# WAGE STRUCTURE AND LABOR MOBILITY IN THE UNITED STATES

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## Introduction

The new availability of linked employer-employee data in the United States has led to an explosion of interest in research about the outcomes of the labor market interactions of firms and workers. The long history of the examination of worker-based data has revealed the fundamental heterogeneity of worker outcomes, even with rich information on worker characteristics. Similar, but more recent, examination of firm-based data has revealed startling heterogeneity of firm outcomes, despite similarly rich information on industry and firm structure. One of the most interesting, although perhaps not surprising, results from the very recent access to linked employer-employee data has been that researchers can explain much more when they have information on both sides of the labor market, rather than one or the other.

In this chapter we exploit the access to examine the sources of variation in two core outcomes of interest to economists – the earnings distribution and mobility patterns. We particularly focus on the contribution of within and between employer variation in these outcomes. In what follows we provide a brief literature review and institutional background. We also briefly describe the new database infrastructure, as well as present some basic statistics about the structure of wages within and between firms as well as job mobility patterns.

## Review of the Literature

The increased earnings inequality in the U.S. that was so evident in the 1980s and early 1990s has not been so apparent in the mid to late 1990s (Card and DiNardo 2002). Although the consensus in the literature is that skill biased technical change was the primary driver behind the increased inequality (see, e.g. Acemoglou 2002), Card and DiNardo cast doubt on this since the mid to late 1990s has been characterized by enormous technological advances without commensurate increases in inequality

Rising wage inequality in the 1980s in the U.S. has been attributed in part to increasing returns to education. However, increases in wage dispersion among similar workers suggest that returns to unobservable skill or individual life chances have also increased (Katz and Autor, 1999, Levy and Murnane 1992). Despite the overall increase in wage inequality in the U.S. since the late 1970s, changes in wage structures vary widely across states and across industries. Increases in wage inequality across states are highly correlated with shifts in industrial composition, particularly the decline in manufacturing (Bernard and Jensen, 1998). In the state of Maryland, sizeable differences in the trends in earnings inequality are observed across industries (Burgess, Lane and McKinney, 2001).

Changes in the distribution of wages may partly reflect changes on the firm (or demand) side of the labor market. Numerous studies have established the role of firm effects on wages and on wage inequality. Important early work in this area is Groshen (1991) who explored the role of demand side effects from BLS Occupational Wage Surveys. She found that establishment wage differentials account for a substantial fraction of the variation in wages. Related work has examined the establishment and firm characteristics that matter. For example, firm size is an important determinant of wages, and wage inequality has increased both among and within manufacturing plants (Davis and Haltiwanger, 1995, 1991). Differences in industry employment shares across states partially explain differences in wage inequality across states (Bernard and Jensen 1998). “High wage firms”, or firms that seem to pay a wage premium or markup, and “high wage workers,” or those who earn a premium, can be identified (Abowd, Kramarz and Margolis, 1999). Changes in the allocation of workers to jobs could affect the wage distribution, if high wage workers are more likely to sort towards firms that pay a high wage premium and

low wage workers more likely to sort towards firms that pay workers a discount, then the earnings distribution will become more unequal (Burgess, Lane and McKinney, 2001).

Indeed, earlier work (Andersson et al., 2005) which focused on the low-wage labor market, found that where low-wage workers work can have a major impact on their earnings and, indeed, that the process by which workers are matched to firms in the low-wage labor market has large and important effects on the outcomes we observe for these workers. This very detailed analysis also found that there is considerable mobility into and out of low earnings categories over time, that the characteristics of employers are highly correlated with earnings and with transitions out of low earnings status and that the characteristics and behaviors of particular firms affect opportunities for low earners.

Work by Davis et al. (2006) has directly examined the way in which changes in workforce composition, firm entry and exit and job reallocation affect industry-specific earnings distributions between 1998 and 2003. They found that worker entry and exit had very little impact on changes in the earnings distributions: despite the ample opportunities for firms to change their workforce composition, industry workforces remained, by and large, very similar, and earnings gains due to experience tended to be higher at the lower end of the distribution. This does not lend credence to the notion that individual firms are changing their production technologies in a way that is biased towards skill. Changes in observable characteristics, which mainly involved the aging of the workforce within each industry, tended to shift the earnings distributions of all industries to the right. The net impact of firm entry and exit is to reduce the dispersion of earnings for all industries. Sorting of workers based on the “human capital” measures over time tended to increase the dispersion of industry earnings distributions between 1992 and 2003. This is consistent with the idea that the driving force of economic change is the

entry and exit of firms, and can be linked to the selection of new technologies, and the associated workforce, by new firms. Their results suggest that the underlying dynamics of earnings inequality are complex, and are due to factors that cannot be measured in standard cross-sectional data.

**Background**

The United States has had lower unemployment than most OECD countries in the 1980's and 1990's: below 7% for almost all of the past decade. Although there was weak growth and a mild recession in the early 1990's, the mid to late1990's were characterized by strong growth – between 2 and 5% in the two years selected for this chapter. See Table 1 for a summary of the macro-economic conditions in the U.S. during this time period.

A number of labor market changes took place during the period. First, US unionization rates dropped markedly from 20.1% for all workers in 1983 to 12.9% in 2003. The decline is even more in the private sector, where unionization is now at 8.2%; public sector unionization rates are around 37% (Card (1998). Several researchers (DiNardo, Fortin and Lemieux (1996) and Card (1998)) find that this decline explains at least part of the increase in the variance of log wages.

Second, there has been substantial immigration. More than 15% of the workforce is foreign born, and immigrants account for more than half of the growth in the workforce in the 1990's. These workers are disproportionately employed in jobs that require little education – particularly the 40% who came from Mexico and Central America (CBO, 2005).

Third, the growth in the rate of labor force participation slowed substantially from earlier decades: from a 3.6% annual increase in the 1970's to 2.8% in the 1980's to a scant .6% rate of increase in the 1990's, although this is due to complex offsetting factors. On the one hand, the

substantial increase in the prime-age 25–54 year-old population (from approximately 50 percent of the over-16 population in 1975 to nearly 58 percent in 1996), acted to increase participation rates. In addition, the flat participation rates of never-married mothers, increased dramatically in the mid 1990's after the passage of Personal Responsibility and Worker Opportunity Reform Act of 1996 (PRWORA) and the expansion of the Earned Income Tax Credit program (EITC). On the other, male labor force participation rates continued decline, and the increases in the participation of married mothers, which had had so much impact in the 1970's and 1980's slowed substantially in the 1990's (Juhn and Potter, 2006)

Finally, the real value of the minimum wage declined systemically over the period (see Blackburn, Bloom and Freeman (1992). DiNardo, Fortin and Lemieux (1996) and Lee (1999)).

These changes were accompanied by rising wage inequality in 1980s and 1990s. The general characterization of this increase is its "fractal" nature: that a large component of the level *and growth* in dispersion is within-group (Levy and Murnane, 1992; Moffitt 1990, Burtless 1990). In addition, the college-high school premium increased much less in the 1990s than in the 1980s despite the fact that relative supply kept increasing at the same rate (see Card and DiNardo (2002), Beaudry and Green (2004) and Lemieux (2004)).

The United States example is particularly instructive in that a great deal of research has been devoted to decomposing the earnings distribution into observed and unobserved factors by Abowd and coauthors (see Abowd, Lengermann and McKinney (hereafter ALM) 2002 for the most recent summary). Briefly, using data and methodology described in detail below, the ALM approach permits the decomposition of the wage rate into time-varying characteristics, person effect (unobserved and measurable), firm effect, and residual. The results of this decomposition using the data used in the basic statistics discussed later in the paper are reported in Table 2.

Unlike other versions of this table (e.g., ALM), this one has been weighted to be representative of the U.S. workforce 1990-2000. Table 2 also presents simple correlations of the wage components. By construction, the wage residual is orthogonal to all other wage components.

Intuitively, the person effects, which include some factors that are often observable to the statistician, such as years of education and sex; and some factors that are often not, such as innate ability, "people skills," "problem solving skills," perseverance, family background, and educational quality can be thought of as their human capital; the firm effects can be thought of as the pay premium as a result of unionization, rent sharing or compensating differentials.

There are several striking results to be found from an examination of the table. Most obviously, person and firm heterogeneity are both highly correlated with annualized wages, despite only being mildly positively correlated with each other. In addition, the correlation between time-varying individual characteristics and annualized wages, while positive, is smaller than the correlation between either person or firm effects and wages. It is also interesting that both the observed constant person effects and the unobserved person effects are important components of the variation in log wages across individuals.

ALM have also examined changes in human capital over time. They find a pronounced right shift in the overall distribution of human capital over the five year period of 1992-1997. This is due to increased labor market experience of the existing workforce, offset slightly by a net reduction in human capital from entry and exit. Their analysis notes that these changes took place despite the fact that the overall wage distribution remained largely unchanged over the same period, largely reflecting the tendency of labor force entrants to sort into firms with below average internal wages and of continuers to sort into firms with above average internal wages, thereby exacerbating pre-existing wage differences.

ALM also examined the human capital distributions for firms in both 1992 and 1997,and found a pronounced tendency for firms to employ workers at the ends of the human capital distribution rather than the middle – even within firms in the same industry. Between 1992 and 1997, between firm variation in the employment shares of low skilled workers declined, while the average firm in virtually every industry upskilled considerably. Employment shares in the bottom two skill deciles fell by 7.7% and 5.2% respectively but increased by 6% in each of the two highest skill deciles.

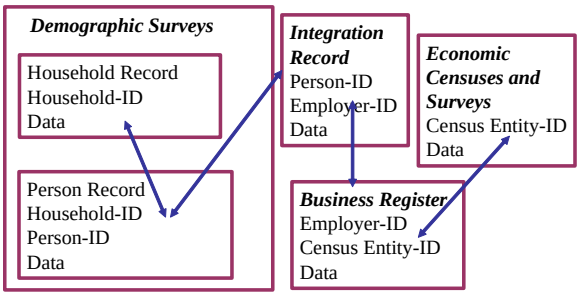
**The Structure of the LEHD Program Data**

The LEHD database infrastructure is complex. The core integration records are state Unemployment Insurance wage records (which are described in detail elsewhere). The integration of the business and demographic data by means of these records, which takes place under strict confidentiality protection protocols[1], can be visualized by examining figure 1. These UI records, from now more than 40 partner states representing more than 80% of US employment, consist of quarterly reports filed by employers every quarter for each individual in covered employment. These records permit the construction of a database that provides longitudinal information on workers, firms, and the match between the two. The coverage is roughly 96% of private non-farm wage and salary employment; the coverage of agricultural and federal government employment is less comprehensive. Self-employed individuals and

[1] The data are anonymized before use, may only be used for statistical purposes and for approved projects by Census Bureau employees. In addition, the data are protected by Title 13 of the U.S. Code: employees who disclose the identity of an individual or business are subject to a penalty of five years in jail, a $250,000 fine, or both.

independent contractors are also not covered.[2] Although the administrative records themselves are subject to some error, staff at the LEHD program has invested substantially resources in cleaning the records and making them internally consistent.[3]

**The LEHD Program**




The Census Bureau information that is integrated into this infrastructure backbone consists of basic demographic information: date of birth, place of birth, sex and a crude measure of race and ethnicity for almost all workers in the dataset – the non-match rate is about 4%. Other demographic survey data are integrated if the use is permitted under Title 13 of the U.S. Code. While the Census Business Register is the core integration file for business data, other business surveys are also included and integrated (again if the use is permitted under Title 13 of U.S.C. -- more information on the micro business data integrated can be found at the Center for Economic Studies website at www.ces.census.gov). To sum up, for the universe of employers

[2] See David Stevens, "Employment that is not covered by State Unemployment", LEHD Technical Paper no. TP-2002-16. The LEHD program is currently working on using administrative data to track self-employment.

[3] The approach is described in John Abowd and Lars Vilhuber "The sensitivity of economic statistics to coding errors in personal identifiers" Journal of Business and Economic Statistics, forthcoming.

and employees the range of information is limited to earnings histories, earnings, employment matches and basic information such as gender and age of the worker and the location and industry of the business. However, for subsamples of records integrated with Census demographic and business data additional detailed information is available.

In the current paper, we present some summary statistics of the structure of wages within and between firms as well as patterns of worker turnover. There are some conceptual issues that need to be made clear. Although we typically refer to the employer as a "firm", the actual reporting unit in the data is an administrative, rather than an economic entity, since the filing unit reflects an "Employer Identification Number", rather than a specific firm. The distinction is immaterial for about 70% of workers, who work for a single establishment employer – but those who work for a multiple establishment employer, the use of the term "firm" in this book is less well-defined. In addition, no occupation information is available. We observe a "job" as an employer-employee match, and we can only observe internal earnings mobility – not occupational mobility.

An important issue to address is that of earnings. According to the *BLS Handbook of Methods* (1997) UI wage records measure "gross wages and salaries, bonuses, stock options, tips, and other gratuities, and the value of meals and lodging, where supplied." They do not include OASDI, health insurance, workers compensation, unemployment insurance, and private pension and welfare funds. In addition, since neither hours nor weeks workers are available on the data, there is no information on hourly or weekly earnings. Consequently, low earnings in a given year (or quarter) can be due to low hourly wages, low hours, or both. Thus some industries, like retail trade, will show up as low earnings industries at least partly because so

much of the work in that industry is part time. Note that hours or weeks worked are typically not reported by employers.

In this paper, the dependent variable is based on the annualized full-year full-time wage rate developed in Abowd, Lengermann and McKinney, 2002[4]. It is, essentially, the sum of full-quarter income for four consecutive quarters over the calendar year. When full quarter income is missing, it is estimated based on the expected full quarter income for that quarter given the pattern of employment in the 6-quarter window that includes the last quarter from the previous year, the four quarters of the current year, and the first quarter of the next year. We derived monthly income by dividing the annualized measure by 12, and deflated it by the CPI-U (base 1990=1.00). Only the observation for the dominant employer (the one with whom the individual had the largest earnings (not wage rate) in a given year). Only full-time employees are used (based on the first implicate of the full-time imputation).

A change in the monthly wage rate is computed for individuals with two consecutive years of full-time employment. The change in the wage rate is w(t) – w(t-1). Only those observations present in t-1 enter the change tables. The weight used is for period t. In computing entry, we define individuals as "entrant" in year t if this year's dominant employer is different from last year's. Similarly, an individual is defined as an "exiter" in year t if this year's dominant employer is different from next year's.

Finally, in the results we reported above in Table 2, we used this data to estimate measures of individual and firm fixed effects, following the methodology described in Abowd, Lengermann and McKinney, 2002.

$$\ln w_{it} = \theta_i + \psi_{J(i,t)} + x_{it}\beta + \varepsilon_{it} \qquad (1)$$

[4] Abowd, J, P Lengermann and K. McKinney "The Measurement of Human capital in the U.S. Economy" LEHD Technical Paper No. TP-2002-09

where the dependent variable is the log wage rate of an individual *i* working for employer *j* at time *t* and the function J(*i*,*t*) indicates the employer *j* of individual *i* at date *t*. The first component of equation (1) is the time invariant person effect, the second component is the time-invariant firm effect, the third component is the contribution of time varying observable individual characteristics, and the fourth component is the statistical residual, orthogonal to all other effects in the model. The econometric methodology and estimates of human capital used in this paper are discussed and described in detail in Abowd *et. al* (2002).[5]

More complete details of the database used in this paper are provided in appendix A. For the current paper, we use a limited number of states for the years 1993 and 1998. However, as described in appendix B, we have developed weights so that the statistics here can be interpreted as nationally representative.

**Analysis**

The key purpose of this chapter is to describe wage structure and individual mobility within and across firms over the period in question. The first panel of Table 3 provides the individual analysis by describing the distribution of real monthly wage rates and log real monthly wage rates for individuals – the summary statistics include the average, standard deviation, 90$^{th}$ and 10$^{th}$ percentiles wages in that distribution.[6]

The first thing to note is that the entire distribution of earnings shifted to the right, as already noted by ALM: average wages increased over the period, as did the wages for workers at the top and bottom end of the distribution (the 90$^{th}$, 75$^{th}$, 25th and 10th percentiles). It is also clear that the dispersion of earnings across workers is enormous. The standard deviation of log

[5] Recent research has extended this type of analysis to permit a mixed effects specification – see Abowd et. al. (2006).

[6] An individual is included in the analysis if that person had a dominant employer in 1993 or 1998 and worked full time at that employer.

earnings is about 80 log points. Using an alternative measure of dispersion, the worker at the 90th percentile in 1998 has log wages that are about 200 log points larger than those of the worker at the 10th percentile, and this pattern is relatively stable between the two periods.

The second panel, the firm level analysis[7], permits the quantification of the between versus within variation in wage patterns, since it shows the average wage and the variation in wages across firms. Note that the average wage in the average firm is lower than the average individual wage -- reflecting the skewed size distribution of firms. In other words, although most workers work in large firms, most firms are small. Since small firms pay less than large, a wage distribution based on firms as the unit of analysis will inevitably have a lower mean than one with individuals as the unit.

As with the individual analysis, it is clear that the entire distribution has shifted to the right during the period in question. In addition, the standard deviation of log wages between firms is large – about 50 log points in 1993 and 1998. The 90-10 differential between firms is also large – around 130 log points. Although this is substantially less than the standard deviations associated with the individual distribution, it is clear that one of the key patterns for understanding the structure of wages is the earnings differences across firms.

The third issue is examining the within firm wage dispersion, which is presented in the third panel. This shows tremendous variation in the dispersion of log wages within firms. Using as the metric the within firm standard deviation of wages, the third panel shows that the mean standard deviation within firms is around 60 log points, or about ¾ of the individual earnings

[7] A firm is included in the analysis if that firm had positive average month 3 ES-202 employment during the year of 25 or more.

distribution.[8] Those firms with the least compressed distribution, those at the 90th percentile, have a standard deviation of 80 log points and even in those firms with quite compressed earnings distribution, namely those at the 10th percentile of firms, the within firm standard deviation is about 40 log points. Interestingly, the distribution of standard deviations also shifted to the right (albeit slightly) during the period.

The fourth panel, which performs the same analysis for a different statistic, the average coefficients of variation across firms, shows similar patterns in terms of the earnings distribution. However, the dispersion of earnings relative to the mean wage is remarkably high: the standard deviation of earnings is about 75% of the mean wage. Even for the most compressed firms (the 10th percentile), the standard deviation is about 40% of the mean wage; for the least compressed. (the 90th percentile), a startling 120%.

Both of these panels make it clear that there is substantial within firm variation at all points of the distribution and that this variation is a sizable fraction of individual variation. As a result, understanding within firm dispersion in wages is likely to be an important component to understanding the individual earnings distribution. The large spread of earnings within firms is also consistent with the popularly held notion that the spread between top and bottom earnings within a US firm is substantially greater than in their European counterparts.

At the very bottom of Table 3 is the simple statistic showing the correlation between the within firm standard deviation of wages and the average wages of the firm. In dollars the correlation is positive but this reflects scale effects on the standard deviation measured in dollars. When wages are measured in logs, the correlation is slightly negative and essentially zero. Thus, for the entire U.S. there is little systematic relationship between within firm dispersion of wages

[8] Some caution must be used in comparing average standard deviation within firms to overall standard deviation across individuals since the average standard deviation within firms is not employment-weighted across firms.

and average wages. This pattern is likely sensitive to industry and occupation. For example, in a study of the software industry and software engineers and managers, Andersson et. al. (2006) find a positive relationship between within firm dispersion of earnings and average earnings. However, as argued in the latter paper, this pattern reflects the "winner take all" product mixes in some parts of the software industry such as in computer games.

The fact that the data are linked longitudinally at the individual level permits an analysis of wage dynamics by examining changes in the wage rate and changes in the log wage rate[9]. A set of summary statistics is presented in Table 4.

An examination of the individual earnings distribution in the first panel reveals that the typical wage change in 1993 was negative and in 1998 positive. This result is consistent with the macroeconomic environment in both periods, since the former is likely to reflect recessionary pressures, while the later expansionary pressures. It is noteworthy that many workers did get sizable raises even in the recessionary periods, since the order of magnitude of the dispersion of wage changes is quite large – about 50 log points – and the order of magnitude did not change much in the expansion. This finding is consistent with the notion that macroeconomic conditions affect the level but not the distribution of wage changes.

The wage growth distribution is quite remarkable. An analysis of this distribution shows that even when economic activity is strong, as in 1998, a substantial portion of the population actually experienced quite substantial earnings declines. Indeed, even at the 25$^{th}$ percentile, log earnings declined by 6 points, and at the 10$^{th}$ percentile, log earnings declined by a startling 38 points. At the top end of the distribution, earnings increased by as much as 50%. In keeping with this finding, the standard deviation is quite large – about 50 log points.

[9] An individual is included in the analysis if that person had a dominant employer in (1992,1993) or (1997,1998) and worked full time in both years. A firm is included in the analysis if that firm had positive average month 3 ES-202 employment during the year of 25 or more.

The fact that the linked employer-employee data are also linked longitudinally at the firm level enables us to calculate the change in mean firm log wages. An analysis of the results of this calculation, which are presented in the second panel, mirrors the individual distribution in that the mean log wage of firms actually declined in the first period, and increased in the second[10]. Just as in the individual distribution, there are substantial differences across firms: more than 25% of firms actually decreased their mean log wage in both periods; and there were large changes in mean log wages for some firms in both periods. Indeed, the 90$^{th}$ percentile firm actually increased mean log wages by 14 log points in the first and by more than 21 log points in the second period. The summary standard deviation statistics shows that between firm dispersion in log wage changes is around 19 log points.

Because the data are linked longitudinally in both firms and workers, we can also calculate the distribution of the change in log wages for workers within each firm, and calculate the standard deviation of this statistic. We provide summary information about the distribution of the standard deviation of this measure of the within firm wage dispersion in panel three. What is especially striking is the large within firm dispersion in wage changes. On average, within firm dispersion in wage changes in 45 log points in 1993 and 49 log points in 1998. In other words, some workers are doing much better within firms than others in terms of wage growth. Even in firms which kept the spread of their wage changes relatively compressed (the 10$^{th}$ percentile), the standard deviation was 20 log points; at the other end of the distribution (the 90$^{th}$ percentile) the standard deviation was a substantial 70 log points. The fourth panel, which reports a similar measure of spread -- the coefficient of variation, reflects the same basic facts.

[10] Of course, it remains an open question how much of this change is due to changes in wages for continuing workers, and how much is due to changes in the workforce at the firm.

The last panel of Table 3 sheds light on the structure of wage changes for those who changed firms. In contrast to the distribution of individuals as a whole, on average the wage change is positive, especially in 1998, suggesting that the average worker gained from job change. However, the dispersion in wage changes is very large across those who changed firms, and clearly some workers lose substantially. At the 90$^{th}$ percentile, the average wage change is almost 100 log points in 1998 while at the 10$^{th}$ percentile it is about -80 log points.

The counterpart of the analysis of wage changes within and across firms is clearly an analysis of mobility, and the results of just such an analysis are presented in Table 5. We find a very high pace of accessions and separations[11]. We also find that workers much more mobile at bottom end of distribution than at top – both in 1993 and 1998. Interestingly, despite the differences in macroeconomic activity in both periods, both entry and exit rates increased in 1998.

**Summary**

This chapter has provided an initial examination of the earnings distribution both within and between firms at two different points of the business cycle. There is enormous variation in earnings across workers in the U.S. A decomposition into the factors underlying this dispersion suggests that about half of the variation is associated with worker characteristics and about half due to firm effects. Thus, both who you are and where you work are very important in the determination of earnings. While there is substantial between firm variation in earnings, the within firm variation of earnings is very large in terms of both levels and changes of earnings

[11] These rates are averages across firms and have not been employment-weighted so they are somewhat larger than analogous accession and separation rates that are employment weighted. In addition, these measures of worker turnover are higher than measures that use point in time changes and/or only count transitions for workers with some minimum duration of employment. There is an implicit duration requirement in that average real monthly earnings must exceed $100 for a worker to be counted in these statistics but this might still include a substantial number of short duration jobs.

over time. So while where you work matters substantially, there is enormous variation in earnings within where you work as well. Accompanying the substantial between and within firm variation in earnings levels and changes is a high pace of worker turnover. The earnings dynamics and turnover are not surprisingly connected with workers that change jobs having on average a positive increase in earnings. However, underlying this positive average is substantial variation with the 25$^{th}$ percentile of job changers exhibiting over a 20 percent decline in earnings and the 75$^{th}$ percentile exhibiting a 40 percent increase in earnings. Putting all the pieces together suggests a rich and continuous ongoing matching and sorting of heterogeneous firms and workers with a wide variation in outcomes in the U.S. labor market.

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**Appendix A: Summary of U.S. statistics measurement**

The nature of administrative data means that a number of technical issues arise in the creation of measures that are sensible for economic analysis. There is extensive documentation on the LEHD website (http://lehd.dsd.census.gov) on the characteristics of the data and the methods used to standardize information from different states. What follows is a brief summary of the approach used to prepare the data for this chapter.

Data from seven states are used in this analysis: California, Florida, Illinois, Maryland, Minnesota, North Carolina and Texas, comprising about 40% of US employment. The employer is the dominant employer in a given year; although multi-state employment is not eliminated for a given year).

The earnings data are from quarterly unemployment insurance (UI) wage records from each participating state. UI wage records measure "gross wages and salaries, bonuses, stock options, tips, and other gratuities, and the value of meals and lodging, where supplied" (U.S. Department of Labor, Bureau of Labor Statistics 1997a, p. 44). They do not include OASDI, health insurance, workers compensation, unemployment insurance, and private pension and welfare funds.

The following steps are taken in creating the earnings measures used in this paper. First, earnings are converted to real earnings using the CPI. They are then annualized using the approach described in ALM (2003), and converted to monthly earnings by dividing annualized earnings by 12. Workers are included in analysis if real monthly earnings exceed $100 and are less than $100,000.

The unit of observation for the firm is the SEIN. The SEIN is the state Unemployment Insurance Account Number. For single-unit establishment firms, the SEIN defines both the

establishment and the firm. For multiple establishment firms, the SEIN typically includes all establishments within the state that are owned by this firm. For firms that operate in multiple states, the SEIN does not capture all activities of the firm but rather the operations for the state in question. Firms are included in the analysis if employment is larger than 25.

National person and firm weights have been developed for the U.S. statistics in a manner described in Appendix B.

Worker flows are calculated as follows. Entry (accession) and Exit (separation) rates reflect links across years for jobs, where the unit of observation is defined as an individual-SEIN year observations (persons linked to an SEIN in a given year). Entry refers to workers who have zero earnings with SEIN in prior year (t-1) and have positive earnings in current year (t). Workers are only counted for purposes of computing rates if they satisfy above earnings thresholds[12]. Exit refers to workers who have positive earnings in year t at SEIN and zero earnings in year t+1. Workers are counted for purposes of computing rates if they satisfy above earnings thresholds[13]. There is an important timing difference – entry refers to flow into firm from t-1 to t; exit refers to flow out of firm from t to t+1. It is thus inappropriate to compute net flows from entry and exit.

Employment measures -- average employment and employment growth -- are based on QCEW/202[14] employment from the 3rd month of each quarter. Average employment is computed

[12] Note however that a worker who has positive earnings in year t-1 and t but in one year earnings do not satisfy thresholds is not counted as an entrant.

[13] In a symmetrical fashion to entry, a worker who has positive earnings in year t-1 and t but in one year earnings do not satisfy thresholds is not counted as an exit.

[14] QCEW/202 employment is the number of workers on the payroll for the payroll period including the 12th of the month.

as the average across the four quarters of the 3rd month QCEW/202 employment measure. Net growth across years is based on the difference between the average value in time t and t+1.

**Appendix B: The construction of the National Weights**

*Person level*

The control source is the final individual weights from the March Current Population Survey. The population was defined as those 18-70 year olds who were part of the employed, domestic, civilian non-institutional population (ESR = 1 or 2), Age 18-70 (inclusive). The major industry classifications were the 22 CPS major industry categories. In constructing the weights, we used 5 age categories (18-24, 25-34, 35-44, 45-54, 55-70), three education categories (0-11 years, exactly 12 years (completed), more than 12 years) and two sex categories ( male, female).

For each year and major industry we computed the expected number of employed persons inside each education x age x sex cell based on a log-linear probability model with three-way interactions suppressed estimated from the final weighted March CPS Annual Demographic Supplements (public use files). This is the weight numerator.

For each year and major industry we computed the number of persons in each education x age x sex cell from the LEHD sample[15] . This is the weight denominator.

The Pweight used is the ratio of the weight numerator to the weight denominator. Pweight thus performs a post-stratification of the state specific sample to 600 employment cells each year. The weighted person-level data are representative of the employed civilian non-institutional population in each year.

The variable pweight was used to weight all person-level estimates. For changes, the t-period and not the t-1 period weights were used.

*Firm level*

The employment measure used was the average month 3 employment from the QCEW for every quarter that the SEIN had data in a given year. The control source was the Current

[15] There are no empty cells

Employment Statistics national estimates for 2-digit SICs. The population used was all non-farm establishments, with the following exceptions. SICs for which the LEHD sample was not representative (SIC's 01 02 08 43) were excluded by means of assigning missing weights. Certain SICs were pooled (SIC's 20-21, 71-72, 88-89, 90-99). Public administration (90-99) was estimated from federal, state and local government employment exclusive of government-owned establishments in USPS, health, education, and social services, which were either excluded (USPS) or included in the correct SIC.

The numerator of the weight was calculated for each year and 2-digit SIC from the total average annual employment from the national CES series.

The denominator of the weight was calculated for each year and SEIN in the LEHD sample from total employment in the same 2-digit SICs. Note that there are no empty cells and the exclusions noted above take care of industries in which the sample is probably not representative.

Fweight is the ratio of the weight numerator to the weight denominator. The fweight is a post-stratification of the LEHD sample to 2-digit SIC average annual employment in the CES. This fweight is used to weight all firm-level statistics in the tables.

Table 1: Macroeconomic Conditions

| | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Unemployment Rate | 5.6 | 6.8 | 7.5 | 6.9 | 6.1 | 5.6 | 5.4 | 4.9 | 4.5 | 4.2 | 4.0 |
| Change in GDP | | | | | | | | | | | |
| 1 year | 0.5 | 0.9 | 4.0 | 2.6 | 4.1 | 2.2 | 4.1 | 4.3 | 4.8 | 4.3 | 2.3 |
| 2 year | 1.6 | 0.7 | 2.5 | 3.3 | 3.3 | 3.1 | 3.1 | 4.2 | 4.6 | 4.6 | 3.3 |
| 5 year | 2.8 | 2.4 | 2.4 | 2.1 | 2.4 | 2.7 | 3.4 | 3.4 | 3.9 | 3.9 | 4.0 |

Table 2
Decomposition of the Real Wage Rate
Standard Deviations and Correlations of Components
(Weighted)

| | StD | log real wage | time varying char | person effect | unobserved person effect | constant person char. | firm effect | residual |
|---|---|---|---|---|---|---|---|---|
| 1 log real wage | 1.914 | 1.000 | 0.732 | 0.225 | 0.216 | 0.483 | 0.470 | 0.394 |
| 2 time varying char | 1.656 | 0.732 | 1.000 | 0.347 | 0.200 | 0.627 | 0.141 | -0.008 |
| 3 person effect | 1.502 | 0.225 | 0.347 | 1.000 | 0.914 | -0.513 | 0.074 | 0.001 |
| 4 unobserved person effect | 1.417 | 0.216 | 0.200 | 0.914 | 1.000 | -0.576 | 0.059 | 0.001 |
| 5 constant person char. | 1.808 | 0.483 | 0.627 | -0.513 | -0.576 | 1.000 | 0.068 | -0.009 |
| 6 firm effect | 0.798 | 0.470 | 0.141 | 0.074 | 0.059 | 0.068 | 1.000 | 0.000 |
| 7 residual | 0.769 | 0.394 | -0.008 | 0.001 | 0.001 | -0.009 | 0.000 | 1.000 |

Table 3: Structure of Wages Within and Between Firms

| | Monthly Full-Time Wages in $1990 | | | Log monthly wages in $1990 | |
|---|---|---|---|---|---|
| | 1993 | 1998 | | 1993 | 1998 |
| Average Wage (employed persons) | 3,074 | 3,253 | | 7.6848 | 7.7323 |
| (s.d.) | 4015 | 4230 | | 0.81 | 0.82 |
| (90%-ile) | (5555) | (5925) | | (8.6225) | (8.687) |
| (75%-ile) | (3671) | (3774) | | (8.2083) | (8.2359) |
| (25%-ile) | (1319) | (1389) | | (7.1847) | (7.236) |
| (10%-ile) | (798) | (855) | | (6.6824) | (6.7513) |
| [N – workers] | [26403031] | [40110897] | | [26403031] | [40110897] |
| Average of firm average wage (firms, US operations) | 2,819 | 3,020 | | 7.6111 | 7.6639 |
| (s.d.) | (1758) | (2051) | | (0.4968) | (0.5157) |
| (90%-ile) | (4649) | (5070) | | (8.228) | (8.304) |
| (75%-ile) | (3464) | (3645) | | (7.956) | (7.9988) |
| (25%-ile) | (1719) | (1791) | | (7.2591) | (7.3018) |
| (10%-ile) | (1284) | (1336) | | (6.9757) | (7.0129) |
| [N – firms] | [132659] | [202528] | | [132659] | [202528] |
| Average of s.d. of wage (firms, US operations) | 2,280 | 2,434 | | 0.5923 | 0.5966 |
| (s.d.) | (2354) | (2452) | | (0.1708) | (0.1741) |
| (90%-ile) | (4403) | (4888) | | (0.8038) | (0.8132) |
| (75%-ile) | (2595) | (2848) | | (0.6815) | (0.6866) |
| (25%-ile) | (1030) | (1062) | | (0.48) | (0.4813) |
| (10%-ile) | (711) | (732) | | (0.402) | (0.4043) |
| [N – firms] | [132659] | [202528] | | [132659] | [202528] |
| Average Coefficient of Variation of wages (firms, US operations) | 0.75 | 0.75 | | 0.0782 | 0.0783 |
| (s.d.) | (0.39) | (0.37) | | (0.024) | (0.024) |
| (90%-ile) | (1.2) | (1.2) | | (0.1079) | (0.1082) |
| (75%-ile) | (0.87) | (0.88) | | (0.0904) | (0.0903) |
| (25%-ile) | (0.52) | (0.52) | | (0.0626) | (0.0624) |
| (10%-ile) | (0.42) | (0.42) | | (0.0521) | (0.0522) |
| [N – firms] | [132659] | [202528] | | [132659] | [202528] |
| Correlation (average wage, s.d. of wage) (firms, US operations) | 0.7622 | 0.7856 | | -0.0561 | -0.0515 |

Table 4: Wage Dynamics

| | Change in Monthly Wages in $1990 (defined as wage in year t less wage in year t–1) | | | Change in Log Monthly wages in $1990 (defined as log wage in year t less log wage in year t–1) | |
|---|---|---|---|---|---|
| | 1993 | 1998 | | 1993 | 1998 |
| Average change in wage (employed persons) | | | | | |
| | -18 | 152 | | -0.0039 | 0.0496 |
| (s.d.) | (2844) | (3041) | | (0.467) | (0.511) |
| (90%-ile) | (837) | (1120) | | (0.362) | (0.495) |
| (75%-ile) | (262) | (408) | | (0.106) | (0.17) |
| (25%-ile) | (-231) | (-144) | | (-0.093) | (-0.064) |
| (10%-ile) | (-869) | (-784) | | (-0.386) | (-0.379) |
| [N – workers] | [17614249] | [35607319] | | [17614249] | [35607319] |
| Average of firm average change in wage (firms, US operations) | | | | | |
| | -1 | 166 | | -0.0017 | 0.0558 |
| (s.d.) | (991) | (1109) | | (0.183) | (0.191) |
| (90%-ile) | (426) | (675) | | (0.1404) | (0.2153) |
| (75%-ile) | (152) | (300) | | (0.0661) | (0.1261) |
| (25%-ile) | (-191) | (-92) | | (-0.0641) | (-0.0181) |
| (10%-ile) | (-459) | (-337) | | (-0.1567) | (-0.1124) |
| [N – firms] | [106732] | [202335] | | [106732] | [202335] |
| Average of s.d. of change in wage (firms, US operations) | | | | | |
| | 1,621 | 1,782 | | 0.4462 | 0.4917 |
| (s.d.) | (1858) | (2021) | | (0.202) | (0.206) |
| (90%-ile) | (3192) | (3625) | | (0.707) | (0.7554) |
| (75%-ile) | (1836) | (1993) | | (0.5504) | (0.6012) |
| (25%-ile) | (675) | (738) | | (0.3072) | (0.3499) |
| (10%-ile) | (442) | (496) | | (0.2255) | (0.2623) |
| [N – firms] | [106732] | [202335] | | [106732] | [202335] |
| Avg coefficient of variation of change in wages (firms, US operations) | | | | | |
| | 2.50 | 2.49 | | -1.3944E+12 | 9.15283E+12 |
| (s.d.) | (40.69) | (105.29) | | (1.2939E+15) | (3.6786E+15) |
| (90%-ile) | (15.55) | (15.19) | | (16.561) | (14.4548) |
| (75%-ile) | (5.72) | (6.3) | | (6.2325) | (6.18) |
| (25%-ile) | (-6.36) | (-4.64) | | (-5.6833) | (-2.8749) |
| (10%-ile) | (-15.91) | (-13.83) | | (-15.9834) | (-11.4428) |
| [N – firms] | [106732] | [202335] | | [106732] | [202335] |

| | | | | | |
|---|---|---|---|---|---|
| Avg change in wage for people who change firms (employed persons) | -9 | 195 | | 0.0243 | 0.1031 |
| (s.d.) | (3506) | (3664) | | (0.789) | (0.786) |
| (90%-ile) | (1660) | (1880) | | (0.918) | (0.997) |
| (75%-ile) | (666) | (805) | | (0.391) | (0.46) |
| (25%-ile) | (-548) | (-394) | | (-0.327) | (-0.238) |
| (10%-ile) | (-1716) | (-1460) | | (-0.895) | (-0.799) |
| [N – workers] | [3718398] | [10522612] | | [3718398] | [10522612] |
| Percentiles for individuals were computed without using person weights due to computer memory limitations. | | | | | |

Table 5: Mobility
Panel A
All Jobs*

| | All firms with 25+ employees | | | |
|---|---|---|---|---|
| | 1993 | 1998 | | |
| Employees | 150 | 156 | | |
| (s.d.) | (782) | (817) | | |
| Employment growth | 0.14 | 0.17 | | |
| (s.d.) | (0.48) | (0.49) | | |
| Exit (separation) rate | 0.36 | 0.40 | | |
| (s.d.) | (0.24) | (0.24) | | |
| Exit rate, top quartile of firm wages | 0.28 | 0.31 | | |
| (s.d.) | (0.27) | (0.28) | | |
| Exit rate, bottom quartile of firm wages | 0.49 | 0.53 | | |
| (s.d.) | (0.27) | (0.26) | | |
| Exit rate, top decile of firm wages | 0.28 | 0.30 | | |
| (s.d.) | (0.32) | (0.32) | | |
| Exit rate, bottom decile of firm wages | 0.57 | 0.61 | | |
| (s.d.) | (0.31) | (0.30) | | |
| Entry (accession) rate | 0.27 | 0.34 | | |
| (s.d.) | (0.24) | (0.24) | | |
| Entry rate, top quartile of firm wages | 0.20 | 0.26 | | |
| (s.d.) | (0.26) | (0.27) | | |
| Entry rate, bottom quartile of firm wages | 0.36 | 0.45 | | |
| (s.d.) | (0.27) | (0.26) | | |
| Entry rate, top decile of firm wages | 0.19 | 0.24 | | |
| (s.d.) | (0.29) | (0.32) | | |
| Entry rate, bottom decile of firm wages | 0.40 | 0.49 | | |
| (s.d.) | (0.31) | (0.31) | | |
| Number of Firms (Sum of Weights) | 503,990 | 547,462 | | |