Gross Job Flows for the U.S. Manufacturing Sector: Measurement from the Longitudinal Research Database

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November 29, 2006

Abstract

Measures of job creation and destruction are now produced regularly by the U.S. statistical agencies. The Bureau of Labor Statistics releases via the Business Employment Dynamics (BED) on a quarterly basis measures of job creation and destruction for the U.S. nonfarm business sector and related disaggregation by industrial sector and size class. The U.S. Census Bureau has developed the Longitudinal Business Database (LBD) covering the nonfarm business sector that has been used to produce research analysis and special tabulations including tabulations of job creation and destruction. Both of these data programs build upon the measurement methods and data analysis of job creation and destruction measures from the Longitudinal Research Database (LRD) developed and published by Davis, Haltiwanger and Schuh (1996). In this paper, the LRD based estimates of job creation and destruction are updated and made available for consistent annual and quarterly series from 1972-1998. While the BED and LBD programs are more comprehensive in scope than the LRD, the extensive development of the LRD permits the construction of measures of job creation and destruction for a rich array of employer characteristics including industry, size, business age, ownership structure, location and wage structure. The updated series that are released with this working paper provide measures along each of these dimensions. The paper describes in detail the changes in the processing of the Annual Survey of Manufactures over the 1972-1998 period that are important to incorporate by users of the LRD at Census Research Data Centers as well as users of products from the LRD such as job creation and destruction.

JEL Numbers: J63, L6, and Y1.

This paper was written in part by Census Bureau Staff. This work is unofficial and thus has not undergone the review accorded to official Census Bureau publications. The views expressed in the paper are those of the authors and not necessarily those of the U.S. Census Bureau. We thank Stacey Cole and Robert Struble for their help in understanding the features of the 1994-1998 ASM panel and Jason Faberman for sharing his extended BED data series with us. We have benefited from comments from Ron Jarmin, C.J. Krizan, Javier Miranda, Steve Davis, and seminar participants at the Center for Economic Studies. Contact author: John Haltiwanger at haltiwan@econ.umd.edu.

1. Introduction

With the creation of the Longitudinal Research Database (LRD) in the mid-eighties, economists no longer had to rely solely upon aggregate data to investigate the changing structure of the manufacturing sector of the U. S. economy. The LRD made it possible to observe the variations in behavior among manufacturing establishments and to determine how changes in the behavior of individual establishments affected the enterprise or the aggregate statistical totals. One line of empirical research using the LRD is the measurement of job creation and job destruction. Davis, Haltiwanger, and Schuh (1996) developed these measures of job creation and destruction and presented their results for 1972-1988 in *Job Creation and Destruction*. The job flows series were updated and extended to cover 1989-1993 by C.J. Krizan and John Haltiwanger. This paper further extends the job flows series to cover 1994-1998 as well as improving measures of plant characteristics for the entire 1972-1998 period.[1]

Following the development of the LRD, other establishment-level datasets have been developed that can also provide measures of job creation and job destruction. For example, researchers at the Census Bureau have developed a longitudinal version of the Census business register called the Longitudinal Business Database (LBD). The LBD covers the entire U.S. economy and currently is available annually over 1976-2004. The expanded coverage of the LBD relative to LRD is one of its strongest points. Nevertheless, the LRD maintains a depth of coverage (including detailed information on inputs) that is not available on the LBD. The Bureau of Labor Statistics (BLS) has developed a longitudinal version of their Quarterly Census of Employment and Wages data called the Business Employment Dynamics (BED) data. The BED covers the private economy and is currently available quarterly over 1992-2005. Relative

[1] The data discussed in this paper can be found at: http://www.bsos.umd.edu/econ/haltiwanger/download.htm and will also be made available on the NBER website.

to the LRD, the BED has wider coverage but again less depth of coverage.[2] The empirical exercises in this paper include a comparison of the LRD, LBD, and BED statistics and we are heartened to find that they are consistent. Moreover, the alternative series taken together with some series that can be constructed from the BLS Manufacturing Turnover Survey permits constructing a very long time series on job creation and destruction for the U.S. manufacturing sector. This long time series is used in Faberman (2006) and Davis, Faberman and Haltiwanger (2006) and we include it here given that the source data includes the updated gross job flow series reported in this paper.

To preview our main results, we find that the 1994-1998 data reveal some interesting differences in the manufacturing sector as a whole as compared to the earlier time period. One of the most noticeable differences is that the manufacturing sector experienced positive net employment growth in the 1990s that is unprecedented since the late-1970s. Underlying this positive net employment growth are higher than average job creation rates and lower than average job destruction rates. In the past, job creation and destruction rates moved in opposition, but the job creation and destruction rates began to move in tandem towards the end of the latest panel of data. Interestingly, during the last period of extended positive net employment growth in manufacturing, job creation and destruction rates were also positively correlated (even more so during this earlier period which had stronger positive net employment growth). The volatility of job creation and destruction rates declines in the latest time period. Total reallocation rates are

[2] Another related statistical program at the U.S. Census Bureau is the Quarterly Workforce Indicators (QWI) produced by the LEHD program at Census. The QWI produces measures of accessions, separations, job creation and destruction by employer and employee characteristics for local areas. Information on the QWI can be found at http://lehd.dsd.census.gov/led/index.html. We do not compare and contrast the QWI statistics in this paper since the focus of the QWI is local employment dynamics and at present the QWI are not available on a national basis (although national statistics from the LEHD program are planned).

slightly lower than before. When put together in the extended time series, we find that job reallocation rates over the 1947-2005 period exhibit a pronounced negative trend.

Underlying these differences at the total manufacturing sector level are some interesting differences in classes of establishments. We find that reallocation rates in the latest panel relative to the earlier period are even higher for younger, single unit, low wage establishments. It is not surprising then, that the Davis, Haltiwanger, and Schuh findings that job creation and destruction rates are highest for young, single unit and low wage establishments still hold. We also find heterogeneity in job creation and destruction rates by industry and by location commensurate with what had been found in earlier time periods.

The paper is organized as follows. Section 2 describes our data and the methodology for measuring job creation and job destruction. Section 3 presents results for the total manufacturing sector. This section starts with comparisons of the gross flows data derived from the LRD with those derived from other data sources. Section 4 presents results by the following characteristics: firm and establishment age, industry, ownership type, wage class, and location. Section 5 presents concluding remarks.

2. Methodology

As much as possible we use the same methodology as in earlier research on job creation and destruction in order to maintain the continuity of the data series. Our main dataset, the LRD, is comprised of the data on U.S. manufacturing establishments collected in the Census of Manufactures (CM) and Annual Survey of Manufactures (ASM). The CM is a quincennial census collected on the universe of manufacturing establishments (collected in years ending in '2' and '7'). From the census-year universe, a sample of manufacturing establishments is drawn

which are then surveyed in the five successive years commencing two years after the census-year. Thus, for example, the 1994-1998 ASM panel was drawn from the 1992 CM.

The sampling procedure for the ASM has followed the same general logic over 1972-1998.[3] Roughly speaking, large plants (plants with at least 250 employees in the CM) are chosen with certainty, medium plants are sampled with probabilities that increase with plant size, and small plants are excluded from the sample (their data are included in publications via administrative records). The small plants that are excluded from the ASM sample account for a large share of the number of establishments but a very small share of manufacturing employment (about 5 percent). New establishments are added to the ASM panel as it ages to incorporate births and to ensure representativeness. In addition, ASM processing adds in existing establishments that have been newly classified as manufacturing establishments. Thus the LRD is a series of contiguous five-year panels with annual data on many manufacturing establishments as well as census-year data on the universe of manufacturing data. The LRD contains roughly 300,000-400,000 establishments in census years and roughly 50,000-75,000 establishments in non-census years.

The panel nature of the ASM sample means one must take care when linking the data over time. While it is straightforward to link the certainty cases across panels, most of the non-certainty cases do not cross panels. We use a simple regression-based imputation procedure to estimate job creation and destruction rates for the first panel periods (both quarterly and annual). The imputation model rests on the assumption that the relationship between the creation (destruction) rates of noncertainty plants and certainty plants is time-invariant (controlling for the

[3] For the exact sampling rules, see ASM publications available from the Census website: www.census.gov. See also Davis, Haltiwanger, and Schuh (1996) for a detailed description concerning this and other issues discussed in this section.

total manufacturing employment growth rate). The imputation regressions are run by sector and predicted values are used to impute creation and destruction rates for plants that do not cross panels.

One other timing issue concerns quarterly production worker employment. The quarterly employment data collected by Census are collected for the weeks containing March 12th, May 12th, August 12th, and November 12th. The quarterly production worker employment is adjusted to account for the fact that first quarter data is collected in the third month of the quarter while data for other quarters is collected in the second month of the quarter. We adjust for the uneven sampling intervals by randomly reassigning one fourth of the first-quarter employment to the previous quarter.

2.1 Establishment Births and Deaths

One of the innovations in our update to the job creation and destruction series is our verification of the birth and death status of an establishment using the LBD. In non-Census years, an establishment that appears (disappears) from the sample may have done so for reasons other than being a true birth (death). For example, an establishment might have existed for a while but has been newly classified in the manufacturing sector and hence added to the ASM. In the earlier versions of the job creation and destruction series, we identified births and deaths using data only from the LRD. In the current version, we identify establishment births and deaths using the LRD and then use the LBD to verify whether the births and deaths were accurately measured.

Our new panel covers the time period in which industry classification switched from the Standard Industrial Classification (SIC) to North American Industrial Classification System

(NAICS). The 1997 CM was collected under SIC but published under NAICS and the 1998 ASM was collected and published under NAICS. Thus in 1998, establishments that were no longer classified as manufacturing under NAICS were removed from the ASM panel and a small sample of establishments that were newly classified as manufacturing under NAICS were added to the ASM panel. The number of single unit births captured in the 1998 ASM is lower than usual. Although this did not appear to be directly related to the switch to NAICS, we did make adjustments for this. Using the LBD to measure the true number of births in the manufacturing sector for 1998, we adjusted the weights applied to these births accordingly by applying the average ratio of ASM to LBD births found for 1995-1997 to 1998.

As described in detail in the Technical Appendix of Davis, Haltiwanger, and Schuh (1996), quarterly establishment births and deaths are inaccurately concentrated in the first quarter of each year. Many of these births and deaths actually occurred at some point in the previous year, but were only measured in the first quarter of the current year due to differences in timing of Census data collection. We retime these first-quarter births and deaths by randomly redistributing them over the quarters of the previous year. The procedure that we use imposes the same job creation and job destruction patterns on the retimed plants as are evident in the continuing plants. The quarterly retiming weights vary by year and four-digit industry.

In the current panel, we also found that changes in quarterly employment are inaccurately concentrated in the first quarter of our new panel (1994-1998 panel). We call these cases in which there is no employment change within a year but only changes across years flatliners because they have zero employment growth within the affected year. We retime the employment changes in these quarters using the same type of method used to retime births and deaths.

2.2 Job Creation and Destruction Measures

The LRD contains information concerning annual total employment, quarterly production worker employment, production worker wages, industry classification, location, ownership type, and capital, materials, and energy usage. Therefore we are able to calculate gross job flows over a variety of plant characteristics. In addition to calculating gross job flows for the total manufacturing sector, we also calculate gross job flows for the following plant characteristics: establishment age, firm age, industry, location, establishment type, and wages.

For any classification of businesses by type *s*, job creation represents the employment gains from all expanding establishments including startups and job destruction represents the employment losses from all contracting establishments including shutdowns. The employment growth rate (g_{est}) at an establishment *e* of type *s* in time *t* is the change in employment between *t* and *t-1* periods divided by the average employment in the two time periods (denoted by Z_{est}). This growth rate is symmetric and bounded between -2 and 2.[4] All measures are expressed as rates and all measures are constructed on an employment share basis (where the employment share is Z_{est} / Z_{st}). Note that in all cases, ASM sample weights are used as well so that the statistics are appropriately representative. Thus the job creation (POS) and job destruction (NEG) rates for establishment type *s* in time *t* are defined in the following manner:

$$POS_{st} = \sum_{e \in S^+} \frac{Z_{est}}{Z_{st}} g_{est} \qquad NEG_{st} = \sum_{e \in S^-} \frac{Z_{est}}{Z_{st}} | g_{est} |$$

Where:

$$Z_{est} = .5(X_{est} + X_{es,t-1}) \qquad g_{est} = \Delta X_{est} / Z_{est}$$

[4] The desirable features of this growth rate measure are discussed in Davis, Haltiwanger and Schuh (1996). The underlying statistical properties are discussed in detail in Tornqvist, Vartia and Vartia (1985).

The net employment growth rate (NET) is simply the job creation rate less the job destruction rate. Similarly, the measure of total job reallocation (SUM) is the sum of the job creation and job destruction rates.

In addition to the job creation and destruction statistics and the classification variable *s*, we also release the employment share for the sector. It is possible to decompose job creation (destruction) into job creation (destruction) from continuers and job creation (destruction) from establishment births (deaths). Due to disclosure issues, we are only able to release these more detailed job creation and destruction rates for broad sectors (e.g., two-digit industry and total manufacturing).

3. Gross Job Flows for Total Manufacturing

In this section we present the gross job flows for total manufacturing for the period 1972-1998. The data used for 1972-1993 are the previously released data (the earlier employment data are not revised).[5] We first present results for the annual and quarterly gross job flows and then compare our job flows with job flows derived from other data sources. We compare our *net* employment growth rates to those from the LBD and from BLS' Current Employment Statistics. We also compare our annual data to job flows derived from the LBD and our quarterly data to job flows derived from BLS' Business Employment Dynamics data.

3.1 Annual Gross Job Flows

[5] Revisions in the imputation procedure will mean that first panel periods prior to 1994 may differ slightly when comparing job flows by plant characteristics to total or industry job flows.

Figure 1 shows the annual gross job flows for the manufacturing sector. The top panel shows the job creation (POS) and job destruction (NEG) rates. The middle panel decomposes the job creation rate into job creation from continuers (POSC) and the job creation from startups (POSB). The bottom panel decomposes the job destruction rate into job destruction from continuers (NEGC) and the job destructions from shutting down businesses (NEGD).

Casual observation of the top panel of the figure reveals that the 1994-1998 data are unusual in that job creation rates are higher than job destruction rates for much of the time. It is also evident that the usual pattern of job creation and job destruction rates moving in opposition no longer holds by the end of the latest ASM panel. The middle panel of Figure 1 shows that the volatile time series pattern for job creation in the last years has mostly been driven by job creation rates for continuers. Job creation rates due to new establishments have been steadily rising since 1991 except for a reversal in 1998. Job creation rates for continuers and new establishments both show a pronounced decline in 1998. The time series pattern for job destruction in the last few years has been driven by both continuers and shutting down plants.

Table 1 shows the summary statistics for the annual gross flows for the entire sample period, the earlier data (1973-1993), and the new panel of data (1994-1998). The figures in the table confirm the impression from the plots in Figure 1 that the job flow trends in the latest panel are very different from the earlier period as a whole. The manufacturing sector experienced positive net employment growth over the new ASM panel (Row 3). The variance of POS and NEG are also lower over the new ASM panel and the correlation between them is positive over this period.

If one compares the new ASM panel to a time period that is similar based on its place in the business cycle, the new ASM panel is still rather unusual. The NBER dates the last three

recession troughs at November 1982, March 1991, and November 2001. Thus the new panel of data covers five years of data approximately three years after the business cycle trough. A comparable time period then is 1985-1989 that starts approximately three years after the 1991 trough. One difference in the two time periods is that net employment growth is negative during the earlier time period. One similarity in the two time periods is that variance of POS and NEG markedly declines during these periods. However, during the earlier time period the variance of NEG is still larger than that of POS. In addition, in the earlier time period the correlations between POS and NEG and NET and SUM are negative.

As noted in the Introduction, this extended period of positive net employment growth and comovement between job creation and job destruction was last seen in the late-1970s. As compared to the entire earlier time period, the latest ASM panel also has higher than average job creation rates and lower than average job destruction rates.

3.2 Quarterly Gross Job Flows

Figure 2 shows the seasonally adjusted quarterly gross job flows for the manufacturing sector. (The quarterly series publicly available are not seasonally adjusted.) Recall that the employment data available at the quarterly frequency is for production workers only. The quarterly job creation and job destruction rates for production workers show the same general time series pattern as for the total workers annual rates. Job creation and job destruction rates move in opposition until 1997 when they begin to move together.

Panel A of Table 2 shows the summary statistics for the quarterly gross flows for the entire sample period, the earlier data (1972:1-1993:4), and the new ASM panel (1994:1-1998:4). As was the case for the annual data, the figures in the table confirm the impression from the plots

that the job flow trends in the latest panel are very different from the earlier period as a whole. Notice again, that there is positive net employment growth, lower variances in job creation and destruction in the new panel relative to the earlier data, and the correlation between job creation and destruction is positive. However, unlike for the annual data the variance of job destruction is still higher than it is for job creation and thus the correlation between NET and SUM is negative.

As we did for the annual data, we compare the new ASM panel to a time period that is similar based on its place in the business cycle (1985:1-1989:4). One difference in the two time periods is that net employment growth is negative during the earlier time period. In addition, the correlation between POS and NEG is positive during the most recent panel while it is negative over the earlier panel. However, in both panels the variance of NEG is larger than that of POS and the correlation between NET and SUM is negative.

To obtain a longer time series, the quarterly series reported in Figure 2 are spliced together with the BED series and the older BLS Labor Turnover Survey (LTS). Faberman (2006) and Davis, Faberman and Haltiwanger (2006) offer a detailed discussion of the splicing method. Figure 3 shows the resulting spliced series for the 1947-2005 period and Panel B of Table 2 shows the summary statistics for the series. Figure 3 shows pronounced spikes in job destruction rates during employment downturns, as stressed by Davis and Haltiwanger (1990, 1992). Figure 3 also shows a long downward slide in job creation rates before, during, and well after the 2001 recession. There is no such downward slide in job creation rates during or after the 1990-1991 recession. Moreover, the 58-year time series for manufacturing shows no comparable episode with a sustained downward drift in gross job creation rates coupled with declining employment. Judging by the available evidence, such a long slide in job creation rates is not a feature of any other recession in the postwar era. However, these patterns (as well as related patterns shown in

Davis, Faberman and Haltiwanger (2006) using data for the private sector for the 1990-2005 period) suggest that the recent slide in job creation rates is part of a longer-term fall in the overall magnitude of job flows. Davis et al. (2006) provide additional evidence for this view. They document large trend declines since the mid-1970s in the cross-sectional dispersion of employment growth rates and in the volatility of business growth rates.[6]

3.3 Comparison of Net Employment Growth Rates

In this subsection, we compare the manufacturing net employment growth rates from the LRD, the LBD, and the Current Employment Statistics (from BLS). As can be seen from Figure 4, which plots the net employment growth rates from all three sources, the net employment growth rates track each other closely over time. The correlations for all three variables are all above 0.80.[7] The one noticeable exception to the series similarities occurs in 1981-1982 where the LBD shows spikes that the other data series do not. According to the researchers who developed the LBD, these two spikes are the result of a temporary change in the editing methodology of the LBD and should be ignored. It is reassuring to see that the net employment growth rates from three very different data sources are in such close agreement.

3.4 Comparison to Longitudinal Business Database

In this subsection, we compare the annual gross job flows from the LRD to those for the manufacturing sector of the LBD. Figure 5 shows the job creation rates (upper panel) and job

[6] Recent studies by Comin and Philippon (2005) and others find a trend increase in volatility among publicly traded firms. Davis et al. (2006) show that rising volatility among publicly traded firms is overwhelmed by declining volatility among privately held firms, which account for about 70 percent of private business employment.

[7] The correlations are as follows: correlation (LRD, LBD) = 0.81, correlation (LRD, BED) = 0.96, and correlation (LBD, BED) = 0.86.

destruction rates (lower panel) for the LRD and LBD. Interestingly, the job creation and job destruction rates using the LRD are consistently below their LBD counterparts. This difference perhaps reflects the higher job creation and destruction rates of very small manufacturing plants that are in the LBD but not covered by the LRD. The job creation rates from the LRD generally show the same time series patterns as do the LBD series. Job destruction rates from the LRD very closely track those from the LBD.[8]

3.5 Comparison to Bureau of Labor Statistics Data

Recall that BLS has created a longitudinal version of the Quarterly Census of Employment and Wages that is known as the Business Employment Dynamics (BED) data. The BED provides quarterly job flows for the private sector from 1994 to the present by broad industry and region. Faberman (2006) and Davis, Faberman and Haltiwanger (2006) extend the historical data for this series and hence our job flows series from the BED start in 1990. We have already used the spliced version of these data in Figure 3. However, it is useful to take a step back and compare the unspliced series from the BED to the LRD in the overlap period.

Figure 6 compares the manufacturing quarterly job flows from the BED to their LRD counterparts. The BED and LRD series in the plot have been seasonally adjusted (and were adjusted using the same method). The series track relatively closely suggesting that very small manufacturing plants which are present in the BED but absent from the LRD do not greatly impact job creation and job destruction rates, at least at a quarterly frequency. We do find that that the LRD job flows are more volatile. The variance of the job creation rate is 0.07 for the

[8] The deviation in the 1981-1982 net employment growth rates is revealed to be due to a spike in job destruction in 1981 and a spike in job creation in 1982 for the LBD.

BED and 0.32 for the LRD for 1990:2-1998:4. The variance of the job destruction rate is 0.44 for the BED and 0.55 for the LRD for 1990:2-1998:4.

4. Gross Job Flows by Plant Characteristics

In this section, we examine gross job flows over the following establishment characteristics: firm and establishment age, industry, ownership type, wage class, and location.

4.1 Age

As noted earlier, the development of the LBD allows us to improve our measures of births (and deaths). In addition to providing greater scope of coverage (the entire economy as opposed to manufacturing), the LBD provides more frequent full coverage (every year as opposed to every five years for the Economic Census). We use the first year in the LBD to identify true births and to establish a plant's age. In addition to measuring establishment age, we also measure firm age. The firm age is the maximum of the ages of all of the manufacturing establishments under that firm identification. From the establishment and firm ages, we create broad age classes and detailed age classes. The broad age classes are 0-3, 4-8, and 9 or more years old. The detailed age classes are 0-1, 2, 3, 4, 5-8, 9-14, and 15 or more years old. These age classes are not directly comparable to those published in Davis, Haltiwanger, and Schuh because the classes are defined slightly differently (and the detailed age classes use a different set of data for measuring age).

Table 3 presents summary statistics for annual gross job flows for broad age classes (Panel A) and detailed age classes (Panel B) as defined for establishments. As Davis, Haltiwanger, and Schuh found, younger plants experience noticeably higher job creation and

destruction rates. The job creation rates for the youngest age class (whether the broad or detailed measure) are especially high in the new ASM panel. The average job creation rate for youngest plants as measured using the broad measure in 1973-1993 is 30.9 percent but it is 45.8 percent for 1994-1998. As in the past, the average reallocation rate for the youngest age class is much higher than for the other classes in 1994-1998, but in the latest ASM panel the gap between youngest and the other classes is even larger. The average reallocation rate for the youngest age class is 46% in 1973-1993 and increases to 61% in 1994-1998 (while the reallocation rates for the other classes have essentially stayed the same). The net employment growth rates for the youngest class are usually positive but very volatile. They are strongly positive over much of the entire new panel of data. In contrast, the net employment growth rates of the oldest class of establishments are usually negative and are negative in all but on year in the new panel of data.

The detailed age measure shows that the increase in job creation rates is concentrated in births and newly born establishments. The job creation rates for 2-4 year-old plants are actually slightly lower in the new panel than in the earlier period. Much of the improvement in net employment growth rates in 1994-1998 has apparently come from new and relatively young establishments.

Figure 7 shows the job creation and destruction rates for the broad establishment age classes. Note that the scale on the vertical axis differs across the job creation and job destruction plots. The figure shows that not only do the youngest plants have higher job creation rates, their job creation rates are also much more volatile than for the older plants. Job destruction rates for younger plants are also higher and more volatile than for older plants but the differences are not as dramatic.

4.2 Industry

We also measure job flow rates for industry at the four-digit industry level and the two-digit industry level. There are twenty two-digit industries and about 450 four-industries in the manufacturing sector.[9] We focus on the two-digit industries in this paper. One of the biggest differences in the new ASM panel as compared to the earlier time period, is the number of industries which experience positive net employment growth rates. Only one industry experienced positive average annual net employment growth in 1973-1993, while fourteen industries experienced positive average annual net employment growth in 1994-1998.

Table 4 shows the summary statistics for job creation and job destruction rates for two-digit industries. It is clear from the table that job reallocation is prevalent in all of the industries of the manufacturing sector. Nevertheless, one of the other features of the data is the heterogeneity of industries. Some industries have relatively low reallocation rates. For example, Tobacco, Printing, Chemicals, and Petroleum all have average reallocation rates that are less than 15 percent while Lumber and Apparel have average reallocation rates that are more than 25 percent for the full sample. In the latest ASM panel, the reallocation rate for Apparel is 31 percent.

Figure 8 plots the job creation and job destruction rates for three of the twenty industries. The top panel shows the job flows for the Apparel industry. Apparel has the highest average reallocation rate of all of the industries in the latest ASM panel. As is evident from the plot, Apparel's high reallocation rate is due to very high job destruction rates and high job creation

[9] The industry classifications used in this paper are Standard Industrial Classification (SIC). During the time period covered by the paper, there have been two major revisions to the classification system. In 1987, the SIC was revised and in 1997 the Census Bureau adopted the North American Industrial Classification System (NAICS). The four-digit data series that we have created uses 1972 SIC until 1986 and 1987 SIC until 1998. We also publish a four-digit series in which we have backcast the 1987 SIC series so that there is one consistent industrial classification over our entire sample period of 1972-1998.

rates. The high destruction rates dominate and yield an average annual net employment growth for this industry over the entire time period of –4.0 percent. On the other hand, Primary Metals (middle panel) and Transportation (lower panel) both have positive average annual net employment growth in the most recent panel of data. The average reallocation rate for Primary Metals has dropped in the latest panel so that Primary Metals has one of the lowest reallocation rates. The average reallocation rate for Transportation, on the other hand, has stayed relatively fixed over the earlier period and the latest panel.

4.3 Ownership Type

Census collects information on the firm that owns each manufacturing establishment making it possible to classify plants based on whether they are part of a single unit firm or a multi establishment firm. While most establishments in manufacturing are single unit firms, employment in manufacturing is concentrated in establishments that are part of multi unit establishment firms (hereafter called multi units). Although the percent of employment at multi units drops in our latest panel of data, from 78 percent on average in 1973-1993 to 74 percent on average in 1994-1998, multi units still dominate in terms of employment.

As is evident from Table 5, single units are subject to greater employment churning than are multi units. On average, single units have a reallocation rate of 25 percent while multi units have a reallocation rate of 17 percent. Interestingly, in the earlier years both types of establishments have negative net employment growth on average but in the recent panel years, single units have strong positive net employment growth on average. The strong positive net employment growth of single units might be related to their relative age. Young establishments

tend to be single units and we have seen that young establishments have especially strong net employment growth in the most recent panel.

Figure 9 shows the job flows by establishment type. It is evident from these plots that job creation rates higher and more volatile for single units than for multi units. There are numerous times in which job creation for single units has an upward spike that is not evident in multi units. Job destruction rates for single units are also generally higher than they are for multi units, but there are periods in which the rates become close.[10] Interestingly, upward spikes in the job destruction rates generally appear of both single units and multi units, but the spikes in job destruction for multi units some times lag one year behind the single units (e.g., in 1982-1983, 1985-1986, 1993-1994, 1996-1997).

4.4 Wage Class

The Census Bureau also collects information on production worker wages in the CM and the ASM. We use this information to classify establishments based upon their place in the distribution of wages.[11] Summary statistics for job flows by wage class are shown in Table 6. As one moves from the highest to the lowest wage classes, the average rate of reallocation rises monotonically. Establishments in lowest wage class have an average reallocation rate of 29 percent while those in the highest wage class have an average reallocation rate of 16 percent for 1973-1998.

[10] We are not able to publish job flows based on size this time. We can use the multi unit designation as a crude measure of size. Recall that Davis, Haltiwanger, and Schuh (1996) had found that large establishments experience larger than average increases in job destruction during recessions.

[11] We compute wage quintiles by year from the hours-weighted distribution of plants' mean hourly wages for production workers.

Underlying this reallocation pattern are job creation and job destruction rates that increase monotonically as one moves from high wage establishments to low wage establishments. The differences in job destruction rates for the top three wage classes are more compressed than they are for job creation rates. Relative to the earlier time period, the reallocation rate for the lowest wage class increased while the reallocation rates for all of the other wage classes decreased. In the earlier time period, all wage classes had negative average annual net employment growth rates (with more negative rates for the larger classes). In the most recent panel, all of the wage classes have positive average annual net employment growth rates except the largest class.

Figure 10 shows the job flows by wage class for the lowest and highest wage class establishments. Confirming the evidence in Table 6, the upper panel shows that job creation rates are higher and more volatile for lower wage establishments. There also seems to be a slight upward trend in job creation rates for establishments in the lowest wage class. The lower panel of Figure 10 shows that job destruction rates are higher and more volatile for lower wage establishments. The volatility of the high wage establishments has declined over recent years.

4.5 Location

Our two measures of location are Census region and state. There are nine Census regions and 51 states (DC included). The nine Census regions are: New England, Middle Atlantic, East North Central, West North Central, South Atlantic, East South Central, West South Central, Mountain, and Pacific. Table 7 shows the summary statistics for job creation and job destruction by Census region. The Mountain and Pacific regions have the highest average reallocation rates of the regions. South Atlantic, East and West South Central, and East North Central all have

similar low reallocation rates. While all but one of the regions had negative average annual net employment growth over 1973-1993, in the most recent panel only two regions had negative average annual net employment growth.

Figure 11 shows the job creation and job destruction rates for the three most populous states (as measured by the 2000 Census), California, Texas, and Florida. The comovement in the 1990s between job creation and job destruction rates is especially evident in California and New York. For example, the correlation between job creation and job destruction for California changed from –0.67 in 1973-1993 to 0.31 in 1994-1998.

5. Summary

This paper provides an overview of updates to recently released job creation and destruction statistics for the U.S. manufacturing sector and comparisons to related data products that have recently been released as well. The basic patterns are similar to those discussed by Davis, Haltiwanger and Schuh (1996) using an earlier version of the data. The period of the 1990s covered by the new release includes a period of positive net employment growth in the manufacturing sector that has not been seen since the late-1970s. As in that earlier period of positive growth, we find that job creation and destruction rates have positive comovements. Moreover, job creation and destruction rates are less volatile and total reallocation rates are slightly lower than before. Reallocation rates are higher for younger, single unit, low wage establishments. These are still the establishments that have highest the job creation rates. We also still find heterogeneity in job creation and destruction rates by industry and by location.

In the time since the original job creation and destruction series were published, other data sources have become available for calculating job creation and job destruction. Comparing

our job creation and job destruction rates we find that they are consistent. Their consistency has allowed the construction of a longer time series (as reported in Faberman (2006) and Davis, Faberman and Haltiwanger (2006)). This longer time series shows a striking downward trend in job reallocation rates in the U.S. manufacturing sector over the post-WWII period.

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Table 1: Summary Statistics for Annual Gross Flows

Measure	1973-1998	1973-1993	1994-1998
Means			
Job Creation	8.87	8.71	9.53
Job Destruction	9.86	10.17	8.55
Net Employment	-0.99	-1.46	0.98
Job Reallocation	18.73	18.88	18.07
Variances			
Job Creation	3.57	4.06	1.34
Job Destruction	6.59	7.54	0.79
Correlations			
POS, NEG	-0.65	-0.68	0.29
NET, SUM	-0.38	-0.39	0.27

The reported mean is the simple average of the rate over the time period.

Table 2: Summary Statistics for Quarterly Gross Flows

Panel A: Using LRD Data

Measure	1972:2-1998:4	1972:2-1993:4	1994:1-1998:4
Means			
Job Creation	5.05	5.07	4.98
Job Destruction	5.27	5.47	4.41
Net Employment	-0.22	-0.41	0.57
Job Reallocation	10.32	10.54	9.39
Variances			
Job Creation	0.56	0.64	0.24
Job Destruction	1.57	1.65	0.31
Correlations			
POS, NEG	-0.19	-0.27	0.65
NET, SUM	-0.48	-0.45	-0.15

The reported mean is the simple average of the rate over the time period.

Panel B: Using Spliced Data

Measure	1947:1-2005:1
Means	
Job Creation	5.69
Job Destruction	5.81
Net Employment	-0.12
Job Reallocation	11.50
Variances	
Job Creation	0.89
Job Destruction	1.13
Correlations	
POS, NEG	0.05
NET, SUM	-0.12

The reported mean is the simple average of the rate over the time period.

Table 3: Summary Statistics for Annual Gross Job Flows by Establishment Age Class

Panel A: Broad Age Classes

Age Class	Job Creation			Job Destruction		
	1973-1998	1973-1993	1994-1998	1973-1998	1973-1993	1994-1998
0-3 years	33.8	30.9	45.8	14.9	14.7	15.6
4-8 years	11.4	11.5	11.3	12.9	13.2	11.5
9 and + years	6.7	6.7	6.8	9.2	9.5	7.9

For each age class, the reported mean is the simple average of the rate over the time period.

Panel B: Detailed Age Classes

Age Class	Job Creation			Job Destruction		
	1978-1998	1978-1993	1994-1998	1978-1998	1978-1993	1994-1998
0-1 years	65.2	57.1	91.2	10.9	10.7	11.3
2 years	18.8	19.5	16.3	17.7	16.1	22.7
3 years	13.8	13.9	13.3	16.8	17.5	14.5
4 years	13.0	13.2	12.5	14.2	14.8	12.4
5-8 years	10.8	10.7	11.0	12.6	13.2	10.4
9-14 years	9.3	9.0	10.1	10.7	11.3	8.8
15 and + years	6.0	6.0	6.1	9.1	9.6	7.5

For each age class, the reported mean is the simple average of the rate over the time period.
Note that detailed age classes start in 1978.

Table 4: Summary Statistics for Annual Gross Job Flows by Industry

Industry	Job Creation			Job Destruction		
	1973-1998	1973-1993	1994-1998	1973-1998	1973-1993	1994-1998
Food	8.4	8.4	8.3	9.0	9.3	8.1
Tobacco	5.1	5.0	5.7	8.5	8.6	7.8
Textiles	6.9	7.0	6.7	9.7	9.7	9.7
Apparel	11.2	10.8	12.6	15.2	14.4	18.3
Lumber	11.8	11.7	12.3	12.9	13.7	9.8
Furniture	10.1	9.8	11.0	10.6	11.0	8.9
Paper	5.9	5.8	6.2	6.3	6.5	5.7
Printing	8.7	8.4	9.6	8.6	8.5	8.6
Chemicals	6.7	6.6	7.2	7.3	7.4	6.8
Petroleum	5.9	5.9	5.9	7.8	8.0	6.7
Rubber	10.2	10.3	9.9	9.4	9.8	7.6
Leather	8.9	8.8	9.5	14.0	13.6	15.7
Stone, Clay	9.1	8.8	10.4	10.5	11.2	7.7
Primary Metals	6.4	6.3	6.7	8.7	9.5	5.5
Fab. Metals	9.3	9.1	10.1	10.2	10.9	7.5
Nonelec. Mach.	9.7	9.5	10.7	10.2	10.8	7.6
Elec. Mach.	9.5	9.3	10.5	9.7	10.1	8.2
Transport.	8.6	8.5	8.9	9.4	9.7	8.2
Instruments	8.4	8.3	8.7	9.1	9.0	9.5
Miscellaneous	11.0	10.6	12.3	12.5	12.8	11.1

For each industry, the reported mean is the simple average of the rate over the time period.

Table 5: Summary Statistics for Annual Gross Job Flows by Establishment Type

Type	Job Creation			Job Destruction		
	1973-1998	1973-1993	1994-1998	1973-1998	1973-1993	1994-1998
Single Unit	12.7	12.2	14.6	12.4	12.8	10.8
Multi Unit	7.6	7.6	7.8	9.1	9.4	7.8

For each type, the reported mean is the simple average of the rate over the time period.

Table 6: Summary Statistics for Annual Gross Job Flows by Wage Class

Wage Class	Job Creation			Job Destruction		
	1973-1998	1973-1993	1994-1998	1973-1998	1973-1993	1994-1998
Lowest	14.2	13.3	18.0	14.4	14.0	16.2
Low	10.6	10.3	11.8	10.7	11.1	9.2
Medium	9.6	9.5	10.3	9.7	10.2	7.7
High	8.5	8.4	8.9	9.1	9.6	6.9
Highest	6.8	6.8	6.7	9.0	9.2	8.1

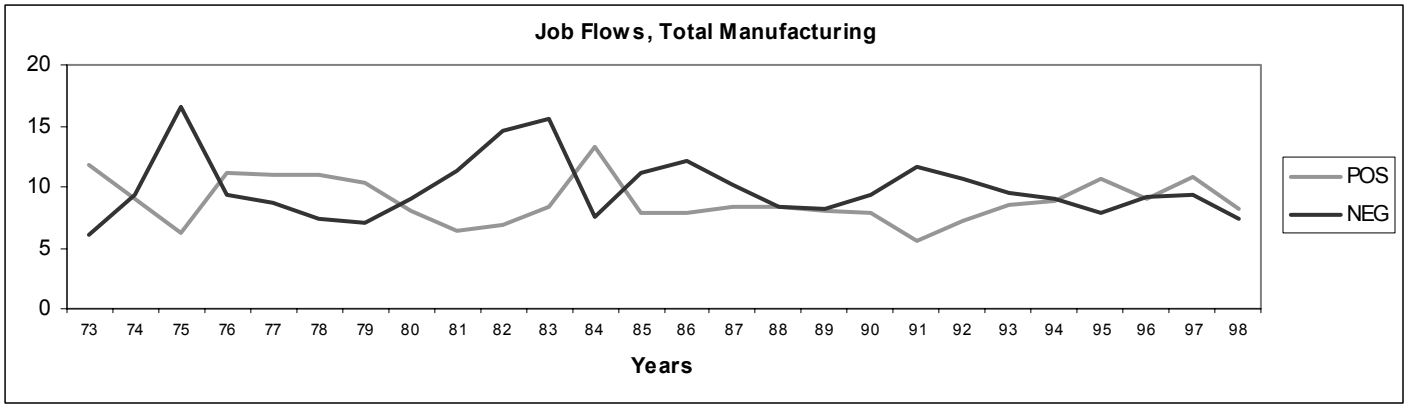
For each wage class, the reported mean is the simple average of the rate over the time period.

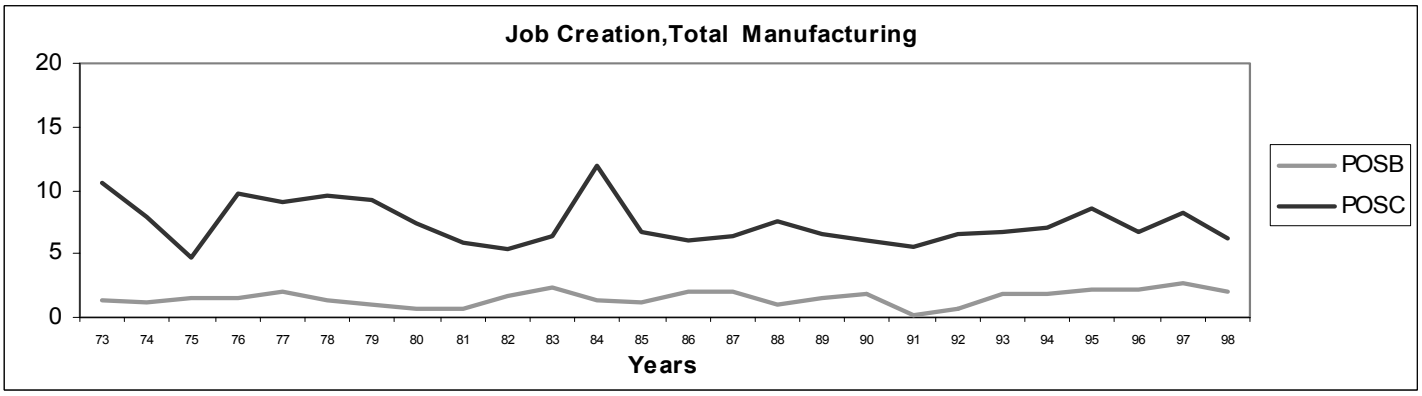
Table 7: Summary Statistics for Annual Gross Job Flows by Region

Region	Job Creation			Job Destruction		
	1973-1998	1973-1993	1994-1998	1973-1998	1973-1993	1994-1998
Northeast	8.5	8.3	9.5	10.0	10.3	8.8
Middle Atlantic	8.4	8.1	9.6	11.2	11.4	10.1
South Atlantic	7.9	7.8	8.5	9.4	9.9	7.1
E. South Central	8.9	8.7	9.4	8.8	9.1	7.3
W. South Central	8.3	8.4	8.2	9.0	9.2	8.3
E. North Central	8.8	8.7	9.1	9.2	9.3	8.6
W. South Central	9.6	9.5	10.1	9.8	10.1	8.3
Mountain	11.2	11.0	11.8	10.1	10.0	10.1
Pacific	11.1	10.8	12.0	11.7	11.9	11.1

For each region, the reported mean is the simple average of the rate over the time period.

Figure 1: Annual Job Flows for Total Manufacturing





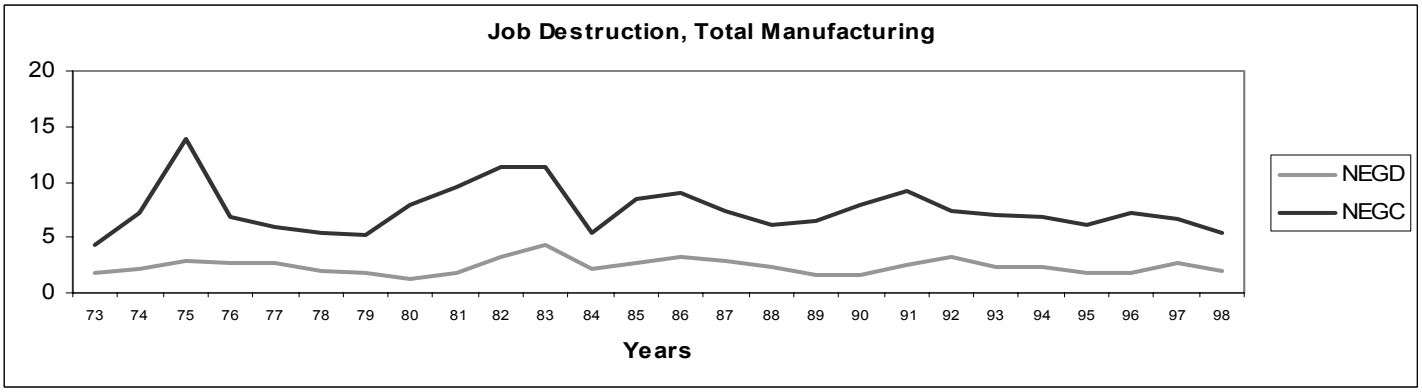


Figure 2: Quarterly Job Flows for Total Manufacturing

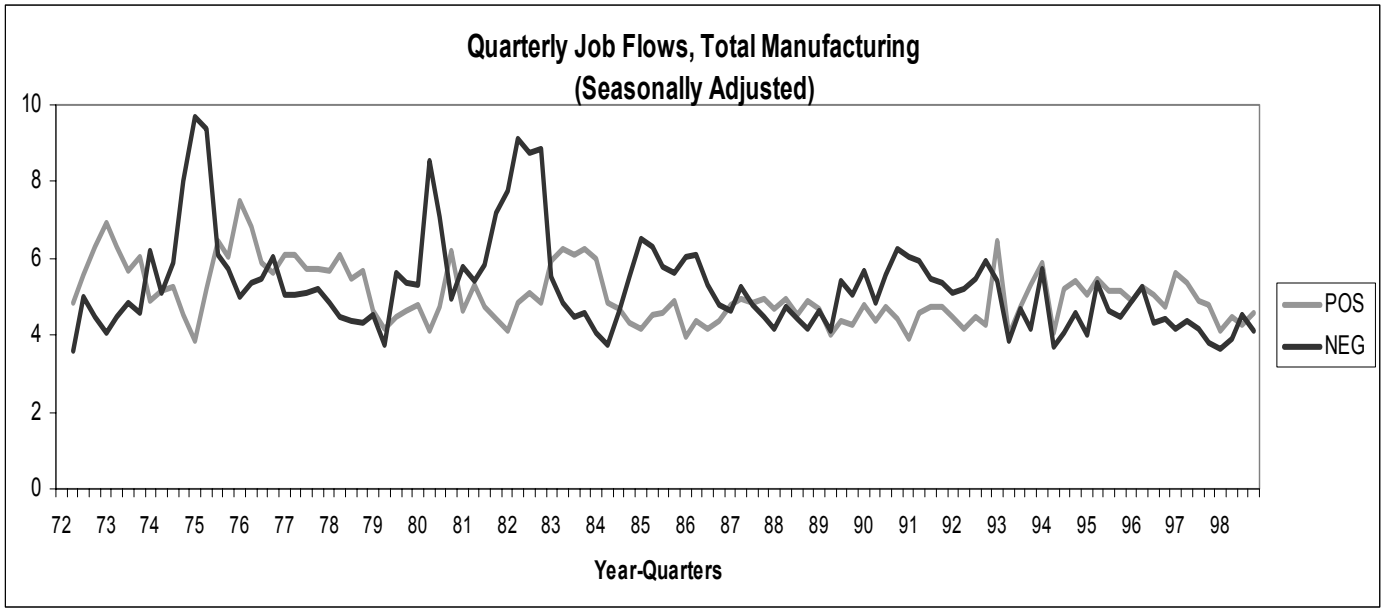
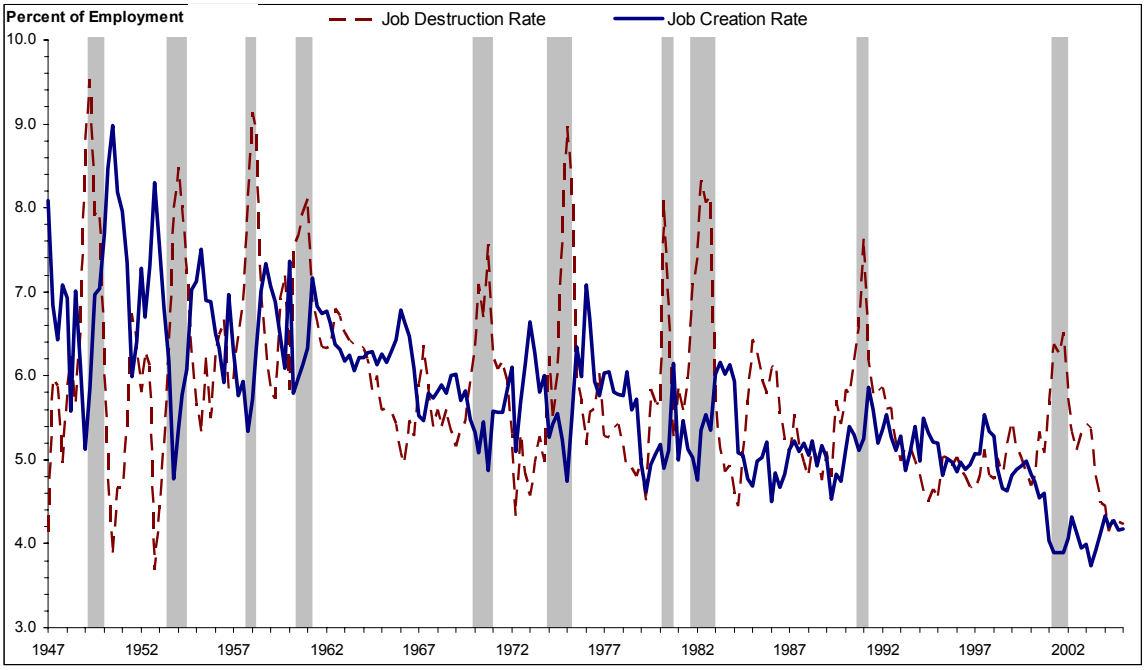


Figure 3: Quarterly Job Flows in Manufacturing, 1947-2005



Source: Faberman (2006) and Davis, Faberman and Haltiwanger (2006); tabulated from the BLS Business Employment Dynamics (BED) micro data from 1990 to 2005 and spliced to estimates using data from the BLS Labor Turnover Survey (LTS) and the Census Longitudinal Research Datafile (LRD). Shaded areas show NBER-dated recessions.

Figure 4: Comparison of Net Employment Growth Rates Across Data Sources

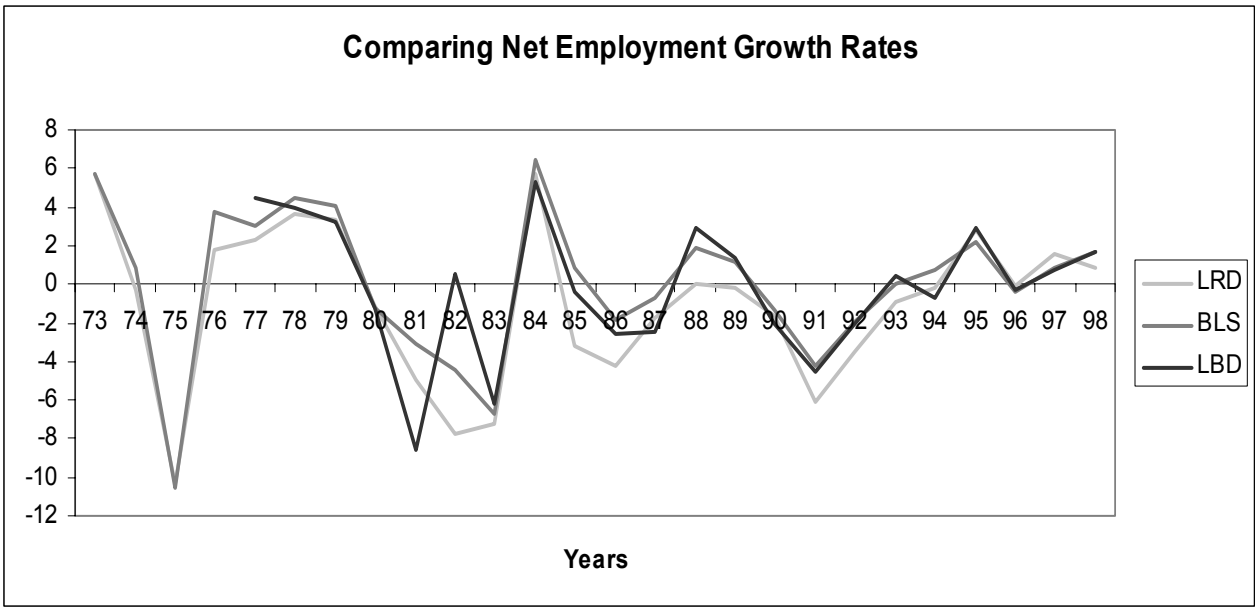
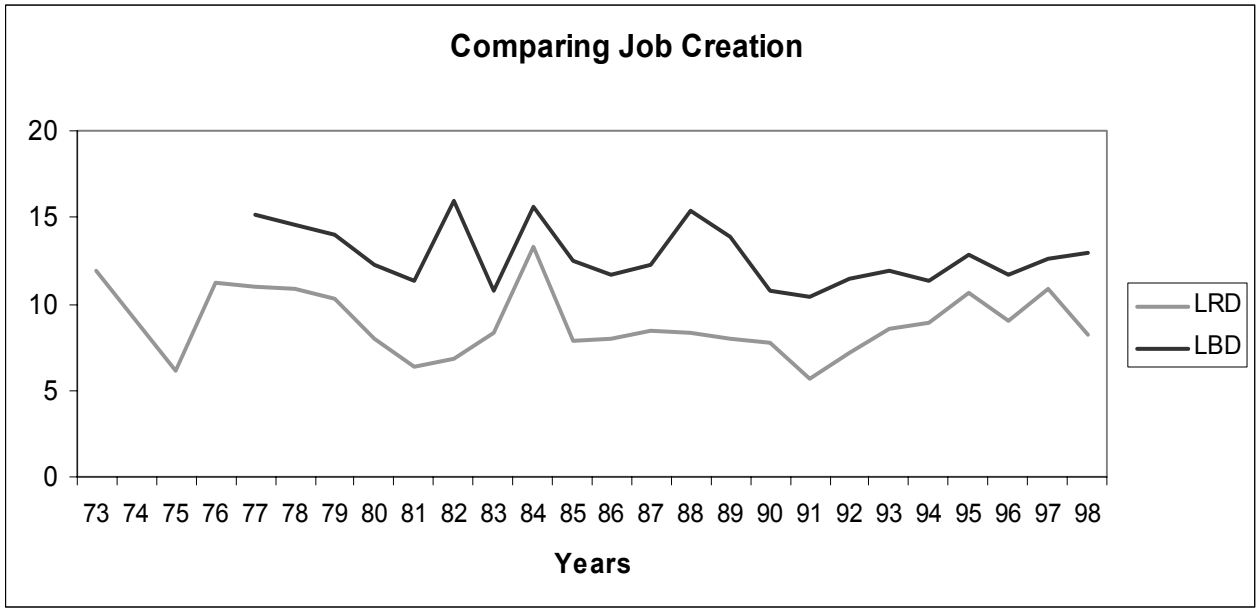


Figure 5: Comparison to the LBD for Job Flows



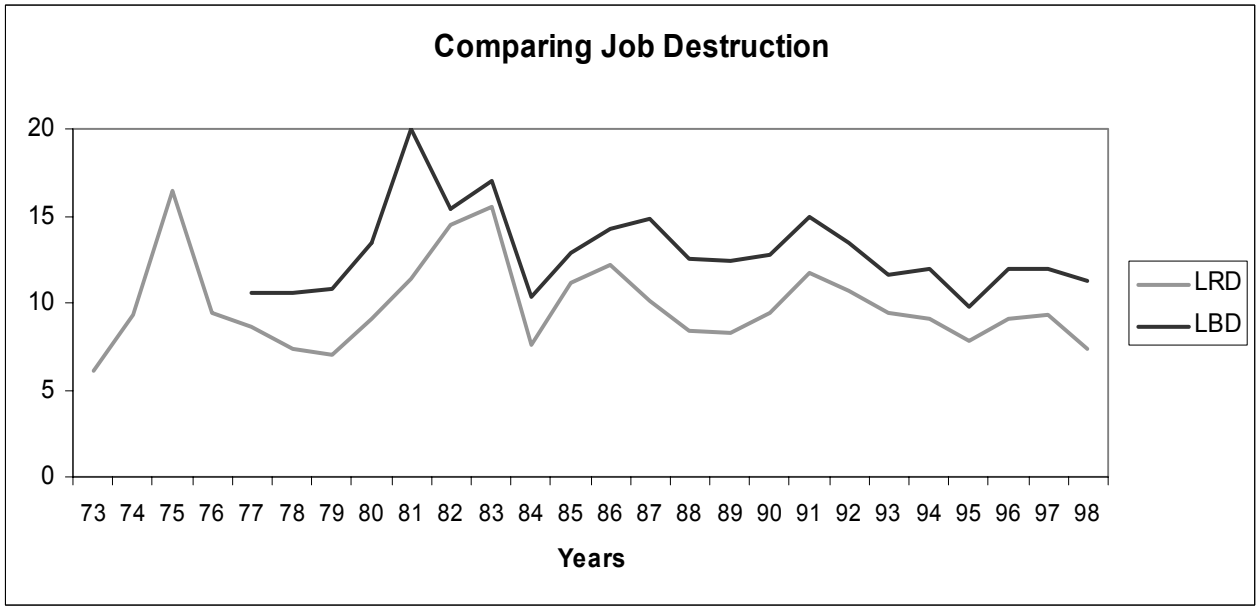
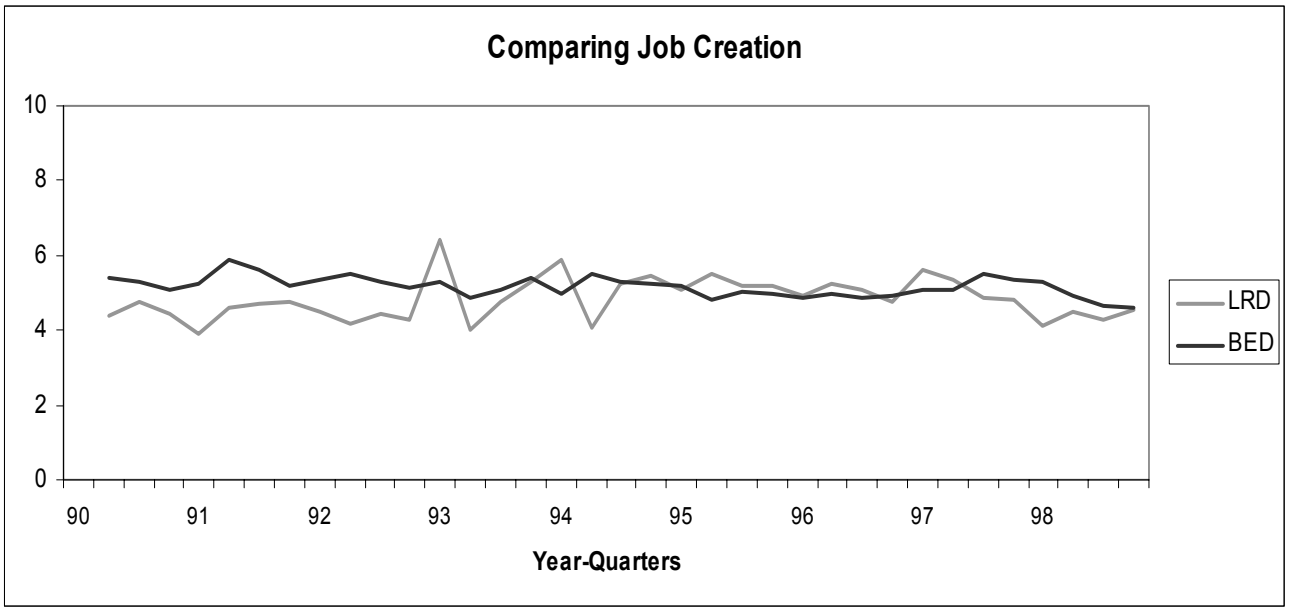


Figure 6: Comparison to the BED for Job Flows



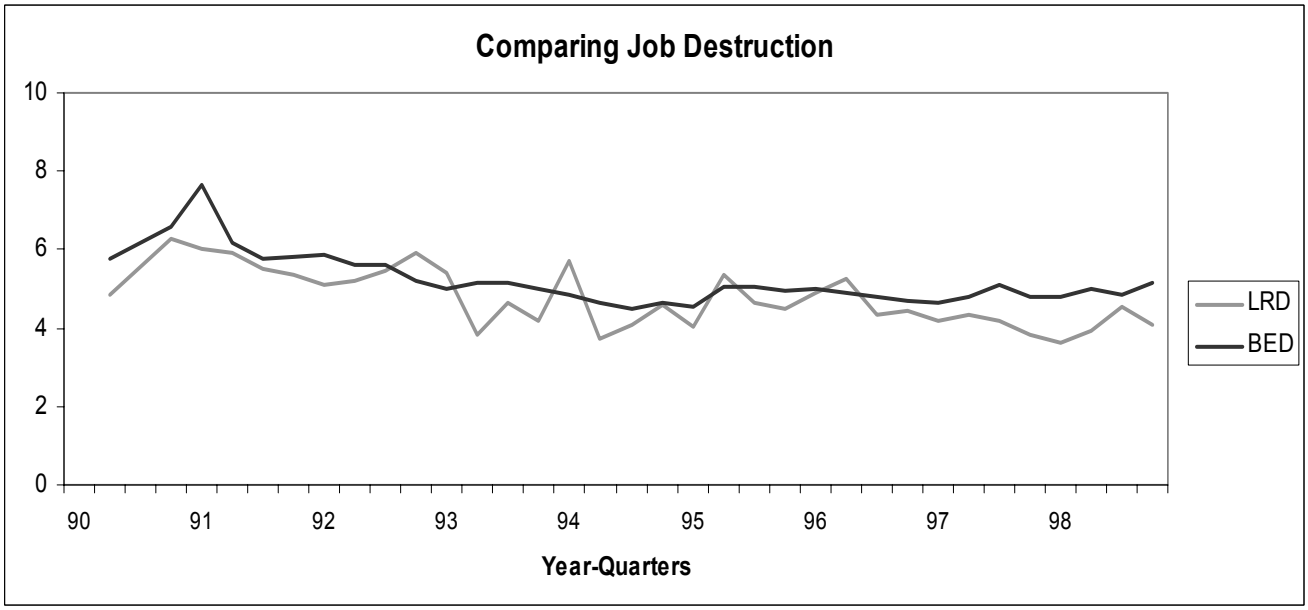
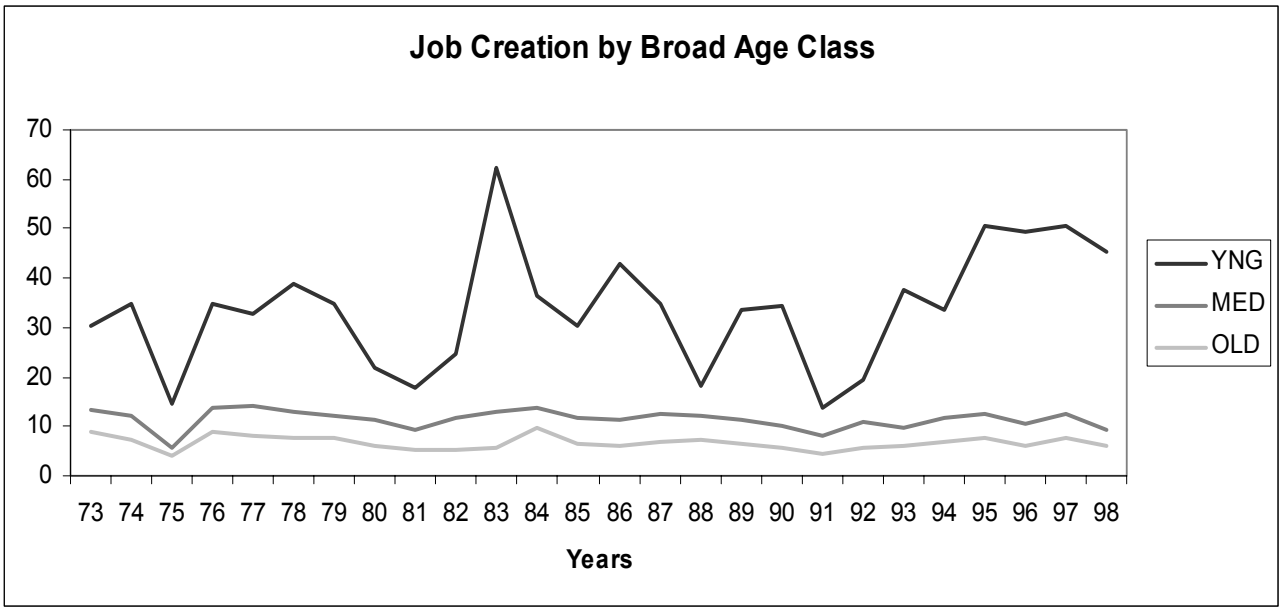


Figure 7: Job Flows by Broad Age Class
(Note scales differ over the two panels.)



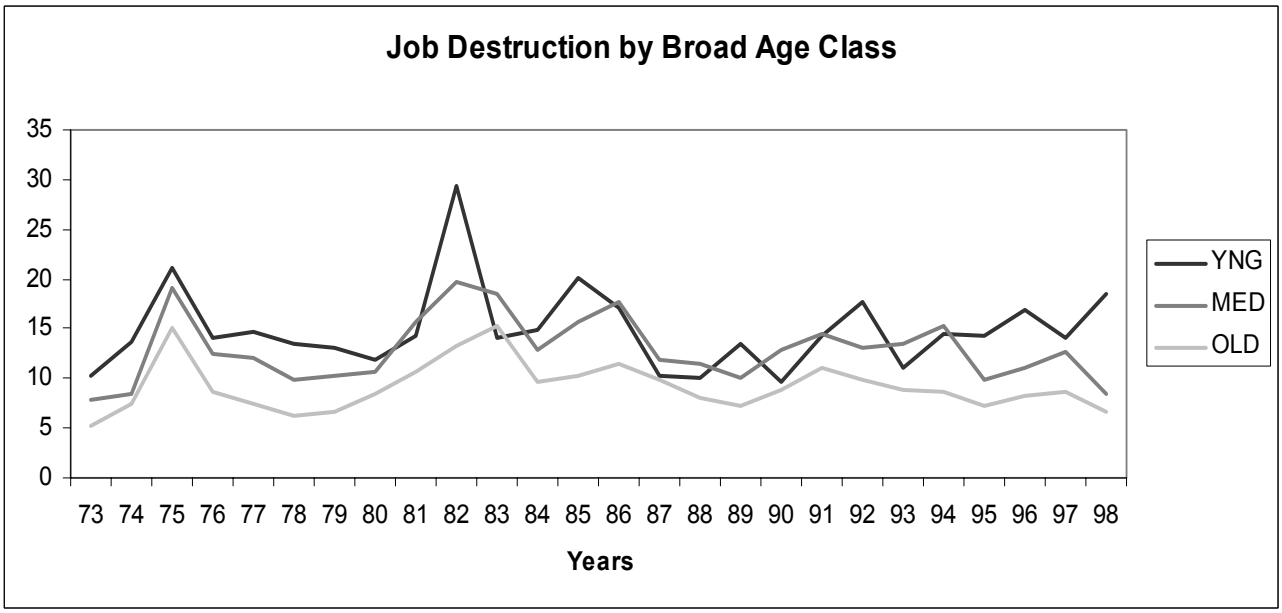
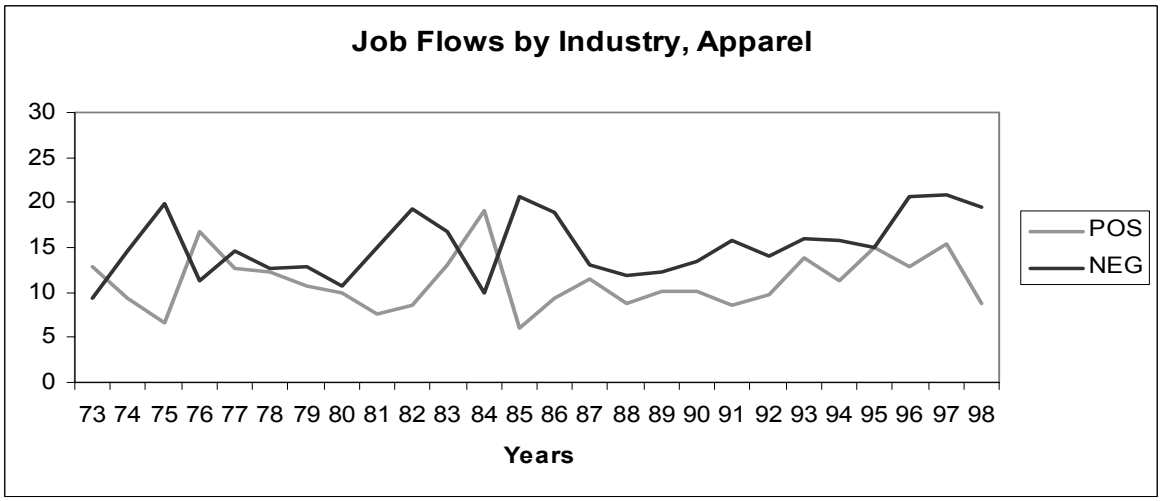
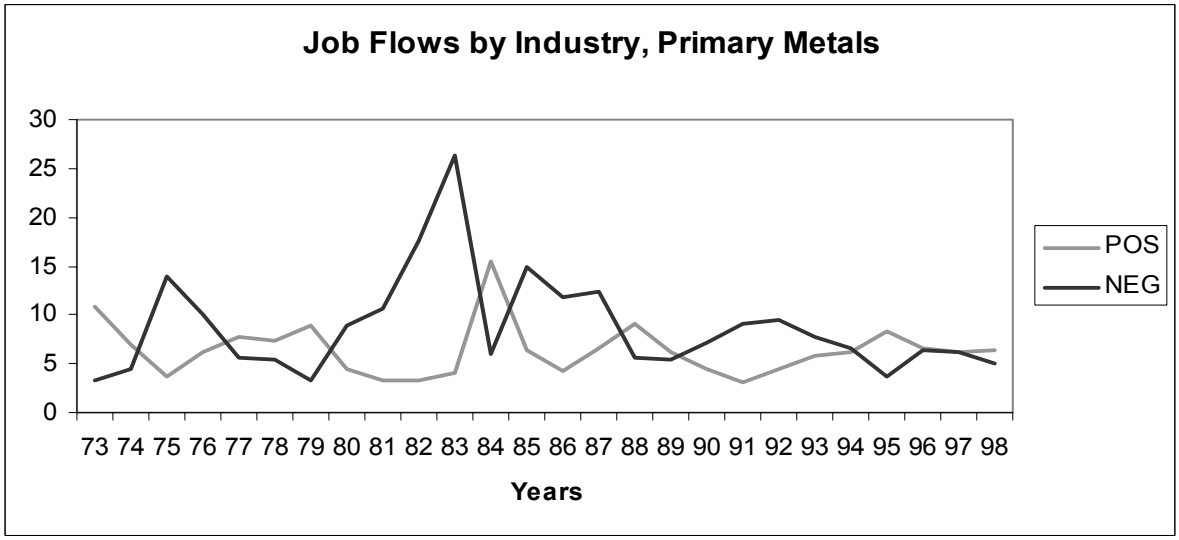


Figure 8: Job Flows for Selected Industries





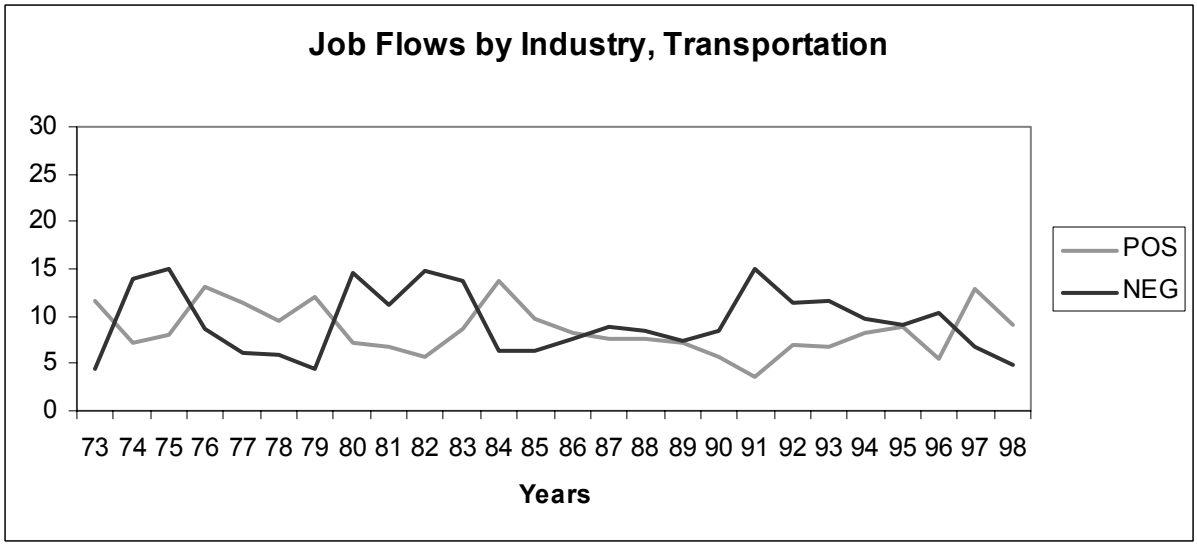
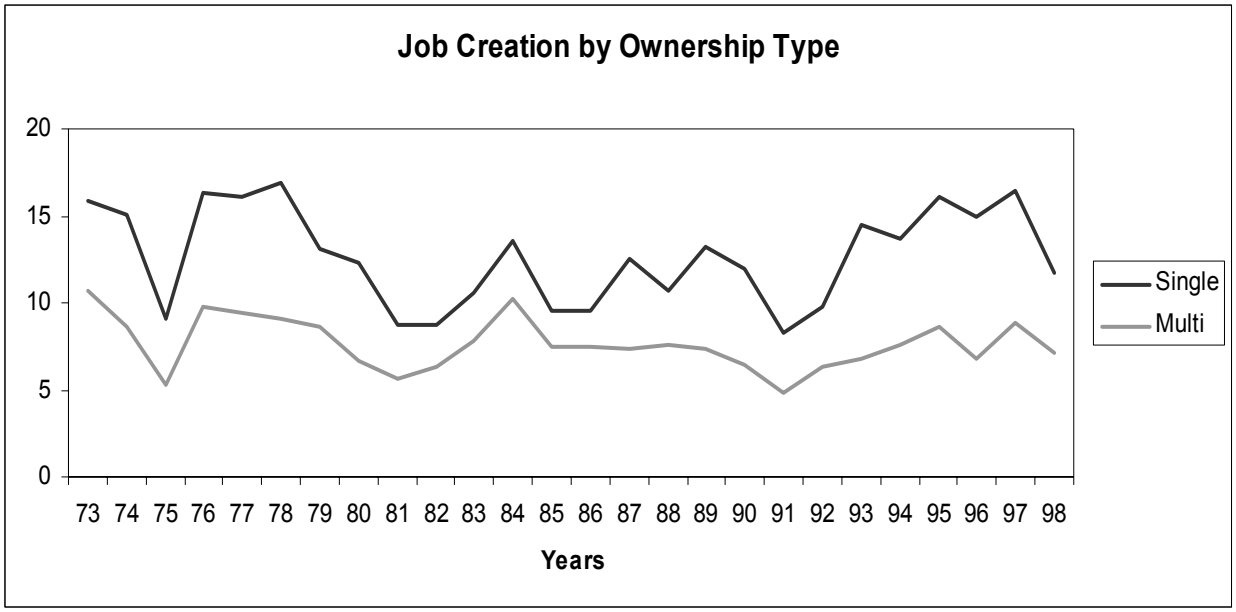


Figure 9: Job Flows by Single and Multi-Unit Establishments



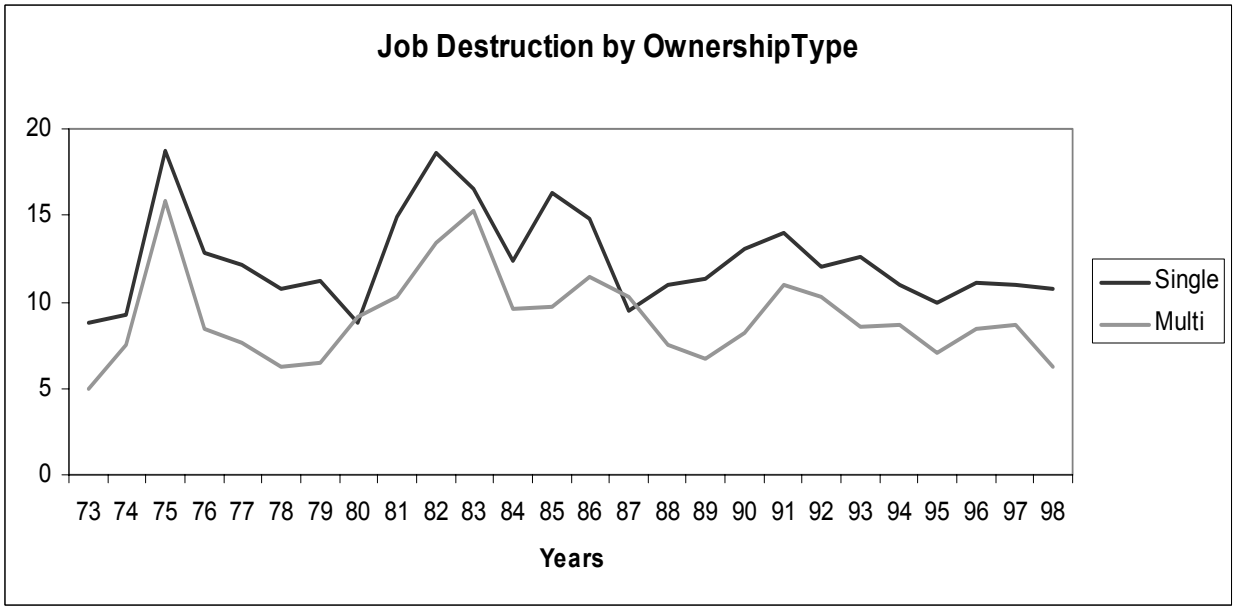
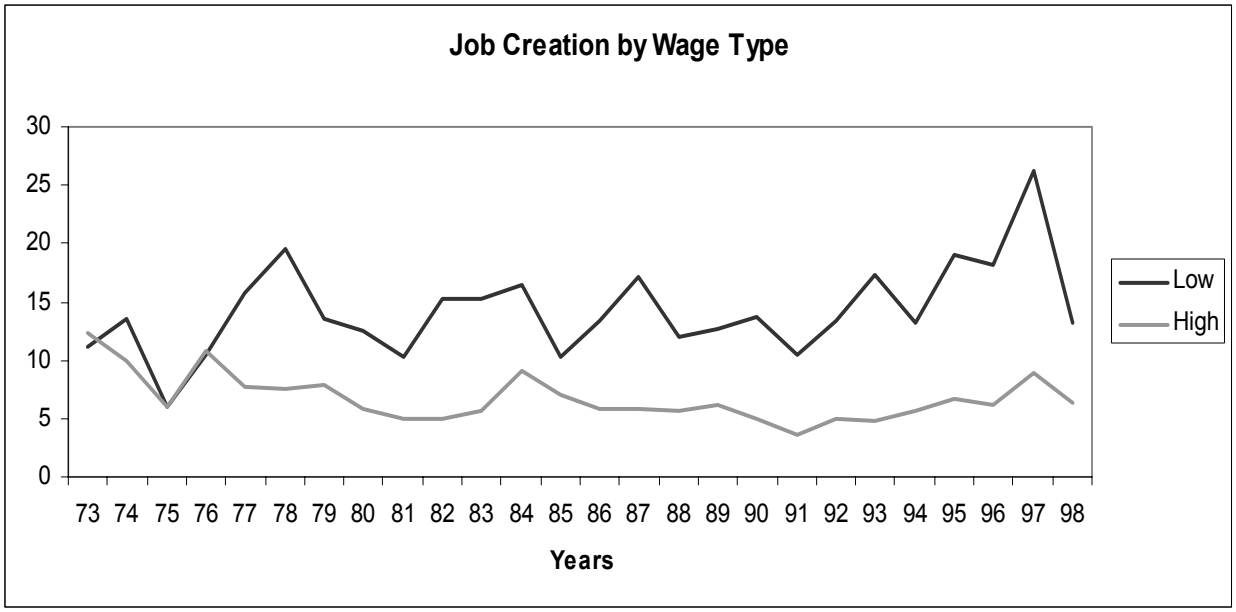


Figure 10: Job Flows by Wage Class



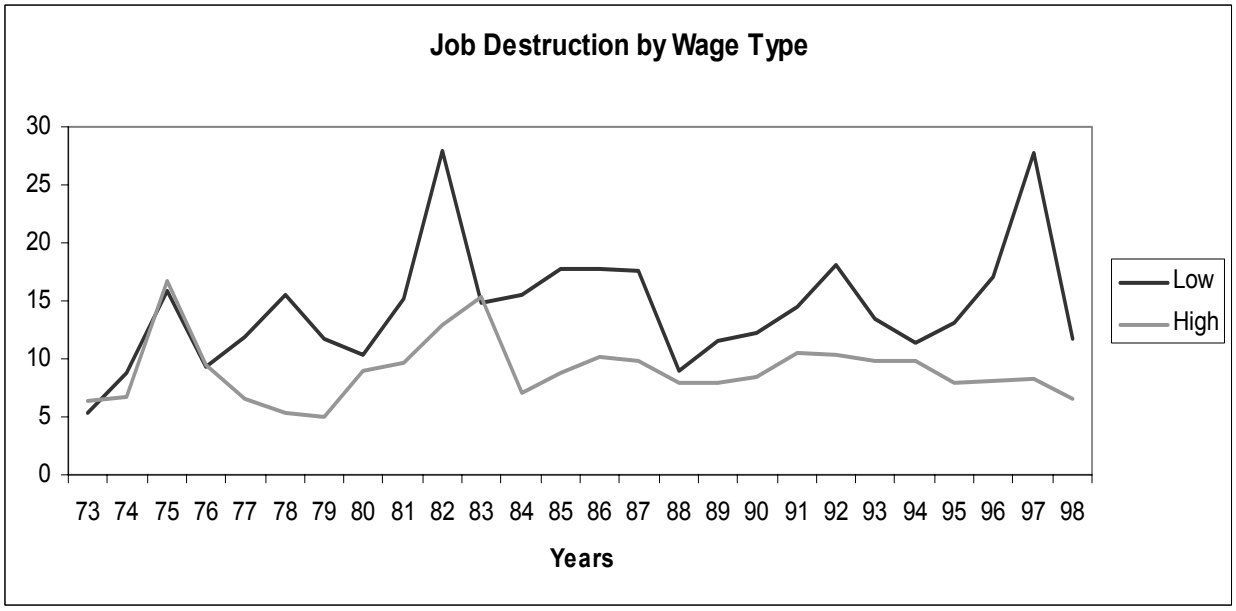


Figure 11: Job Flows for Selected States (Three largest states in terms of population.)