outside of own region

Appendix

CPS March Data

We use the public use March Current Population Survey from survey years 1976, 78, 83, 88, 93, 98, 03,06 to get observations of jobs from 1975, 77, 82, 87, 92, 97, 02, and 05. All samples include workers of age 20-64 with positive hours per week last year, and whose class of work in their longest job last year was private or government wage/salary employment. Agricultural employment, Public Administration and Armed Forces are excluded. Weekly earnings are calculated as annual earnings divided by the weeks worked in the prior year. Gross earnings include wages, salaries, overtime, tips and commissions. Allocated earnings observations are excluded using the earnings allocation flags. Top-coded values before 1996 are multiplied by 1.5. Final weights are used in all calculations. Observations with a real wage below half the minimum wage level in 1982 were excluded. In order to remove outliers, a simple OLS log hourly wage regression was run including age, age square and five educational groups, all interacted with gender; after which observations with residuals outside of 5 times the standard deviation of the residual was removed.

Education:

High school drop outs are defined as those with less than a high school degree. High school graduates as those with a high school degree only. College low level is defined as those with a college education below baccalaureate degree. College degree is defined as those with a baccalaureate degree, and graduate degree as those with a masters or phd degree.

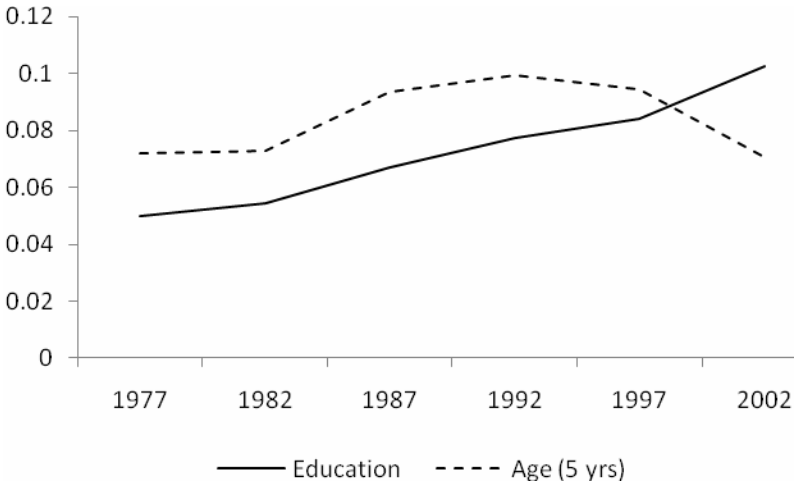
Industry

Codes for Major Industry Groups from 2003 onwards form the basis for the industry classification (recodes in parenthesis): Mining, Construction and Transportation (2,3,6), Manufacturing (4), Trade (5 (incl. Eating and Drinking Places 8680-8690)) , Information (7), FIRE (8), Business services (9,11(excl. 8680-8690), 12(excl.8880-9090)), Education, Healt and Social Services (10), Pers. services (12(8880-9090). Previous years of coding is adapted to these definitions, in particular Newspapers, Data processing, Telecommunication and Libraries are included in the Information sector.

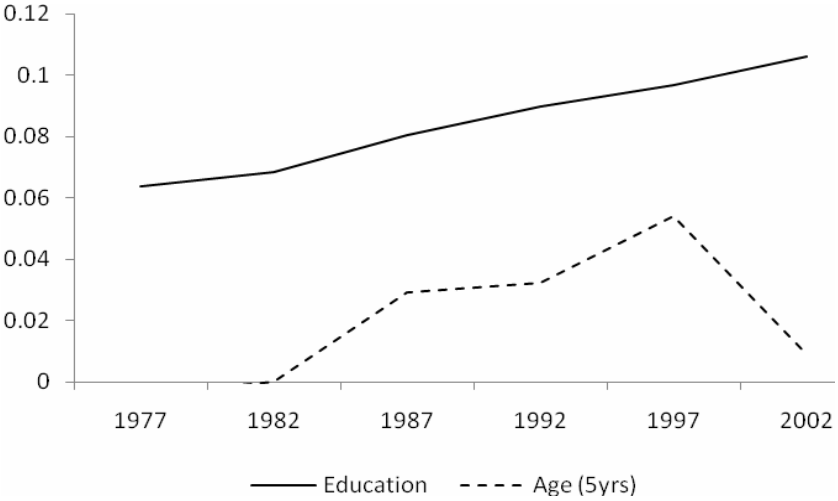
Human capital component of individual earnings

The human capital component of individual earnings is made up by the predicted wage from a model including age, age squared, high school drop out, college lower levels, college graduates, college plus, all interacted with gender. Figures A1a and A1b show the development of the coefficients in the model for men and women respectively. In line with what is reported in the literature (see eg. Goldin and Katz 2008) we find increasing wage premiums for college graduates. Furthermore, the age premium for women has been increasing, probably as a result of both closer association between actual work experience and age over time as female labor force participation has been increasing, and of increasing educational levels in particular for women.

Human capital coefficients 1975-2005, Men



Human capital coefficients 1975-2002, women



Note: The figures shows the average return to one year of education and five years of age (from 35 to 40 years of age) for men and women, from the regression coefficients of a simple log wage regression including grade, age, age squared, and race, all interacted with gender.

Census Bureau's Longitudinal Business Database (LBD)

The establishment level data are from the U.S. Census Bureau's Longitudinal Business Database (LBD) covering the period 1977 – 2002 at five year intervals. The data include all private employers for all sectors except agriculture. The data are sourced from the Census Bureau's business register which is continually updated using administrative records, Economic Census returns, and surveys such as the Company Organization Survey. The file collects establishment payroll and employment data, used to calculate the average establishment wage per worker for observations with positive employment and payroll.

Survey respondents are asked to follow the definition of salaries and wages used for calculating the federal withholding tax. They report the gross earnings paid in the calendar year to employees at the establishment prior to such deductions as employees' social security contributions, withholding taxes, group insurance premiums, union dues, and savings bonds. Included in gross earnings are all forms of compensation such as salaries, wages, commissions, dismissal pay, paid bonuses, vacation and sick leave pay, and the cash equivalent of compensation paid in kind. Salaries of officers of the establishment, if a corporation, are included. Payments to proprietors or partners, if an unincorporated concern, are excluded. Salaries and wages do not include supplementary labor costs such as employer's Social Security contributions and other legally required expenditures or payments for voluntary programs. The definition of payrolls is identical to that recommended to all Federal statistical agencies by the Office of Management and Budget.

Wages are converted to constant 2002 dollars using the Consumer Price Index. Establishments are excluded that have an average wage less than half the yearly equivalent of the 1982 minimum wage of $3.35 an hour (CPI deflated) for a 40 hour week. Establishments with over 100,000 employees are also excluded, as from observation these are generally firm level or miscoded records, and we are not aware of a U.S. establishment that large. One issue with our wage measure is that payroll is reported annually, and employment is reported for the week of March 12. The establishment wage can be affected by significant changes in establishment employment within the year.

The LBD follows establishments over time, where considerable effort was invested by Census to recover longitudinal identifiers through linking records and matching names and addresses (Jarmin and Miranda 2002). We use these identifiers to define establishment births, deaths and continuers. A birth is an establishment that is observed in the data that did not exist five years earlier. Similarly, a death is an observation that does not survive the five years until the next economic census year. Establishments are either single-unit (SU) establishments, where the (generally smaller) firm produces in one location, or multi-unit (MU) establishments that are part of a company that operates at multiple locations.

We further classify establishments by eight broad sectors listed in the table below.

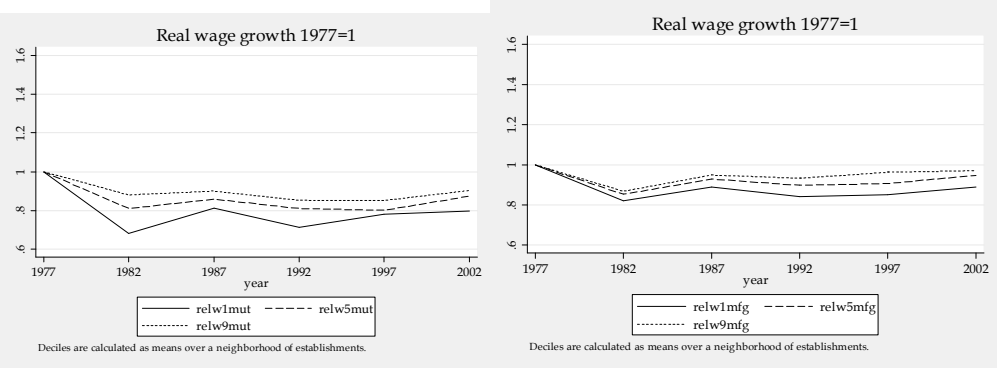
Sector	SIC[16] Industries Included	NAICS Industries Included[17]
Mining, construction, utilities and transport	1, 4, excluding 48	21, 22, 23, 48, 49, 562, 532411, 56151, 56152, 62191, 71393
Manufacturing	2, 3, excluding 27	31, 32, 33
Business services	73, 81, 86, 87, auxiliaries	54, 55, 56, 334611, 5112, 51411, 51419, 51421, 532291, 532299, 5323, 5324, 81292, 8131, 8134, 8139, 92115, excluding 56173
Communications and media	27, 48, 78	51, 53223
Retail and wholesale	5	42, 44, 45, 72, 311811
Finance, insurance and real estate	6	52, 53, 2331, 541191, 551111, 551112, 813211
Personal services	70, 72, 75, 76, 79, 84, 88, 89	532, 71, 721, 81, 326212, 51221, 51229, 541213, 54162, 541921, 561622, 56174, 562991, 611511, 61162, excluding 81291
Health, education and social services	80, 82, 83	61, 62, 339116, 51412, 8132, 8133, 92215

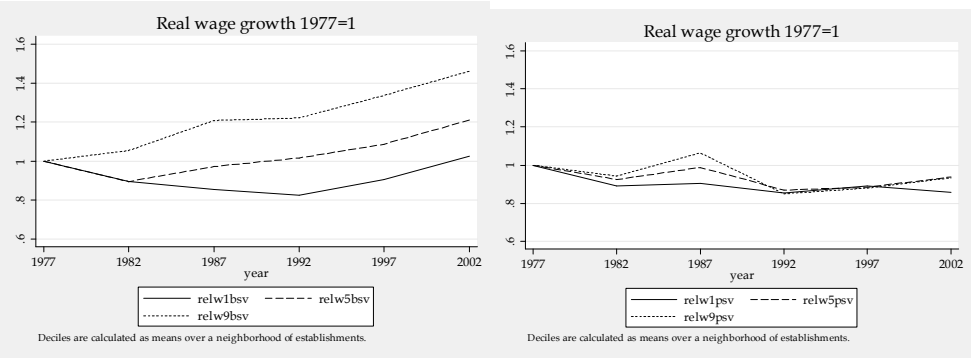
U.S. national average earnings, log earnings, and variance are calculated over establishments by category of sector, SU, MU, births, deaths, continuers from 5 years ago, and continuers to 5 years ahead. We calculate both unweighted averages, and employment weighted averages, where unweighted averaged measures treat the establishment as the economic entity, and weighted averaged measures treat the employee as the economic observation. We primarily focus on weighted average earnings throughout the paper. Exact median and decile statistics are based on one or two establishments which are too few to meet Census Bureau disclosure avoidance procedures. The 10%, median and 90% deciles are calculated by taking a neighborhood of establishments 1% on either side of the decile and using the mean of this sample as a pseudo-decile.

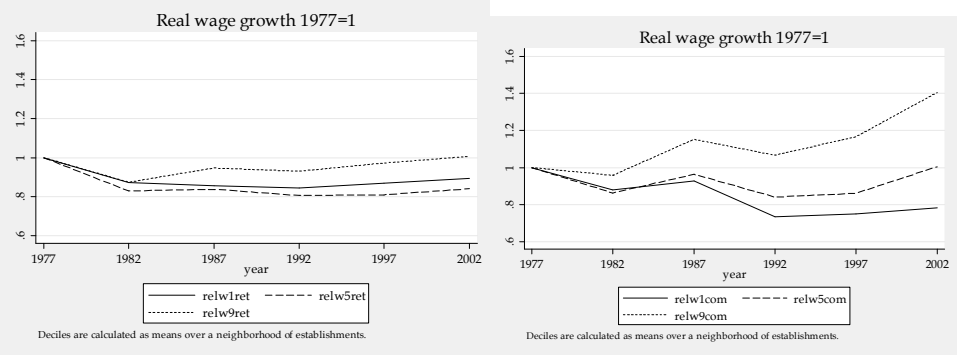
[16] 1977 SIC classifications for establishments in 1977-1987 years of the LBD are converted to 1987 SIC definitions.

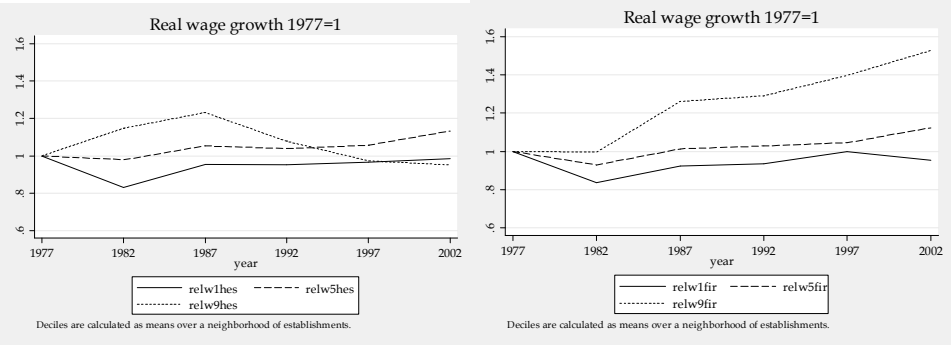
[17] Any 4-, 5- and 6-digit NAICS industries listed for a sector is excluded from the 2-digit industry included in a different sector. Those 5-digit NAICS industries that are part of agriculture in the SIC system are listed as excluded in the table.

Figure A1. Real wage growth for d1, d5 and d9. 1977-2002 by industry.









Appendix Table A: Weekly earnings inequality measures by major industry. Employment weighted. [numbers to be revised]

							Difference	
	1977	1982	1987	1992	1997	2002	92-02	77-02
Mining, Utilities, Construction								
Individual earnings (CPS)								
Variance ln(earnings)	0.348	0.400	0.391	0.383	0.425	0.402	0.019	0.055
Log(w90/w50)	0.571	0.588	0.633	0.609	0.693	0.719	0.110	0.148
Log(w50/w10)	0.854	0.913	0.853	0.869	0.836	0.828	0.04	0.03
Establishment earnings (LBD)								
Variance ln(avg.est.wage)	0.353	0.387	0.394	0.402	0.370	0.362	0.04	0.009
CV avg.est.wage	0.559	0.677	0.598	0.598	0.629	0.657	0.059	0.099
Log(w90/w50)	0.742	0.825	0.790	0.793	0.803	0.775	0.02	0.033
Log(w50/w10)	0.967	1.134	1.022	1.095	0.992	1.058	0.04	0.092
Individual earnings (LEHD)								
Variance within est.				0.283	0.289	0.284	0.001	
Variance betw est				0.180	0.183	0.183	0.003	
Variance ln(wage)				0.463	0.472	0.467	0.004	
Employment share	0.114	0.112	0.108	0.100	0.103	0.104	0.004	0.01
Manufacturing								
Individual earnings (CPS)								
Variance ln(earnings)	0.317	0.343	0.386	0.386	0.412	0.442	0.056	0.125
Log(w90/w50)	0.624	0.647	0.716	0.733	0.773	0.827	0.094	0.203
Log(w50/w10)	0.791	0.828	0.840	0.819	0.836	0.836	0.017	0.045
Establishment earnings (LBD)								
Variance ln(avg.est.wage)	0.209	0.225	0.239	0.238	0.253	0.243	0.005	0.034
CV avg.est.wage	0.485	0.461	0.466	0.466	0.513	0.519	0.053	0.035
Log(w90/w50)	0.604	0.622	0.625	0.641	0.663	0.629	0.01	0.025
Log(w50/w10)	0.882	0.921	0.928	0.946	0.947	0.946	0.000	0.064
Individual earnings (LEHD)								
Variance within est.				0.232	0.250	0.241	0.010	
Variance betw est				0.186	0.187	0.180	0.01	
Variance ln(wage)				0.417	0.438	0.421	0.003	
Employment share	0.264	0.215	0.180	0.160	0.147	0.119	0.04	0.14
Communication								
Individual earnings (CPS)								
Variance ln(earnings)	0.419	0.468	0.440	0.501	0.532	0.612	0.111	0.194
Log(w90/w50)	0.651	0.685	0.606	0.693	0.799	0.877	0.184	0.226
Log(w50/w10)	0.876	0.893	0.934	0.949	0.960	1.020	0.071	0.145
Establishment earnings (LBD)								
Variance ln(avg.est.wage)	0.249	0.310	0.344	0.407	0.457	0.538	0.131	0.290
CV avg.est.wage	0.532	0.500	0.631	0.667	0.761	0.853	0.186	0.321
Log(w90/w50)	0.616	0.721	0.794	0.853	0.919	0.951	0.098	0.335
Log(w50/w10)	1.057	1.037	1.095	1.193	1.196	1.305	0.112	0.248
Individual earnings (LEHD)								
Variance within est.				0.408	0.368	0.342	0.07	

Variance betw est				0.198	0.229	0.285	0.088	
Variance ln(wage)				0.606	0.597	0.628	0.022	
Employment share	0.037	0.039	0.035	0.034	0.032	0.024	0.01	0.01
Retail and Wholes. Trade								
Individual earnings (CPS)								
Variance ln(earnings)	0.535	0.548	0.570	0.566	0.570	0.592	0.026	0.057
Log(w90/w50)	0.856	0.906	0.958	0.948	0.947	0.959	0.011	0.103
Log(w50/w10)	0.956	0.956	0.956	0.949	0.930	0.938	0.01	0.02
Establishment earnings (LBD)								
Variance ln(avg.est.wage)	0.413	0.426	0.457	0.455	0.471	0.477	0.022	0.064
CV avg.est.wage	0.700	0.808	0.819	0.895	0.930	0.933	0.038	0.233
Log(w90/w50)	0.835	0.888	0.957	0.978	1.018	1.015	0.037	0.180
Log(w50/w10)	0.900	0.849	0.879	0.853	0.829	0.840	0.01	0.06
Individual earnings (LEHD)								
Variance within est.				0.352	0.359	0.355	0.003	
Variance betw est				0.235	0.245	0.249	0.013	
Variance ln(wage)				0.588	0.604	0.604	0.016	
Employment share	0.254	0.244	0.256	0.248	0.249	0.239	0.01	0.02
Finance, Ins. & Real estate								
Individual earnings (CPS)								
Variance ln(earnings)	0.419	0.440	0.497	0.523	0.606	0.633	0.110	0.214
Log(w90/w50)	0.914	0.893	0.968	0.920	0.985	1.022	0.102	0.107
Log(w50/w10)	0.621	0.693	0.747	0.801	0.767	0.875	0.074	0.254
Establishment earnings (LBD)								
Variance ln(avg.est.wage)	0.247	0.376	0.523	0.566	0.514	0.575	0.009	0.328
CV avg.est.wage	0.593	0.696	0.958	1.013	1.152	1.213	0.200	0.619
Log(w90/w50)	0.724	0.794	0.943	0.951	1.014	1.031	0.080	0.307
Log(w50/w10)	0.982	1.086	1.075	1.077	1.027	1.145	0.068	0.163
Individual earnings (LEHD)								
Variance within est.				0.420	0.452	0.445	0.025	
Variance betw est				0.182	0.234	0.250	0.067	
Variance ln(wage)				0.602	0.686	0.694	0.092	
Employment share	0.072	0.082	0.091	0.086	0.071	0.072	0.01	0.000
Business Services								
Individual earnings (CPS)								
Variance ln(earnings)	0.552	0.645	0.725	0.670	0.721	0.761	0.091	0.209
Log(w90/w50)	0.921	0.961	0.973	0.967	0.996	1.079	0.112	0.158
Log(w50/w10)	0.956	0.981	1.132	1.034	1.019	1.079	0.045	0.123
Establishment earnings (LBD)								
Variance ln(avg.est.wage)	0.567	0.622	0.676	0.663	0.659	0.705	0.042	0.138
CV avg.est.wage	0.918	0.878	1.004	0.909	0.982	0.990	0.081	0.072
Log(w90/w50)	0.910	1.074	1.127	1.094	1.117	1.098	0.004	0.188
Log(w50/w10)	1.027	1.026	1.157	1.235	1.210	1.193	0.04	0.166
Individual earnings (LEHD)								

Variance within est.				0.352	0.367	0.362	0.009	
Variance betw est				0.339	0.391	0.399	0.060	
Variance ln(wage)				0.691	0.758	0.760	0.070	
Employment share	0.055	0.066	0.082	0.110	0.131	0.171	0.061	0.117
Health, Education, Social w.								
Individual earnings (CPS)								
Variance ln(earnings)	0.538	0.572	0.581	0.602	0.621	0.615	0.013	0.077
Log(w90/w50)	0.733	0.738	0.789	0.807	0.806	0.818	0.011	0.085
Log(w50/w10)	1.019	1.046	1.025	1.099	1.040	1.019	0.08	0
Establishment earnings (LBD)								
Variance ln(avg.est.wage)	0.274	0.274	0.305	0.296	0.280	0.268	0.03	0.01
CV avg.est.wage	0.645	1.033	0.946	0.839	0.768	0.721	0.12	0.076
Log(w90/w50)	1.219	1.378	1.375	1.256	1.137	1.044	0.21	0.18
Log(w50/w10)	0.837	1.001	0.935	0.922	0.927	0.977	0.055	0.141
Individual earnings (LEHD)								
Variance within est.				0.419	0.404	0.398	0.02	
Variance betw est				0.149	0.157	0.150	0.001	
Variance ln(wage)				0.568	0.561	0.548	0.02	
Employment share	0.151	0.179	0.183	0.209	0.211	0.214	0.005	0.064
Personal Services								
Individual earnings (CPS)								
Variance ln(earnings)	0.703	0.642	0.629	0.608	0.555	0.455	0.15	0.25
Log(w90/w50)	0.921	0.961	0.973	0.967	0.996	1.079	0.112	0.158
Log(w50/w10)	0.956	0.981	1.132	1.034	1.019	1.079	0.045	0.123
Establishment earnings (LBD)								
Variance ln(avg.est.wage)	0.449	0.484	0.505	0.396	0.410	0.432	0.036	0.02
CV avg.est.wage	0.821	0.828	0.896	1.134	1.237	1.343	0.209	0.522
Log(w90/w50)	0.874	0.894	0.949	0.851	0.870	0.869	0.018	0.01
Log(w50/w10)	0.901	0.938	0.989	0.919	0.892	0.989	0.070	0.089
Individual earnings (LEHD)								
Variance within est.				0.349	0.355	0.365	0.016	
Variance betw est				0.213	0.211	0.243	0.030	
Variance ln(wage)				0.562	0.566	0.607	0.045	

Employment share	0.055	0.062	0.066	0.054	0.055	0.057	0.003	0.002