The Flow Approach to Labor Markets: New Data Sources, Micro-Macro Links and the Recent Downturn

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Abstract

New data sources and products developed by the Bureau of Labor Statistics and the Bureau of the Census highlight the dynamic character of U.S. labor markets. Private-sector job creation and destruction rates average nearly 8% of employment per quarter. Worker flows in the form of hires and separations are more than twice as large. The data also underscore the lumpy nature of micro-level employment adjustments. More than two-thirds of job destruction occurs at establishments that shrink by more than 10% within the quarter, and more than one-fifth occurs at those that go to zero employment.

Our study also uncovers highly nonlinear relationships of worker flows to employment growth and job flows at the micro level. These micro relations interact with movements over time in the cross-sectional density of establishment growth rates to produce recurring cyclical patterns in aggregate labor market flows. Cyclical movements in the layoffs-separation ratio, for example, and the propensity of separated workers to become unemployed reflect distinct micro relations for quits and layoffs. A dominant role for the job-finding rate in accounting for unemployment movements in mild downturns and a bigger role for the job-loss rate in severe downturns reflect distinct micro relations for hires and layoffs.

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I. Introduction

More than ten percent of U.S. workers separate from their employers each quarter. Some move directly to a new job with a different employer, some become unemployed, and some exit the labor force. The flow of new hires is similarly large, and somewhat larger whenever aggregate employment expands. The magnitude of hires and separations underscores the dynamic character of U.S. labor markets and draws attention to questions of search and matching, recruiting, applicant screening, and employee retention. It also provides powerful motivation for theories of frictional unemployment.

The economic forces behind worker flows can be grouped into two broad categories. On the "demand side", employers create new jobs and destroy old ones in large numbers every quarter. These job flows account for a large fraction of the separations and hires measured at the employer level and a large fraction of the job changes and movements into and out of employment measured at the worker level. Additional worker flows arise as outcomes of job-worker matching and "supply-side" events such as retirements, labor force entry and family relocation. Roughly speaking, job flow measures capture demand-side developments, while worker flow measures reflect events and developments in both broad categories.

Previous research considers a wide variety of data sources and measures to study job and worker flows in the U.S. economy (Davis and Haltiwanger, 1998). Recently, U.S. statistical agencies have developed some remarkable new surveys and administrative datasets that yield a richer, fuller picture of labor market flows. We exploit these data sources in this paper to give empirical content to the flow approach to labor markets and to examine the most recent downturn from the perspective of labor market flows. To fill out our analysis, we also draw on older data sources that complement the newer ones.

The main new sources are developed by the Bureau of Labor Statistics (BLS) and the Bureau of the Census. The BLS Business Employment Dynamics (BED) series provide quarterly job flow statistics for the nonfarm private sector with detailed breakdowns by industry, region and employer size class. The BLS Job Openings and Labor Turnover Survey (JOLTS) provides monthly figures for hires, separations, quits, layoffs and vacancies. We draw heavily on these BLS sources and our analysis of the underlying micro data. We also report evidence from the Longitudinal Employer Household Dynamics (LEHD) program, a longitudinal matched employer-employee data set under development at the Bureau of the Census.[1] Through its Quarterly Workforce Indicators, the LEHD provides statistics on job and worker flows for broad demographic groups and narrowly defined geographic units. Both the BED and LEHD rely on administrative records compiled at the first stage by state-level employment security agencies as part of the U.S. unemployment insurance system. In contrast, the JOLTS is a new survey of employers conducted by the BLS. We supplement the new data sources with evidence from three older sources: the BLS Manufacturing Turnover Data, which span more than 50 years but were discontinued in 1981; the Longitudinal Research Datafile, which provides detailed quarterly and annual job flow measures for the manufacturing sector back to 1972; and gross worker flows between employers and labor market states derived from the Current Population Survey.

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[1] The LEHD program does not yet produce statistics for all states. Since we focus on national outcomes in this paper, we devote less attention to LEHD-based statistics than those derived from the BED and JOLTS.
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A key theme to emerge from our study involves the link between micro and aggregate outcomes. We show that hires, quits and layoffs exhibit highly nonlinear relations to employer growth at the micro level. These micro relations interact with changes over time in the cross-sectional density of establishment-level growth rates to generate recurring patterns in labor market flows. The cyclical properties of hires, separations, layoffs, quits, and unemployment flows can be understood as outcomes of this interaction, and so can systematic differences between deep and shallow downturns. Our attention to the aggregate implications of heterogeneity and nonlinearities at the micro level follows Dunne, Roberts, and Samuelson (1989ab), Davis and Haltiwanger (1990, 1992), Caballero and Engel (1991), Caballero (1992), Foote (1998) and others.

The paper proceeds as follows. Section II provides evidence on the magnitude and cross-sectional distribution of labor market flows. It also documents pronounced industry differences in the character of labor market flows. Section III considers the time-series behavior of labor market flows. Section IV first examines the micro relationships between workers flows and employment growth (i.e., job flows) in the cross section. Using the micro relations, Section IV then develops several testable hypotheses about the cyclical behavior of labor market flows. Section V considers the economic downturn that began in 2001, and that initiated an extended period of sluggish employment performance in the U.S. economy. We exploit evidence on labor market flows to identify some unusual features of this downturn. We also use the micro relations to help understand these features and to assess whether future downturns are likely to mirror the patterns seen in the most recent downturn. Section VI summarizes key findings and offers brief remarks on directions for future research using the data sources featured in this study.

II. Labor Market Flows: Concepts, Measures and Magnitudes

A. Basics

Figure 1 depicts the relationship between worker flows, as measured from the employer perspective, and job flows. For an individual establishment, or at any level of aggregation, the net employment change between any two points in time is related to worker and job flows by a fundamental accounting identity:

$$\text{Net Employment Change} \equiv \underbrace{\text{Hires - Separations}}_{\text{Worker Flows}} \equiv \underbrace{\text{Creation - Destruction}}_{\text{Job Flows}}$$

We consider finer breakdowns of worker and job flows below.

Several points should be kept in mind when interpreting these flows, especially when comparing measures derived from different data sources or procedures. First, hires and separations can be measured as cumulative flows during the sampling interval or by comparing the membership of the workforce at the beginning and end of the sampling interval. Both methods respect the fundamental accounting identity, but the method of point-in-time comparisons misses employment relationships that begin and end within the sampling interval. Also, under point-in-time comparisons, shorter sampling intervals capture a larger fraction of transitory employment changes (job flows) and short-term employment relationships (worker flows). Second, for the purposes of measuring labor market flows, "employers" can be defined at the level of establishments, firms, or tax-paying entities that serve as the unit of observation. We focus on establishment-based measures of labor market flows. Third, high-quality longitudinal links are essential for accurate labor market flows. Broken links create spurious entry and exit, overstating job flows, and spurious job-to-job transitions, overstating worker flows. We focus on data sources with high-quality longitudinal links that are the product of many person-decades of measurement work by the statistical agencies and outside researchers.

Panel A in Table 1 reports average job creation and destruction rates for the U.S. economy. To express gross flows from $t-1$ to t as rates, we divide by the simple average of employment at $t-1$ and t. This procedure yields growth rates in the interval [-2,2] with endpoints corresponding to births and deaths.[2] Quarterly job creation and destruction rates average about 8% of employment in the BED.[3] That is, for every dozen or so filled employment positions at a point in time, on average one disappears in the following three months. In a growing economy, a somewhat larger number of employment positions are added over the same time interval at new and expanding establishments. Monthly creation and destruction rates for continuous units in the JOLTS average 1.5% of employment.[4] Annual job flow rates, not shown in the table, exceed 10% of employment.[5] Clearly, the U.S. economy exhibits high average rates of job creation and destruction. As we show below, this characterization holds in booms and slumps.

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[2] This growth rate measure has become standard in work on labor market flows, because it offers important advantages relative to log changes and growth rates calculated on initial employment. In particular, it yields measures that are symmetric about zero and bounded, affording an integrated treatments of births, deaths and continuing employers. It also lends itself to consistent aggregation, and it is identical to log changes up to a second-order Taylor Series expansion. See Tornqvist, Vartia and Vartia (1985) and the appendix to Davis, Haltiwanger and Schuh (1996) for additional discussion.

[3] Published job flow statistics derived from the BED commence in 1992 and are updated quarterly. We rely on a research version of the BED created by Faberman (2004) that yields job flow statistics back to 1990. The BED is essentially a longitudinally linked census of establishments covered by the U.S. unemployment insurance system. See Pivetz, Searson and Spletzer (2001), Spletzer et al. (2004), and Clayton and Spletzer (2005) for detailed discussions of the BED.

[4] The JOLTS sample commences in December 2000 and is updated monthly. It covers about 16,000 establishments and is weighted to match employment levels in the BLS payroll survey. Respondents report hires and separations during the month, employment in the pay period covering the 12th of the month, and job openings at month's end. See Clark and Hyson (2001), Clark (2004), and Faberman (2005) for additional details about the JOLTS. We rely on in a research version of the JOLTS data described in Davis, Faberman and Haltiwanger (2005a,b). Except where noted otherwise, our JOLTS-based statistics are calculated from continuous units with positive employment in consecutive months.

[5] See Davis and Haltiwanger (1999a) and Pinkston and Spletzer (2004).

Panel B in Table 1 reports worker flow rates. Monthly rates of hires and separations at continuous units average about 3.2% of employment in the JOLTS, more than twice as large as JOLTS-based job flow rates. Panel B also reports quarterly worker flows derived from the LEHD.[6] Here, we exploit individual wage records in the LEHD to compute two distinct measures of hires and separations. One measure cumulates all worker flows during the three-month interval, thereby capturing all employment relationships, however short. A second measure restricts attention to separations of workers who were employed at the same establishment in the previous quarter, and to hires of workers who remain employed at the same establishment in the following quarter. Comparing these two LEHD-based measures, about half of all hires and separations arise in connection with very short employment relationships lasting less than a quarter. However, even when we restrict attention to "full-quarter cases", more than 10% of workers separate from their employers each quarter. Clearly, U.S. employers experience high rates of separations and hires.[7]

B. Differences by Industry

Table 2 reports BED-based and JOLTS-based labor flows for broad industry groups. Even for this coarse classification, average job and worker flow rates vary across industries by a factor of four. Job flow rates are relatively low in Manufacturing and Education & Health, and they are relatively high in Construction, Resources and Leisure & Hospitality. Worker flow rates are relatively low in Information and Financial

[6] See Abowd, Haltiwanger and Lane (2004) for a detailed discussion of the LEHD program.
[7] The reported rates in Table 1 rely on different sources using differing methodology and in some cases reflect differing coverage of industries, states and types of businesses. For example, the JOLTS-based measures do not capture entering and exiting establishments.

Activities, very low in Government, and they are relatively high in Retail Trade, Construction and Leisure & Hospitality.

Table 2 also highlights industry differences in quits, layoffs per quit, and layoffs relative to job destruction. Quit rates differ widely among industries, ranging from 0.6% per month in Government to 4.0% per month in Leisure & Hospitality. Goods-producing industries (Resources, Construction, and Manufacturing) stand out for a high ratio of layoffs to quits, ranging from 1.2 to 1.7. At the other extreme, the layoff-quit ratio is 0.4 to 0.5 in Retail Trade, Education & Health and Leisure & Hospitality. Layoffs per destroyed job are high in all industry groups, ranging from 0.7 to 1.0.

These industry differences in the magnitude and character of labor market flows have interesting implications for workforce management, the incidence of unemployment, and the response of unemployment to industry-level shocks. When normal rates of worker attrition are high, as in Leisure & Hospitality, employers can more readily respond to negative demand shocks without resorting to layoffs. When attrition rates are low, as in Manufacturing, negative demand shocks lead to bigger layoffs. Not surprisingly, the incidence and duration of unemployment are much higher for layoffs than for quits.[8] Thus, we hypothesize that an equiproportionate employment contraction results in greater unemployment among workers who separate from employers with low attrition rates. Testing this hypothesis in full is beyond the scope of this paper, but we show below that the layoff-separation ratio exhibits a strong negative relationship to

[8] Leighton and Mincer (1982) find that unemployment incidence for layoffs is double that for quits in the National Longitudinal Survey. Mincer (1986) also find that, conditional on unemployment, mean spell length is twice as long for layoffs. McLaughlin (1990) finds higher unemployment incidence for layoffs in the PSID. CPS data show that monthly escape rates from unemployment are ten to twenty percentage points lower for permanent layoffs than for quits. See Figure 6.8 in Davis, Haltiwanger and Schuh (1996) and Figure 4 in Bleakley et al. (1999).

employment growth rates, both over time at the industry level and in the cross section of establishment-level observations.

Table 2 also raises a number of deeper questions related to the character of labor market flows. Why do layoffs account for a bigger fraction of separations in goods-producing industries? Do industry differences in the prominence of layoffs result from differences in wage flexibility? If so, why do differences in wage flexibility arise and persist? How effectively can employers influence recruiting and retention by altering pay levels and compensation design? In particular, how do pay compression and the slope of the wage-tenure file affect recruiting and retention? Answering these questions is beyond the scope of this paper, but it is worth remarking that the LEHD is well suited to an investigation of these issues, because it contains individual wage records and has a longitudinal matched employer-employee design.

C. The Distribution of Labor Market Flows by Establishment-Level Growth Rates

Tables 1 and 2 suggest that an employer can bring about a sizable workforce reduction over a period of several months by curtailing new hires and relying on attrition. Conversely, an employer can expand over time by devoting more resources to retention while hiring at a steady pace. In fact, because most establishments undergo small percentage employment changes most of the time, many desired adjustments in workforce size can be achieved by modest changes in recruiting and retention rates. It is important to recognize this point in thinking about the nature of micro-level employment adjustments and the problem of managing workforce size for a typical employer.

For the analysis of labor market flows and their consequences, however, it is equally important to recognize that most job flows occur at establishments undergoing rapid expansions or contractions. Figure 2 illustrates these points using BED data for all nonfarm private-sector establishments in the third quarter of 2001.[9] The figure shows the cross-sectional density of establishment-level growth rates overlaid on the distribution of job flows by establishment growth rates. The (employment-weighted) growth rate density is highly concentrated about zero – 49% of quarterly growth rate observations lie in the interval [-.05,.05], and 68% lie in the interval [-.1,.1]. In contrast, job flows are concentrated at establishments undergoing large percentage changes. Indeed, 68% of job destruction takes place at establishments that shrink by more than 10% during the quarter, and 22% takes place at establishments that decline to zero employment. Hence, most job destruction cannot be interpreted as the product of modest contractions achieved by normal rates of worker attrition. Neither can most job creation be seen as the outcome of modest establishment-level growth rates. In short, job flows are dominated by lumpy employment changes at the establishment level.

Worker flows are less concentrated at establishments with big percentage changes. For continuous units in JOLTS, 51% of hires and separations take place at establishments with monthly growth rates in the interval [-.05,.05], compared to only 27% of job flows. Layoffs, unlike quits and hires, occur mostly at establishments experiencing large percentage changes. For continuous units in JOLTS, 56% of layoffs take place at establishments that shrink by more than 5% during the month, and 45% take place at those shrinking by more than 10%.

[9] The pattern displayed in Figure 2 holds in other quarters as well. Note that the distribution of job flows by establishment growth rates in Figure 2 is employment weighted by construction.

D. Labor Market Flows from the Worker Perspective

Thus far, our discussion has centered on job and worker flows measured from the employer perspective. We can also measure worker flows from the perspective of workers, a frequent approach in research that exploits the Current Population Survey (CPS) and other household surveys.[10] Using longitudinal links to follow individuals over time or data on the duration of ongoing employment and unemployment spells, household surveys yield employer-to-employer flows and changes in labor market status. These flows are typically calculated from point-in-time comparisons, but Shimer (2005) uses the point-in-time comparisons to construct continuous-time hazard rates.

Figure 3 draws on CPS tabulations in Fallick and Fleischman (2004) to report average monthly flows between employers and three labor market states – employment, unemployment, and out of the labor force. Summing entries in Figure 3, an average of 11.9 million persons change labor force status between monthly survey dates, 6.7% of the working-age population. Another 2.8 million persons (1.6% of the working-age population) switch employers between monthly survey dates. Among employed persons, 2.6% switch employers, 1.3% enter unemployment, and 3.0% exit the labor force between monthly survey dates. These CPS-based statistics confirm the dynamic character of U.S. labor markets from another vantage point.

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[10] See, for example, Blanchard and Diamond (1990), Davis, Haltiwanger and Schuh (1996, chapter 6), Bleakley, Ferris and Fuhrer (1999), Fallick and Fleishman (2004), and Shimer (2005). The accounting relationship between worker flows from the employer perspective and worker flows from the worker perspective is complicated. It depends on the exact labor market transitions undertaken by workers (Davis and Haltiwanger, 1998). For a theoretical analysis that involves meaningful economic distinctions among all of the labor flows considered in this paper, see Kiyotaki and Lagos (2005).

III. Labor Market Flows: Time-Series Evidence

A. Job Flows

Figures 4 and 5 display quarterly job flows for the private sector from 1990 to 2004 and for the manufacturing sector from 1947 to 2004. The series in Figure 5 are spliced together from three overlapping sources: BLS Manufacturing Turnover Data (MTD) from 1947 to 1981, the Longitudinal Research Database (LRD) from 1972 to 1998, and the BED from 1990 to 2004. The MTD-LRD splice follows the procedure in Davis and Haltiwanger (1999b), and the LRD-BED splice follows Faberman (2004). Figures 4 and 5 confirm that job creation and destruction rates are remarkably high at all times.

Both figures show evidence of a downward trend in the overall magnitude of job flows. The trend is most evident in Figure 5's long series for the excess reallocation rate, defined as the sum of creation and destruction rates less the absolute value of the net growth rate in employment. Excess reallocation measures job reallocation over and above the minimum amount required to accommodate the net employment change. As Figure 5 shows, quarterly excess reallocation rates fluctuate near 10-11% until the early 1960s in the manufacturing sector then gradually decline to levels near 8% by 2000. The shorter time series for private-sector job flows in Figure 4 also point to a trend decline in the magnitude of job flows.

This trend decline is surprising in light of recent studies that find secular increases in the firm-level volatility of sales and employment growth rates. These studies consider firm-level volatility over time and conclude that average volatility has risen substantially since the early 1960s.[11] There is some tension between this conclusion and the trend decline in the excess reallocation rate, essentially an employment-weighted measure of the cross-sectional dispersion in establishment-level growth rates. To appreciate the tension, consider the simple case in which all employers follow identical and independent autoregressive processes. Then an increase in the innovation variance implies an increase in average employer-level volatility *and* in the cross-sectional dispersion of growth rates (and the magnitude of job flows).

It is possible to break the tight link between idiosyncratic volatility and cross-sectional dispersion in a more complicated specification. It is also possible that firm-level and establishment-level growth processes have evolved along sharply different paths in recent decades. In addition, an increased reliance on independent contractors and temporary workers may have contributed to the declining pace of job reallocation and altered the relationship between employment and sales growth volatility at the micro level. Yet another possibility is that the selected nature of the samples in the firm-level studies paints a misleading picture of volatility trends in the economy as a whole.[12] It is unclear which, if any, of these possibilities resolves the tension. For now, we see the divergent trends in the cross-sectional dispersion of establishment-level growth rates and the average volatility of firm-level growth rates as a puzzle.

Figures 4 and 5 also display interesting behavior at the business cycle frequency. The manufacturing data in Figure 5 show sharp spikes in job destruction rates during

[11] The average magnitude of the idiosyncratic component in firm-level equity returns has also risen in recent decades. See Campbell et al. (2001), Chaney, Gabaix and Phillipon (2002), Comin and Mulani (2003), and Comin and Phillipon (2005)

[12] The firm-level volatility studies cited above rely on Compustat data, which are limited to public firms and which do not cleanly distinguish between domestic and foreign activity for multinational firms. In contrast, the BED covers the universe of nonfarm private-sector establishments with employees for the domestic economy. The LRD covers all but the smallest manufacturing establishments.

employment downturns, as stressed by Davis and Haltiwanger (1990, 1992). This pattern holds throughout the postwar era, but the variability of creation and destruction is more similar in the 1950s than later decades. The shorter BED-based series for the private sector also exhibits job destruction spikes in the 1990-91 and 2001 recessions, but they are much milder than the ones in the manufacturing sector. This pattern is consistent with Foote's (1998) evidence of manufacturing/non-manufacturing differences in the cyclical dynamics of creation and destruction.

Perhaps the most striking aspect of Figure 4 is the downward drift in private-sector job creation rates before, during, and well after the 2001 recession. The manufacturing data in Figure 5 show a similar pattern. There is no such downward drift in job creation rates during or after the 1990-91 recession. Moreover, the 57-year time series for manufacturing show no comparable episode of a sustained downward drift in gross job creation rates coupled with declining employment. Judging by the available evidence, the long slide in job creation rates is unique to the most recent downturn.

B. Worker Flows from the Employer Perspective

Figure 6 shows seasonally adjusted rates of hires and separations from the published JOLTS data. The hires rate declines from 3.8% per month in December 2000 to 3.0% in April 2003, mirroring the downward drift in private-sector job creation rates in Figure 4. Thus, the BED and the JOLTS tell similar stories of weakness in job creation and new hires during the 2001 recession, and for more than a year thereafter. The separations rate also declines during and after the 2001 downturn. As seen in Figure 7, the declining separations rate reflects strong declines in the quit rate. In contrast, the layoff rate rises modestly during the 2001 recession.

As students of the business cycle have long observed, falling (or low) quit rates and rising layoff rates are symptomatic of weak labor markets.[13] Put differently, the mix of separations shifts from quits to layoffs during cyclic downturns. Figure 8 illustrates this phenomenon in the manufacturing sector using MTD data from 1947 to 1981. The figure shows a strong negative relationship between the layoff-separation ratio and the net employment growth rate. Layoffs typically make up 20-30% of separations during employment expansions, as compared to 40-65% during downturns. Available evidence indicates that the layoff-separation ratio underwent even wider swings earlier in the 20th century (Woytinsky, 1942). Taken together, the evidence in Figures 7 and 8 suggests that involuntary job terminations rise sharply in recessions, though less so in mild ones.[14] We return to this issue below, drawing on CPS and JOLTS data.

Figure 9 displays LEHD-based quarterly rates of hires and separations for selected states. As before, we distinguish between cumulative flows and full-quarter cases. Recall that LEHD and JOLTS measures differ in several important respects. The LEHD covers certain states only, uses a quarterly rather than monthly sampling frequency, computes flows from administrative records instead of survey responses, and captures all tax-paying establishments within its limited geographic domain. Despite these differences, the LEHD measures confirm a key aspect of the JOLTS-based story: worker flow rates declined steadily during and after the 2001 recession. Given the reported statistics are for selected states, inferences about national dynamics cannot be

[13] See, e.g., Schlicter (1921), Woytinsky (1942), Akerlof, Rose and Yellen (1988), Boisjoly, Duncan and Smeeding (1998), and Davis and Haltiwanger (1998).

[14] For a contrary view that interprets all separations as voluntary outcomes under symmetric information between employer and employee, see McLaughlin (1991).

directly made. However, it is interesting that in these states the 2001 recession is quite modest but associated with a decline in both separations and hires.

C. Unemployment Inflows and Outflows

Figure 10 reports monthly time series from 1976 to 2004 for unemployment inflows and outflows as percentages of the labor force, inflows by reason as percentages of employment, and unemployment escape rates by reason for unemployment. The flows are calculated by exploiting CPS data on the number of unemployed persons and the number unemployed for less than five weeks.[15]

Panel A shows that worker flows through the unemployment pool rise during recessions, a phenomenon that characterizes earlier postwar recessions as well (Davis, 1987). Unemployment outflows directly to employment also rise in recessions, as documented by Blanchard and Diamond (1990) and Bleakley et al. (1999). Panel A also shows that unemployment flows decline by more than a third from the early 1980s to the mid 1990s. CPS-based measures of employment inflows and outflows exhibit a similar decline (Bleakley et al., 1999, Figure 1). The aging of the labor force is likely a major factor behind this decline, given that younger workers engage in much more job shopping (Hall, 1982 and Topel and Ward, 1992). Another factor is the trend decline in the magnitude of job flows, an issue we briefly return to below.

Panel B shows a sharp jump in the flow of laid-off workers into unemployment in the four recessions spanned by the data. Spikes in both permanent and temporary layoffs are prominent in the recessions of the early 1980s, but the change in temporary layoffs is much more modest in the 1990-91 recession and nearly invisible in the 2001 recession, as

[15] The BLS makes these data available under "Labor Force Statistics from the Current Population Survey" at http://www.bls.gov/data/home.htm.

stressed by Groshen and Potter (2003) and Aaronson, Rissman, and Sullivan (2004). Bleakley et al. (1999, Figures 5 and 6) show that the recessionary upsurge in the flow of job losers into unemployment is largely confined to manufacturing and construction. Layoff spikes are much smaller in the rest of the economy. They also show that the recessionary upsurge of laid-off manufacturing workers into the unemployment pool closely mirrors the spikes in manufacturing job destruction.

Panel C highlights three features of unemployment outflows. First, monthly escape rates are high at all times. Even restricting attention to flows directly from unemployment to employment, the rate exceeds 20% per month at all stages of the business cycle (Bleakley et al., 1999, and Shimer, 2005). As a consequence, spikes in job destruction and layoffs lead to short-lived rises in the unemployment rate, unless the spike itself is long lived. Second, unemployment escape rates are highly procyclical. Movements in the escape rate over time account for most of the time variation in the aggregate rate of unemployment, as recently stressed by Hall (2005) and Shimer (2005). Third, unemployment escape rates are considerably smaller for permanent layoffs than for job leavers and labor force entrants (not shown).[16] Recalling our earlier discussion, workers who separate from their jobs in recessions are more likely to enter unemployment (because of a rise in the layoff-separation ratio). Conditional on entering unemployment, they are also more likely to experience a long spell because exit rates are lower for permanent layoffs and because exit rates decline generally in a recession.

[16] The upward movement in the escape rate for persons on temporary layoff relative to job leavers in 1994 is a consequence of the CPS redesign that commenced with the January 1994 survey. See Polivka and Miller (1998) and Fallick and Fleishman (2004).

IV. Micro Relations and Aggregate Outcomes

A. Hires, Separations, and Employment Growth at the Establishment Level

We turn now to the micro relations between worker flows and establishment growth and show that they provide considerable insight into the behavior of aggregate worker flows, including unemployment inflows and outflows. Figure 11 displays the cross-sectional relationships of the hires rate and the separations rate to the establishment growth rate in the JOLTS micro data. To construct Figure 11, we compute the mean hires rate and the mean separations rate for narrow growth rate bins, a simple nonparametric method.[17] The "pooled" curves exploit data for all months, while two other curves use data for those months with the twelve highest or twelve lowest aggregate growth rates. We have verified that the relations depicted in Figure 11 also hold in quarterly LEHD data, and that they are robust to the inclusion of establishment fixed effects.

The figure contains three noteworthy findings. First, hires and separations are highly nonlinear functions of the establishment growth rate, with sharp kinks and sign changes at zero. Separations rise more sharply to the right of zero than hires rise to the left of zero. This asymmetry reflects the greater separation propensity for new hires coupled with a greater need for new hires at expanding establishments. Second, contracting establishments rely on adjustments in the separations rate, not the hires rate, to bring about month-to-month changes in employment. This point is seen by observing that the slope of the separations-net relation is approximately minus one to the left of zero. In fact, the separations rate increases slightly more than one for one as the growth

[17] Bin widths range from 0.001 to 0.05, with narrower bins closer to zero. This method is equivalent to a least squares regression of the hires (separations) rate on a large number of dummy variables for growth rate intervals that partition the [-2,2] range. In the regression approach, it is easy to include establishment fixed effects that isolate the within-establishment hires-net and separations-net relationships.

rate declines to the left of zero. Likewise, the hires-net relation has a mild *negative* slope just to the left of zero. Third, the hires-net and separations-net relations are highly stable over time and, in particular, between periods of high and low employment growth.[18] Put differently, the hires and separations rates are not very sensitive to aggregate labor market conditions, once we condition on the employer's own growth rate. We quantify this point below.

Figure 12 displays the relationships of the quit and layoff rates to the establishment growth rate. Quits account for a bigger portion of separations than layoffs throughout the positive segment of the growth rate range, and for establishments that shrink by less than 12% during the month. For establishments undergoing sharper contractions, layoffs account for most separations. For establishments undergoing dramatic contractions during the month, almost all separations take the form of layoffs.

B. Movements in Aggregate Worker Flows

In an employment downturn, the cross-sectional density of establishment growth rates shifts to the left, though not necessarily in a shape-preserving manner. This density shift interacts with the micro relations in Figures 11 and 12 to produce movements in aggregate worker flows. If the micro relations are linear and stable over time, then the mean employment growth rate contains all useful information in the cross section for the purpose of explaining movements in aggregate worker flows. In this case, we can reliably account for movements in, say, the aggregate separations rate in terms of a linear regression on the aggregate employment growth rate. If, however, the micro nonlinearities are important for the behavior of aggregate separations, then a statistical

[18] The stability of these relationships holds whether we define high and low growth periods using seasonally adjusted or unadjusted data for employment growth rates.

model that tracks the entire cross-sectional density will outperform the linear regression model. The simplest model along these lines posits a time-invariant separations-net relation at the micro level, and attributes all movements in aggregate separations to movements in the growth-rate density. Thus, we can gauge the importance of micro nonlinearities for aggregate worker flows by comparing the in-sample explanatory power of the linear regression model with the simple distribution-based model.

Figure 13 carries out this comparison by plotting monthly time series for hires and separations rates against the predicted series generated by the two statistical models. As the figure shows, the distribution-based model outperforms the linear regression model for the hires rate and especially for the separations rate. In this regard, recall that the recent downturn involves a rather mild employment contraction. Wider swings about zero in the growth rate of aggregate employment, such as those experienced in the 1970s and 1980s, would lead to greater performance advantages for distribution-based statistical models, because more of the mass in the cross-sectional growth rate density slides back and forth across the kinks at zero in the micro relations.

Table 3 summarizes the explanatory power of the two models for aggregate movements in hires, separations, quits and layoffs. The distribution-based model (Model 1 in Table 3) outperforms the linear regression model (Model 2) for all worker flow measures, which confirms the importance of the micro nonlinearities in the behavior of aggregate worker flows. The better performance is especially noteworthy for separations and layoffs, where the distribution-based model accounts for 42 (80) percent of the variance of separation (layoff) rates, and the linear regression model accounts for only 6 (51) percent. The distribution-based model performs better even though it imposes a time-invariant relationship between worker flows and the net employment growth. Neither model accounts for much of the time variation in the aggregate quit rate.

Table 3 also reports results for a third model (Model 3) motivated by the shapes of the nonlinear relations in Figures 11 and 12. These cross-sectional relations look similar to linear splines with two segments and kinks at zero. To the extent that the cross-sectional relations conform to this type of spline function, the aggregate job creation and destruction rates summarize all useful information in the cross section for the purpose of explaining movements in aggregate worker flows. Hence, our third model generates predicted worker flow rates from time-series regressions on the job creation and destruction rates. As Table 3 shows, this type of regression model accounts for a very high percentage of the movements in aggregate worker flows, ranging from 67% for quits to 92% for hires. The regression model with job creation and destruction rates provides an enormous improvement in fit relative to the regression on only the net growth rate, because it captures the central nonlinearity in Figures 11 and 12. It also outperforms the simple distribution-based model, because it implicitly allows for systematic cyclical variation in the cross-sectional relations.

The lower explanatory power of all of the models for the aggregate quit rate suggests that the cross-sectional quits-net relation varies over time in a significant way. Table 4 pursues this idea directly and the significance of time variation in the micro relations more generally. To construct the entries in the lower panel of Table 4, we fit the micro relations to two subsamples comprised of the twelve months with the highest and lowest employment growth rates. We then calculate aggregate worker flow rates implied by the fitted micro relations and the pooled-sample cross-sectional growth rate density.

That is, we fix the growth rate density while allowing the micro relations to vary between high and low growth months.

Moving from high-growth to low-growth months, the aggregate hires rate falls by 16% and the separations rate rises by 11%, with essentially all of the change in separations coming from layoffs. According to the bottom panel of Table 4, about one-fifth of the decline in aggregate hires reflects a shift in the micro hires-net relation. That is, when aggregate employment expands (contracts), employers hire more (fewer) workers conditional on their own employment growth. In contrast, cyclical changes in the separations-net relation dampen the effect of shifts in the cross-sectional density on the aggregate separations rate. This effect arises because, conditional on an employer's own growth, the quit propensity of employees rises with the aggregate growth rate.

C. Explaining the Cyclical Behavior of Separations, Layoffs and Unemployment Flows

The micro relations in Figures 11 and 12 motivate a number of testable hypotheses about the cyclical behavior of aggregate and industry-level hires, separations, layoffs and unemployment flows.

H1: Time-series movements in separations and hires are negatively related to the employment growth rate when employment contracts, but they are positively related when employment expands.

H2: Time-series movements in the separations (hires) rate is more responsive to the employment growth rate when employment contracts (expands).

H1 and H2 follow immediately from the nonlinear relations in Figure 11, provided that an increase (decrease) in the employment growth rate involves an increase (decrease) in the employment-weighted share of establishments with expanding (contracting) employment. This weak regularity condition is ensured if establishments with near-zero growth have a positive loading on aggregate shocks. In unreported results, industry-level JOLTS data strongly confirm H1 and H2. In fact, the industry-level relations mirror the establishment-level relations depicted in Figure 11.

Two additional hypotheses follow from the nonlinear relations in Figure 12:

H3: Conditional on the aggregate (industry) employment growth rate, the aggregate (industry) layoff-separation ratio rises with the employment-weighted share of establishments that experience sharp employment contractions.

H4: The industry-level layoff-separations ratio declines with the industry employment growth rate, and the relationship flattens at higher growth rates.

H3 follows from the form of the nonlinear relations in Figure 12. H4 follows as well, if the data satisfy the regularity condition that the employment-weighted share of establishments with sharp contractions is negatively related to the employment growth rate. Figure 8 strongly confirms the first part of H4 in MTD data for the manufacturing sector. CPS evidence that recessionary surges in the flow of job losers into unemployment are concentrated in construction and manufacturing also supports H4, because these industries tend to undergo relatively sharp contractions during aggregate downturns. In Figure 14, scatter plots of the layoff-separation ratio against the net employment growth rate confirm both parts of H4 in MTD and JOLTS data. That is, the layoff-separation ratio is less sensitive to employment growth at higher growth rates.[19]

[19] The plotted curves in Figure 14 are based upon the fitted values of a quadratic specification relating the layoff-separation rate to net employment growth. For MTD and JOLTS all industries both the linear and quadratic terms are statistically significantly different from zero. For JOLTS, manufacturing only, where we have fewer observations we can reject the joint hypothesis that both the linear and quadratic terms are equal to zero.

Four additional hypotheses follow by combining the nonlinear relations in Figure 12 with systematic differences in unemployment experiences by type of separation:

H5: Conditional on aggregate (industry) employment growth rate, the unemployment inflow rate among separating workers (from the industry) rises with the employment-weighted share of establishments that contract sharply.

H6: The aggregate (industry) unemployment inflow rate among separating workers declines with the aggregate (industry) employment growth rate.

H7: The average unemployment escape rate declines with the employment-weighted share of establishments that contract sharply in the current and preceding months.

H8: The average unemployment escape rate declines during an aggregate downturn because (in part) layoffs make up a larger fraction of unemployment inflows.

H5 follows by combining the nonlinear relations in Figure 12 with the greater propensity for laid-off workers to become unemployed. According to Figure 12, layoffs account for roughly 1 in 3 separations at establishments that grow and at those that shrink modestly, but the layoff-separations ratio is much higher at establishments that contract sharply. Hence, for a given aggregate (industry) growth rate of employment, a bigger mass of establishments that contract sharply yields a bigger unemployment inflow. H6 then follows by the same regularity condition that underpins H4. Likewise, H7 and H8 follow by combining Figure 12 with the lower unemployment escape rate for laid-off workers. We are evaluating H5 through H8 in research currently underway.

An additional hypothesis about unemployment fluctuations follows by comparing Figures 11 and 12. Recall from Figure 11 that the hires-net relation exhibits a pronounced slope change at zero, and that the slope equals or exceeds unity at all points to the right of zero. Figure 12 shows that the layoffs-net relation is relatively flat on both sides near its trough at zero, but it becomes steeper as the net growth rate becomes more negative. These differences in the micro relations generate systematic differences in the cyclical properties of aggregate hires and layoffs. A mild downturn, for example, slides much of the mass in the cross-sectional density along the steep portion of the hires-net relation, so that aggregate hires respond strongly. The same density shift slides along the flat portions of the layoffs-net relation, so that layoffs respond weakly. In contrast, a severe downturn slides more of the mass along the flatter portion of the hires relation and the steeper portion of the layoffs relation. Hence, a more severe downturn involves bigger movements in layoffs relative to hires.

To translate these observations into a characterization of unemployment fluctuations, use the identity that links the change in the number of unemployed persons to the job-loss and job-finding rates for workers. In the simple case with a constant labor force, the discrete-time version of this identity is

$$\Delta U_t = l_{t-1}E_{t-1} - f_{t-1}U_{t-1}$$

where l is the job-loss rate for employed persons E, f is the job-finding rate for unemployed persons U, and t indexes the time period. Because the hires rate drives the job-finding rate, and the layoff rate drives the job-loss rate, the micro relations for hires and layoffs in Figures 11 and 12 yield the following hypothesis:

H9: In an accounting sense, changes over time in the job-finding rate dominate unemployment rate movements associated with mild contractions in aggregate employment. Changes over time in the job-loss rate account for a relatively larger fraction of unemployment rate movements associated with sharp contractions in aggregate employment.

H9 fits the evidence on postwar U.S. unemployment fluctuations in Shimer (2005).

V. The Recent Downturn

Let us now take stock of the downturn that began with the 2001 recession.

1. The recession itself was mild and brief. It ran from March to November of 2001 (NBER dating). The sharpest quarterly employment contraction, 1.0% occurred in the third quarter of 2001.
2. Sluggish employment growth continued until the latter part of 2003. In fact, aggregate employment fell during much of 2002 and early 2003 (Figure 4).
3. The private sector job destruction rate jumped in 2001, but the surge was modest, especially compared to the historical pattern in manufacturing (Figures 4 and 5).
4. A persistent downward drift in the job creation rate began in late 1999, well before March 2001, and continued 7 quarters after the recession's end (Figure 4).
5. Hires also drifted downward during and well after the recession.
6. The layoff rate rose modestly during the 2001 recession, and the quit rate drifted downward during and after the recession (Figure 7).
7. The flow of worker through the unemployment pool during the 2001 recession rose modestly compared to previous recessions (Figure 10a).
8. CPS data show no surge in the flow of temporarily laid-off worker into the unemployment pool, a sharp departure from previous recessions (Figure 10b).

Our analysis indicates that several of these features reflect two factors: the mild character of the recent downturn, and a secular decline in the employment share of cyclically sensitive goods-producing industries. Mild employment contractions give rise to little or no increase in the aggregate separation rate, because the cross-sectional growth rate density remains centered near the trough in the micro separations-net relation displayed in the lower panel of Figure 11. Of greater significance for unemployment but for a similar reason, the layoff rate and layoff-separations ratio also rise modestly in a mild contraction, as implied by Figure 12 and confirmed in Figure 14. In turn, a modest rise in layoffs produces a modest rise in unemployment inflows.

Historically, goods-producing industries and especially construction and durable-goods manufacturing are more cyclically sensitive than service-producing industries. In particular, service-producing industries are less prone to the violent contractions that give rise to spikes in job destruction, layoffs and unemployment inflows. So, an explanation for the mild character of the 2001 and 1990-91 recessions rests partly on the shrinking share of employment in cyclically-sensitive industries. Because this trend is likely to continue, we anticipate that future recessions will tend to have a milder character than past recessions, and that they will involve milder surges in job destruction, layoffs and unemployment inflows. Nonetheless, if one or more large negative shocks causes aggregate employment to contract sharply, our analysis implies that layoffs and unemployment inflows will spike sharply, as they did in the deep recessions of the 1970s and 1980s. In this regard, we emphasize that the nonlinear relations in Figures 11 and 12 imply that layoffs and unemployment inflows are more sensitive to aggregate employment on the margin, the deeper and more abrupt the employment contraction.

The virtual absence of a surge in temporary layoff unemployment in the 2001 recession is a striking departure from past recessions. The 1990-91 recession also involves a relatively small surge of temporarily laid off workers into the unemployment pool. In part, these developments reflect the declining share of employment in construction and manufacturing, two industry groups that have traditionally relied most heavily on temporary layoffs during downturns, but there is clearly more to the story. It is unclear to us why temporary layoffs were so unresponsive in the 2001 recession. Lacking a fuller explanation for their behaviour in the most recent recession, it is difficult to assess whether temporary layoffs will figure prominently in future recessions.

The long downward slide in the job creation rate is another striking feature of the recent downturn. As we remarked, this slide began more than a year before the 2001 recession and continued for more than a year afterwards. This fact suggests the downward slide in job creation is part of a longer term development in the U.S. economy, an inference reinforced by Figures 4 and 5. The factors behind this secular decline in the magnitude of job flows probably contributed, albeit modestly, to the nearly four-year slide in private sector job creation rates that commenced in late 1999.

Aggregate employment did not resume a pattern of sustained growth until the latter part of 2003. A full explanation for this sluggish employment performance in the aftermath of the 2001 recession is beyond the scope of our analysis, but a likely contributing factor is the strength and duration of the expansion in the 1990s. The employment-population ratio rose from 61.2% at the end of 1991 to 64.7% in mid-2000 and then fell back to 62.1% in late 2003. The employment-population ratio in 2000 is an historical peak that reflects a rise of about 9 percentage points since the early 1960s. The large secular increases in the employment-population ratio and the labor force participation rate may have fully played out by the late 1990s.

VI. Concluding Remarks

The new data sources and products (BED, JOLTS and LEHD) developed by the Bureau of Labor Statistics and the Bureau of the Census provide a strong empirical foundation for the flow approach to labor market analysis. Our study of these data uncovers highly nonlinear relationships of worker flows to employment growth and job flows at the micro level. We show that these micro relations interact with movements over time in the cross-sectional density of establishment growth rates to produce recurring cyclical patterns in aggregate labor market flows. Cyclical movements in the layoffs-separation ratio, for example, and the propensity of separated workers to become unemployed reflect distinct micro relations for quits and layoffs. A dominant role for the job-finding rate in accounting for unemployment movements in mild downturns and a bigger role for the job-loss rate in severe downturns reflect distinct micro relations for hires and layoffs.

The new data sources confirm the remarkable magnitude of labor market flows. Quarterly job creation and destruction rates average nearly 8% of employment in the U.S. private sector. Nearly 11% of workers separate from their employers in an average quarter (among those with job tenure of at least three months). More than 8% of the working-age population changes employer or labor market status from one month to the next. The data also confirm the lumpy nature of micro-level employment adjustments.

More than two-thirds of all job destruction occurs at establishments that shrink by more than 10% within the quarter, and more than one-fifth takes place at establishments that go to zero employment within the quarter.

Other results documented in our study also merit attention. First, the magnitude of job flows has trended downward in recent decades. This trend dates back to the 1960s in the manufacturing sector, and it appears to hold for the private sector as a whole in the period since 1990 covered by the BED. Second and related, the private-sector (gross) job creation rate began declining well before the 2001 recession and continued to slide until the middle of 2003. Based on the available evidence, the recent downturn stands out for an unusually long, steady decline in the job creation rate. The 2001 recession also stands out for the absence of a surge in temporary layoffs. Third, industries differ greatly in worker turnover rates and in employer reliance on layoffs as a tool for adjusting employment levels. Why these large differences arise is an open question. We think it would be especially fruitful to investigate whether industry differences in the magnitude and character of labor market flows are related to differences in compensation structures and the degree of wage flexibility. The new data sources developed by the BLS and the Census Bureau make it possible to explore these and many other interesting issues.

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Figure 1. The Relationship between Worker Flows and Job Flows

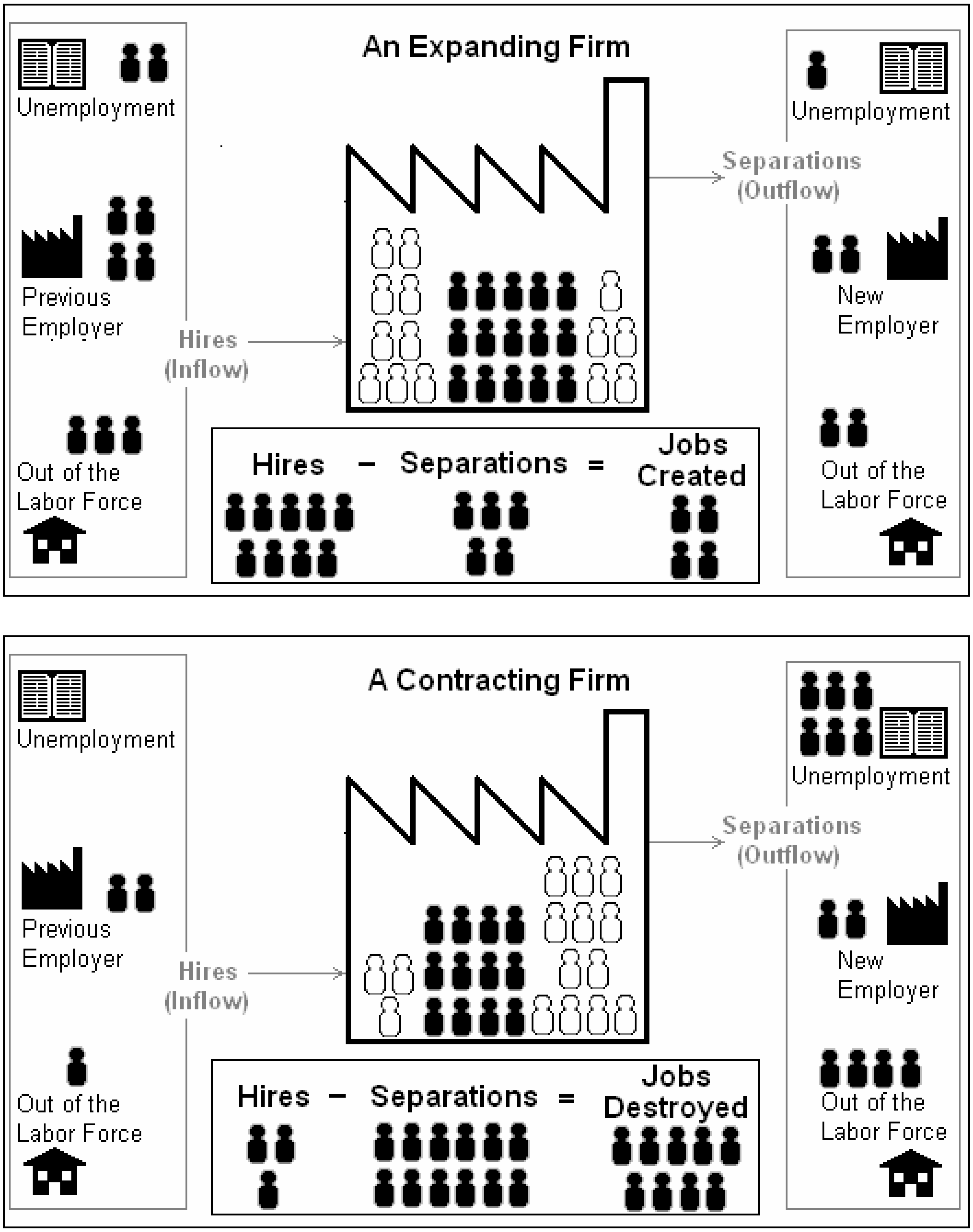
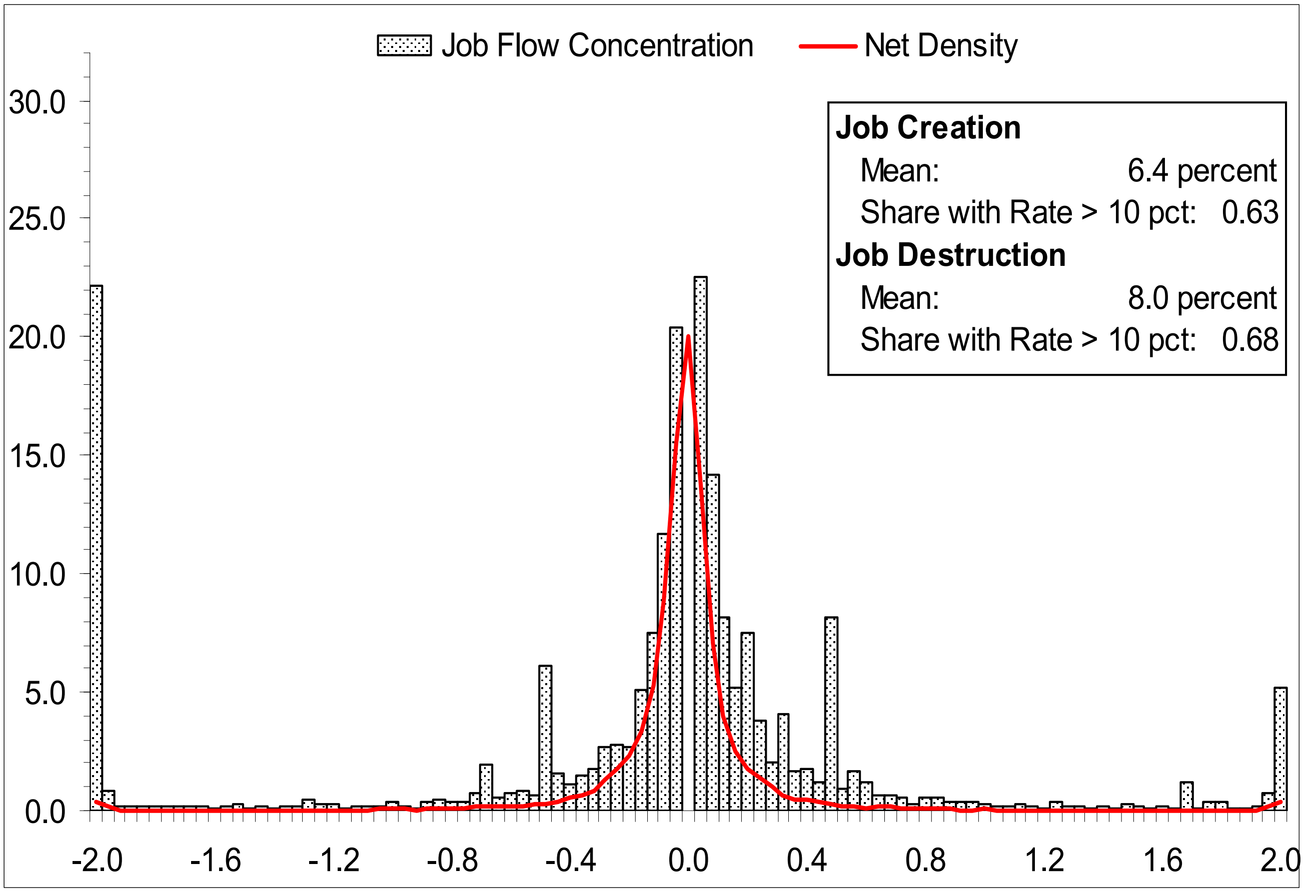
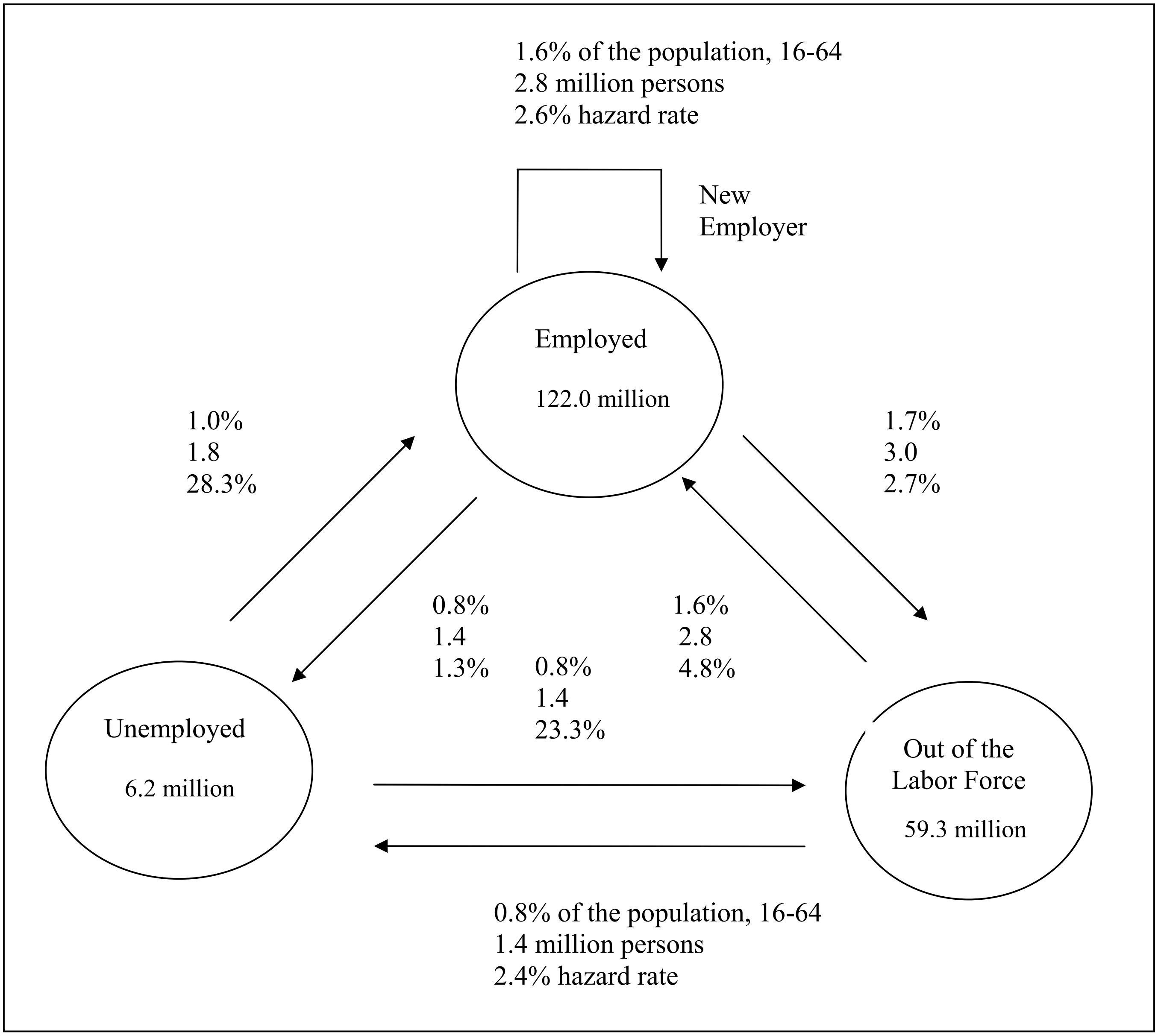


Figure 2. The Distribution of Growth Rates and Job Flows by Establishment Growth Rates, Private Sector, Third Quarter of 2001



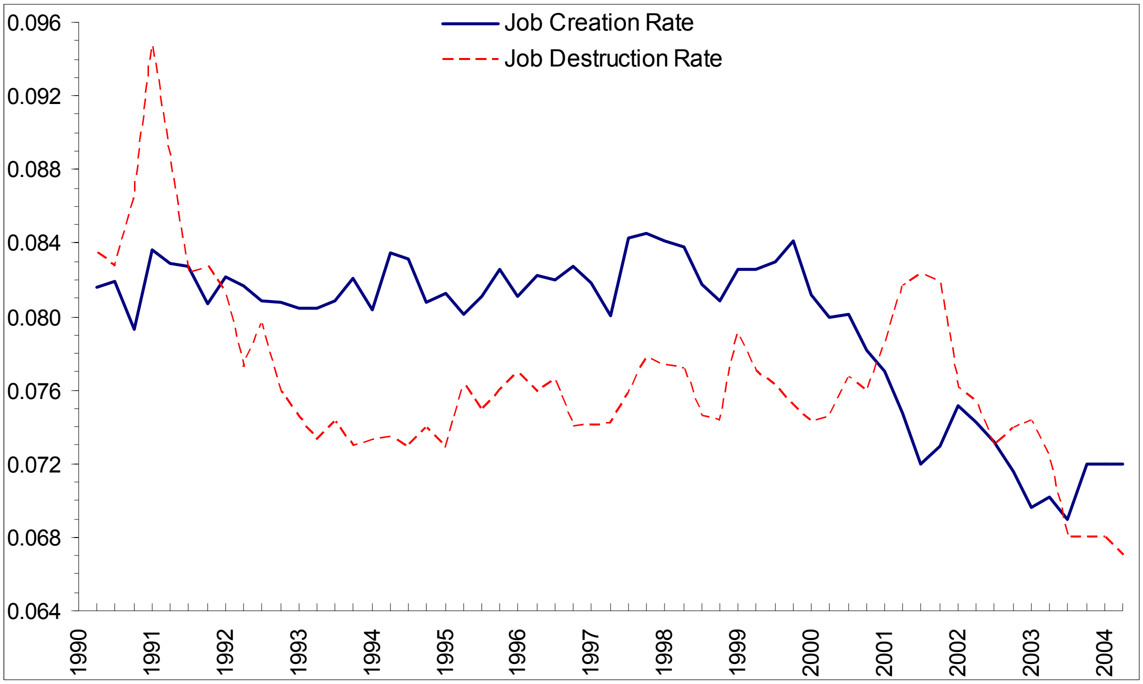
Source: Author's tabulations from the BED.

Figure 3. Average Monthly Worker Flows, Current Population Survey, 1996-2003



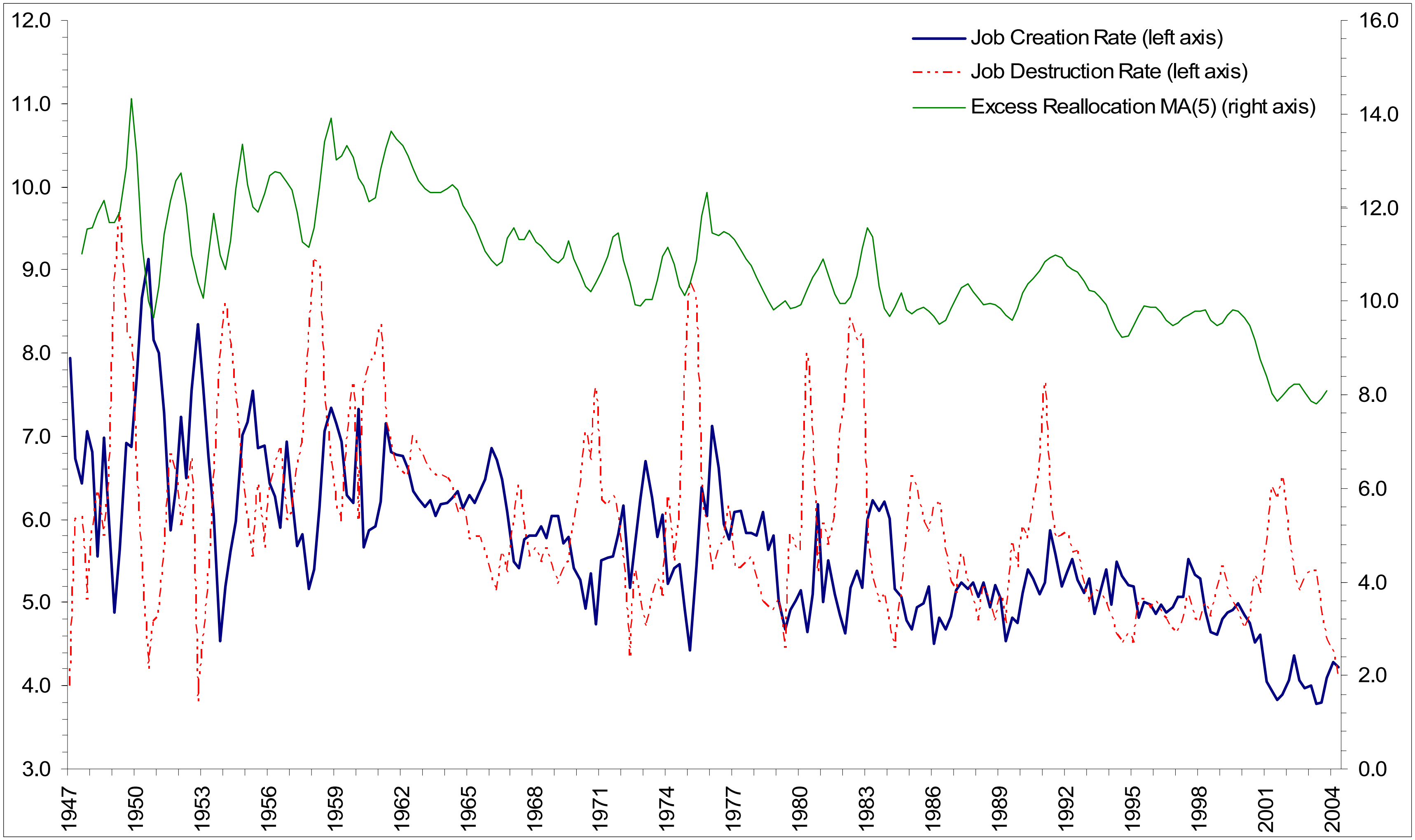
Source: Current Population Survey tabulations reported in Fallick and Fleischman (2004)

Figure 4. Quarterly Job Flows in the Private Sector, Seasonally Adjusted, 1990-2004



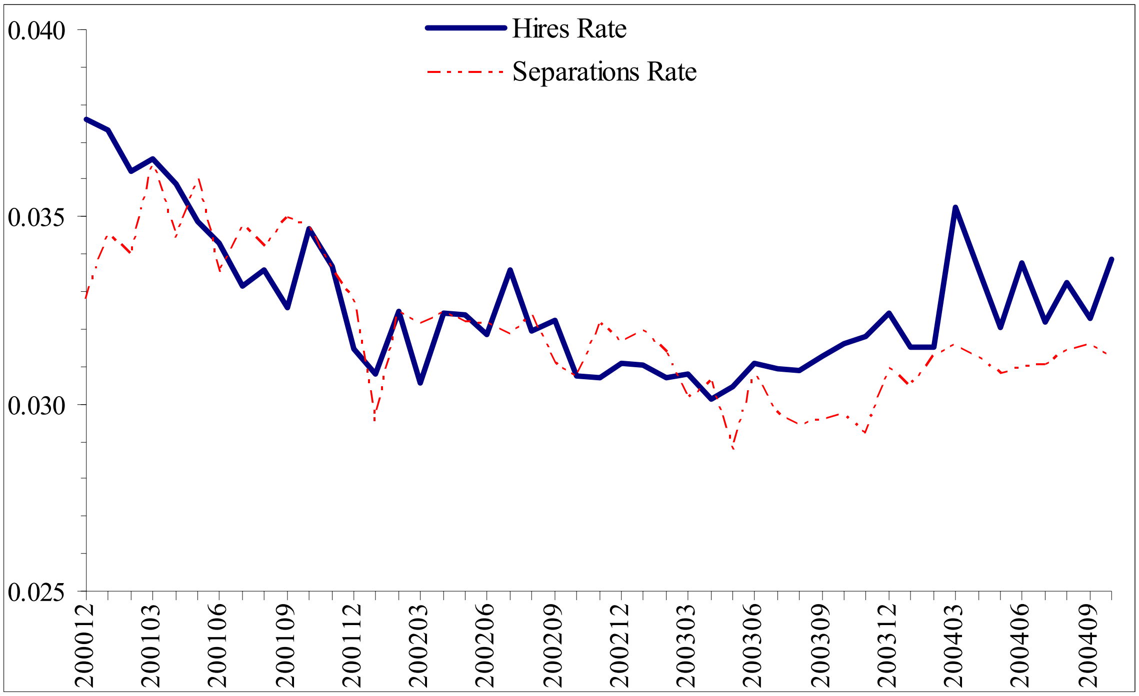
Source: Tabulations of BED micro data from Faberman (2004).

Figure 5. Quarterly Job Flows in Manufacturing, Seasonally Adjusted, 1947-2004



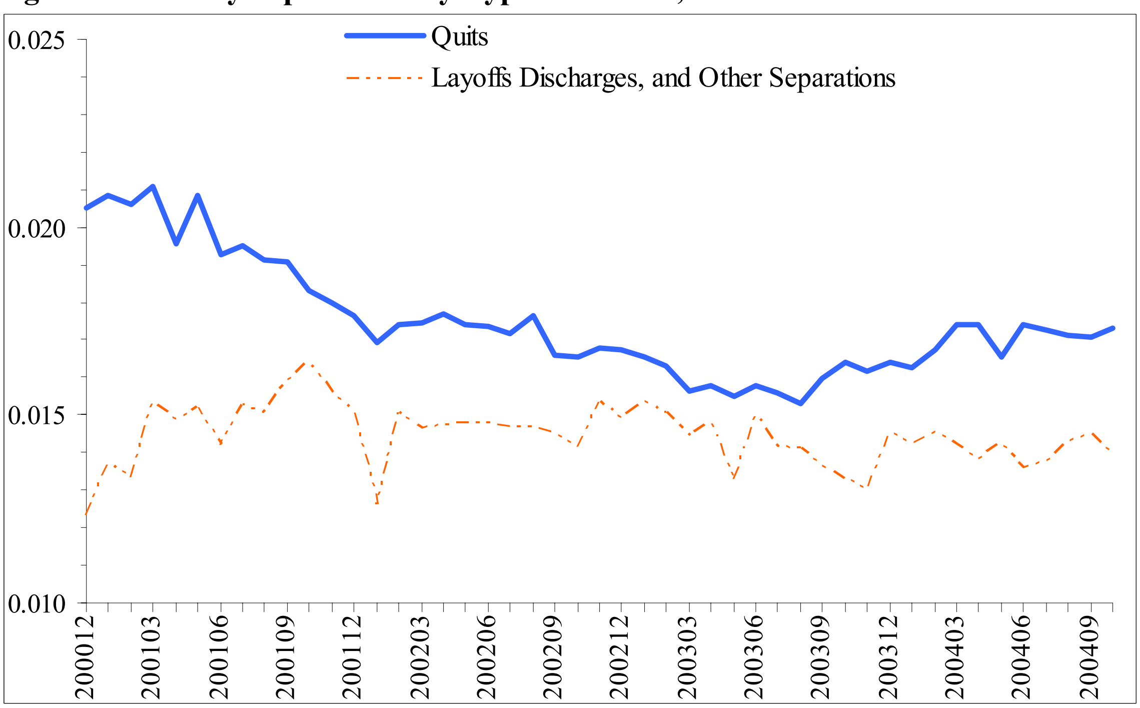
Source: Authors' tabulations and splicing of data from the MTD, LRD and BED. See text for details.

Figure 6. Monthly Hires and Separations Rates in JOLTS, December 2000 to October 2004



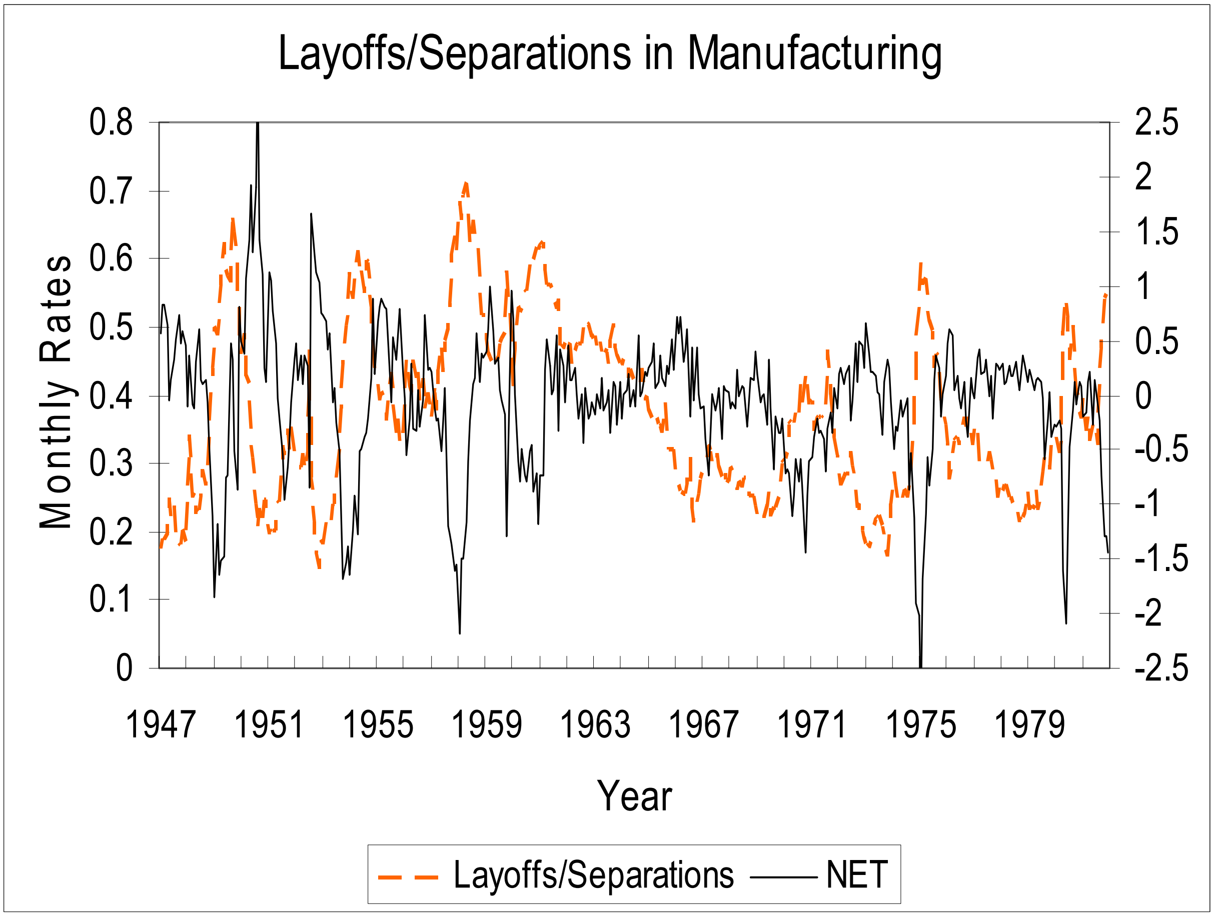
Source: Published JOLTS data, seasonally adjusted.

Figure 7. Monthly Separations by Type in JOLTS, December 2000 to October 2004



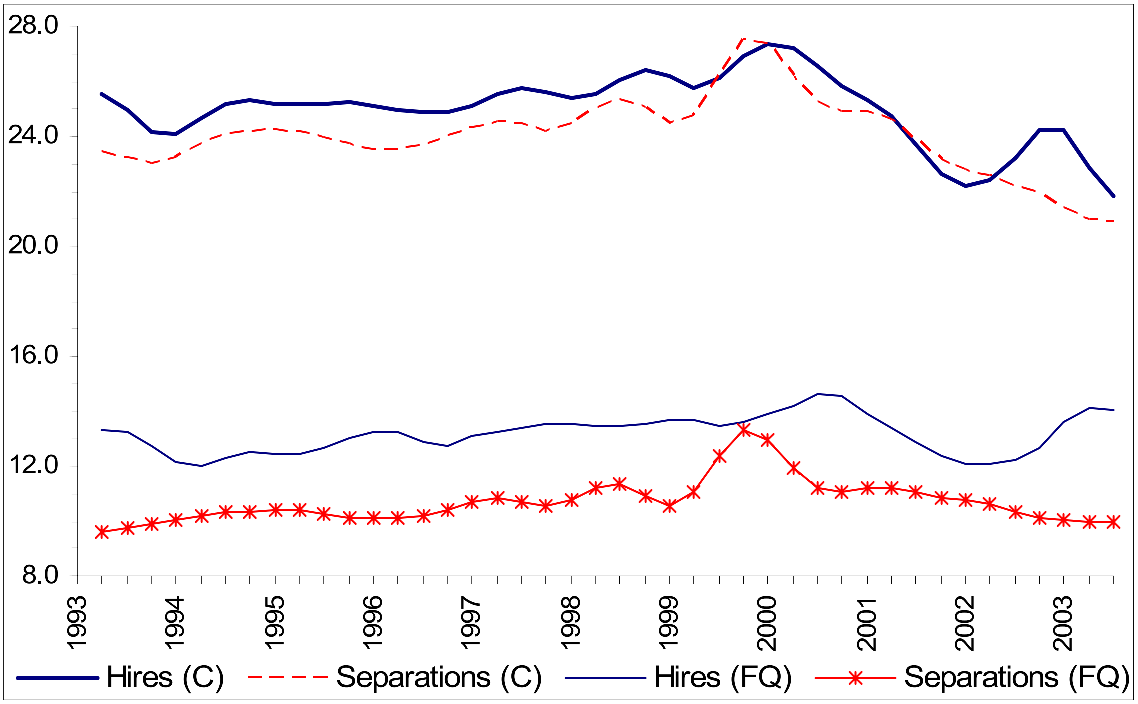
Source: Published JOLTS data, seasonally adjusted.

Figure 8. Cyclical Variation in Layoffs as a Percent of Separations in Manufacturing, Quarterly Averages of Monthly Data, 1947-1981



Source: Authors calculations using the MTD.

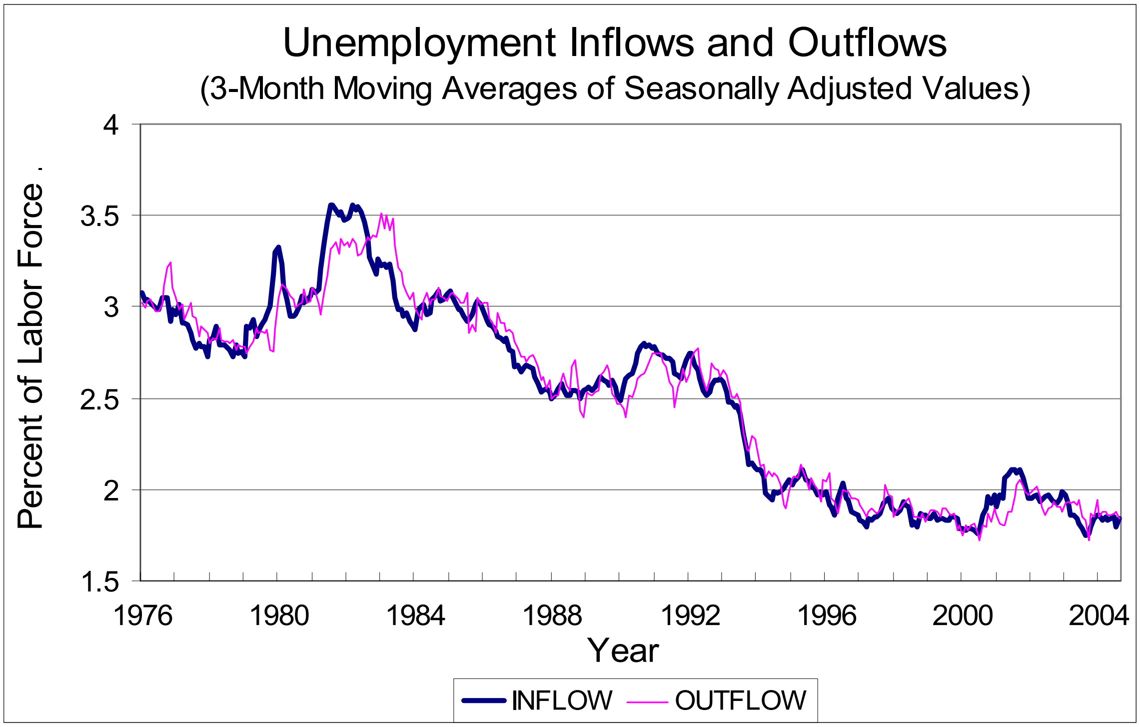
Figure 9. Quarterly Hires and Separation Rates in the LEHD, Selected States, Cumulative Flows (C) and Full Quarter (FQ) Measures

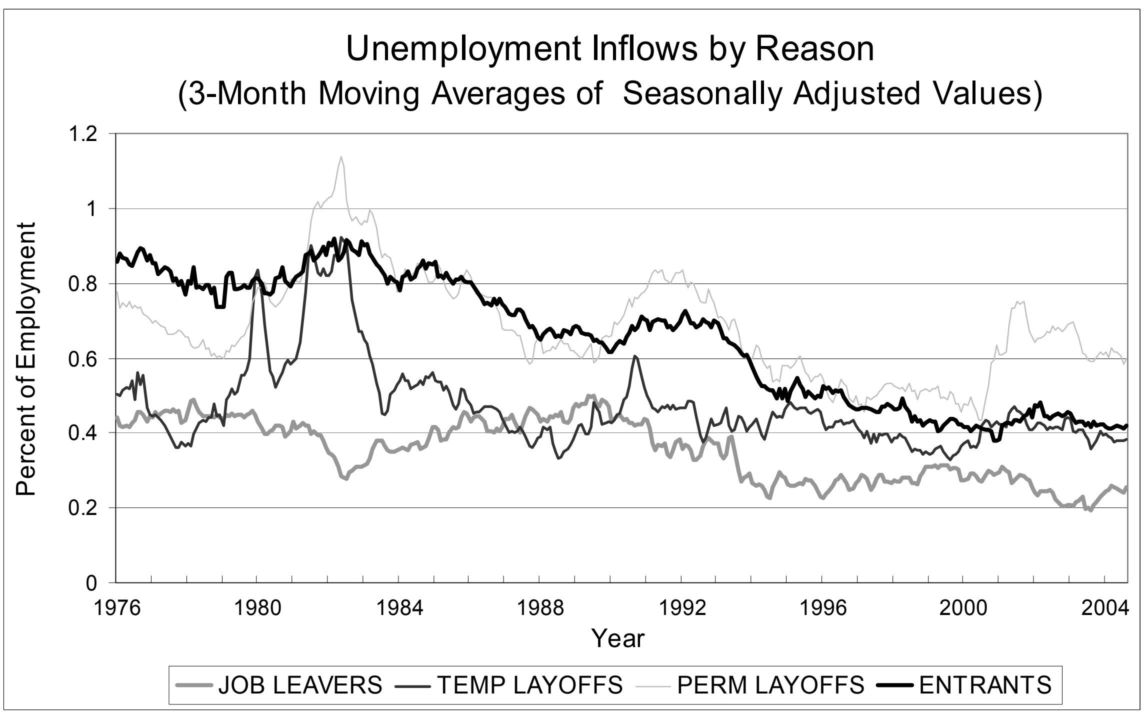


Notes: See the text for a definition of "Cumulative Flows" and "Full Quarter" measures. The data are seasonally adjusted.

Source: Authors' tabulations on LEHD QWI files, ten states.

Figure 10. Monthly Unemployment Inflows and Outflows from the CPS, 1976-2004





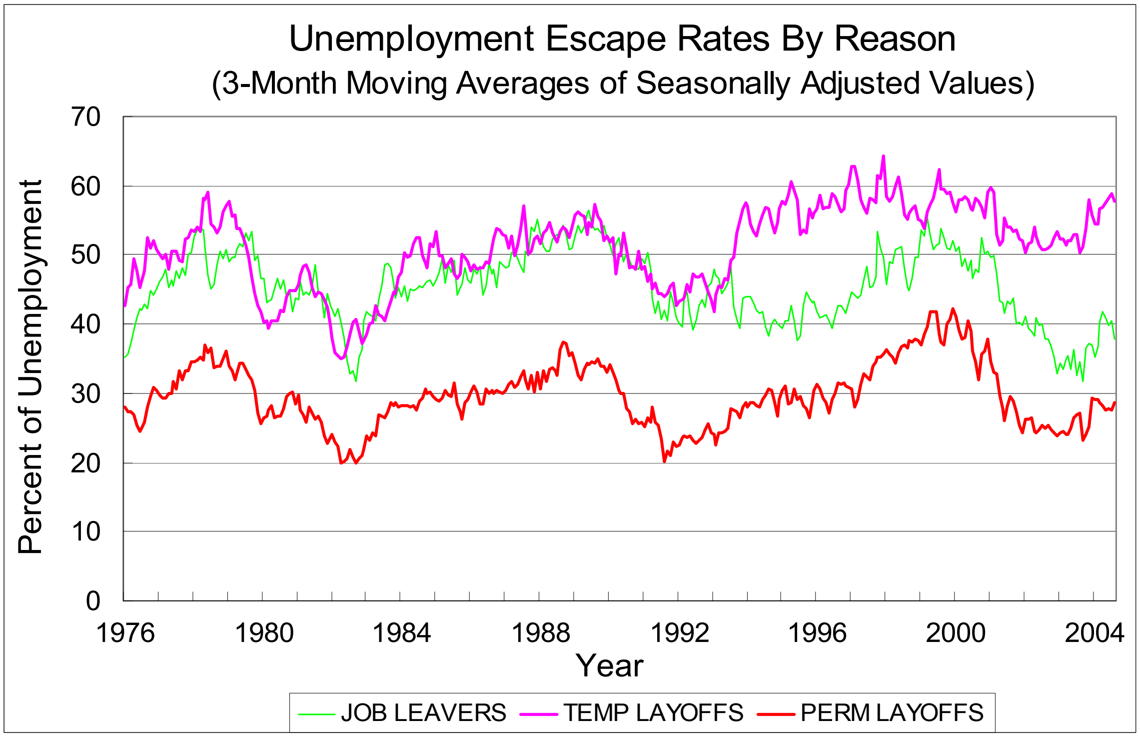
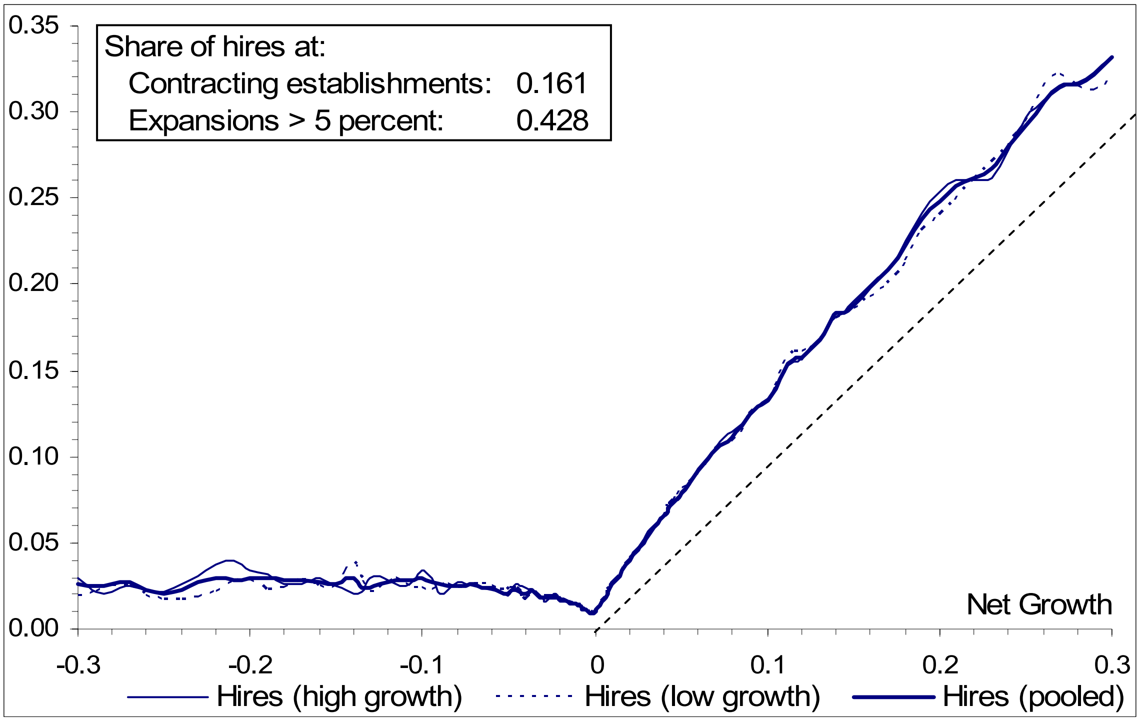
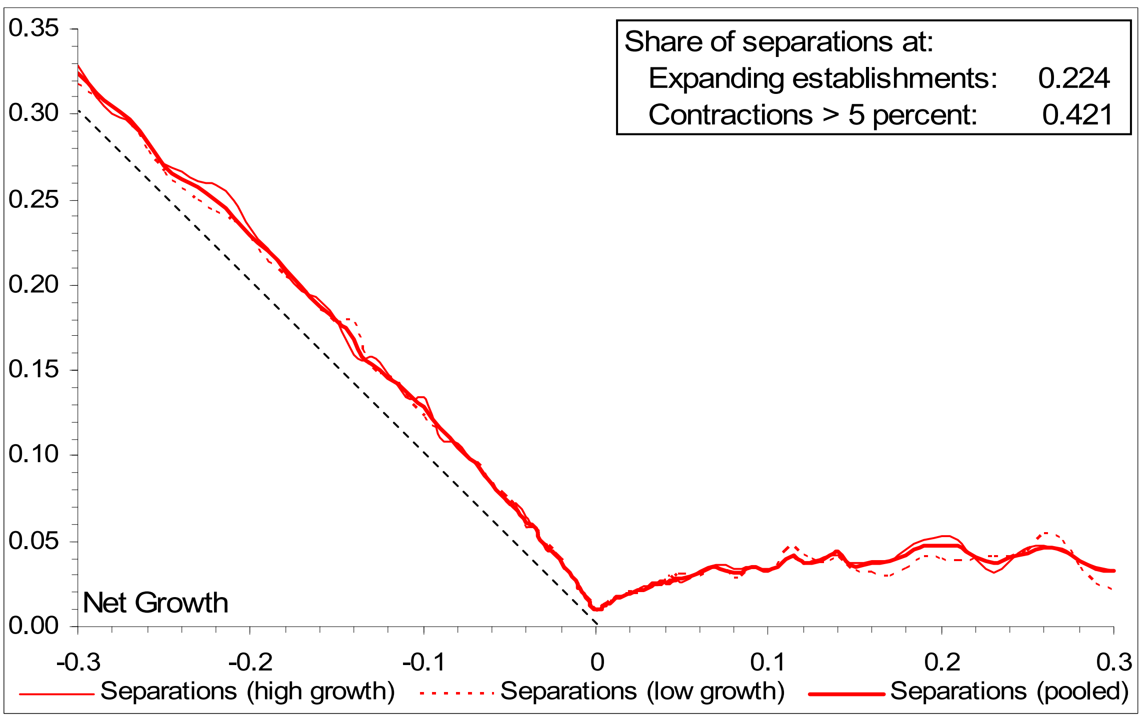

Unemployment Escape Rates By Reason
(3-Month Moving Averages of Seasonally Adjusted Values)
Percent of Unemployment
70
60
50
40
30
20
10
0
1976
1980
1984
1988
1992
1996
2000
2004
Year
JOB LEAVERS
TEMP LAYOFFS
PERM LAYOFFS

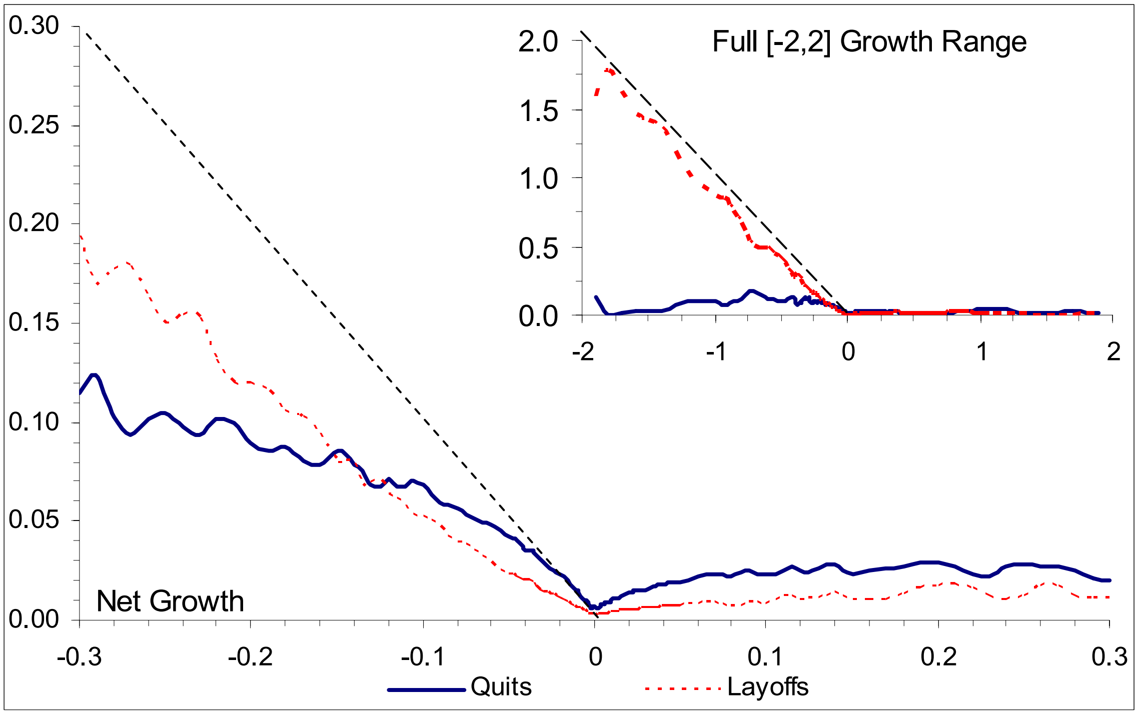
Figure 11: The Relationship of Hires and Separations to Establishment Growth





Notes: The curves are fitted nonparametric regressions of monthly hires and separations rates on establishment-level growth rates in three pooled samples: all months from December 2000 to January 2004, the 12 months with the highest employment growth, and the 12 months with the lowest growth (based on seasonally unadjusted data). Dashed lines are 45-degrees from the origin.
Source: Authors' estimates using JOLTS micro data.

Figure 12. The Relationship of Quits and Layoffs to Establishment Growth

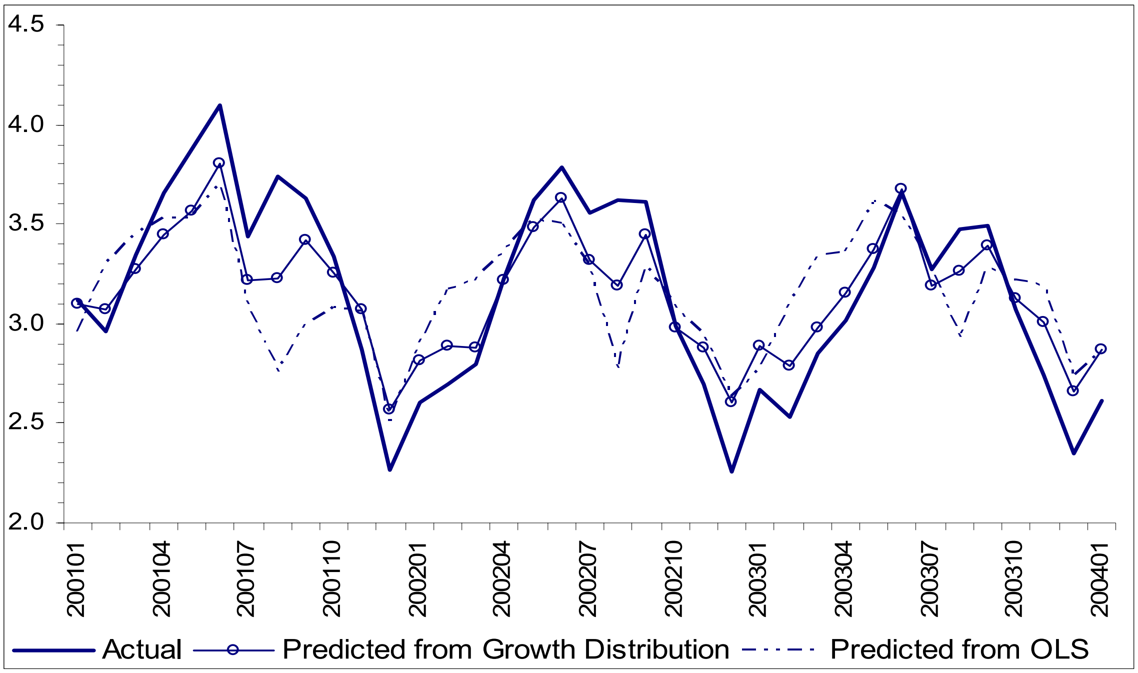


See notes to Figure 11.

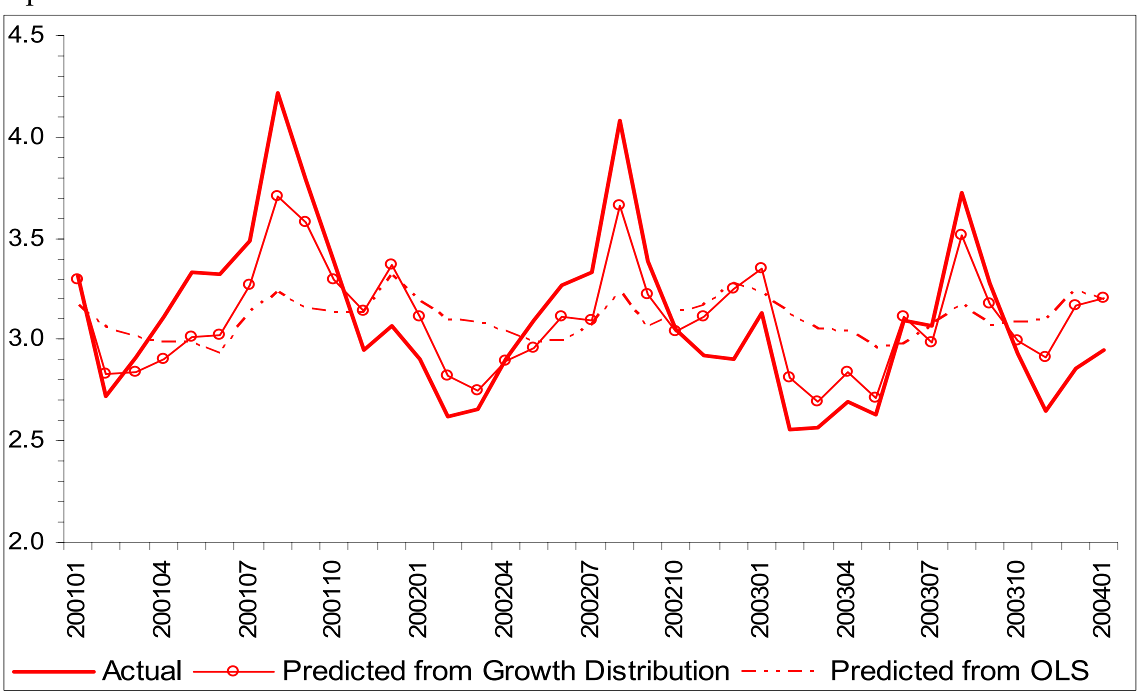
Source: Authors' estimates using JOLTS micro data.

Figure 13. Actual and Predicted Worker Flows, January 2001 to January 2004

Hires



Separations



Note: See text for an explanation how we generate the predicted worker flow rates.
Source: Authors' estimates and calculations using JOLTS micro data, not seasonally adjusted.

Figure 14. Layoffs-Separation Ratio as a Function of Net Employment Growth Rate

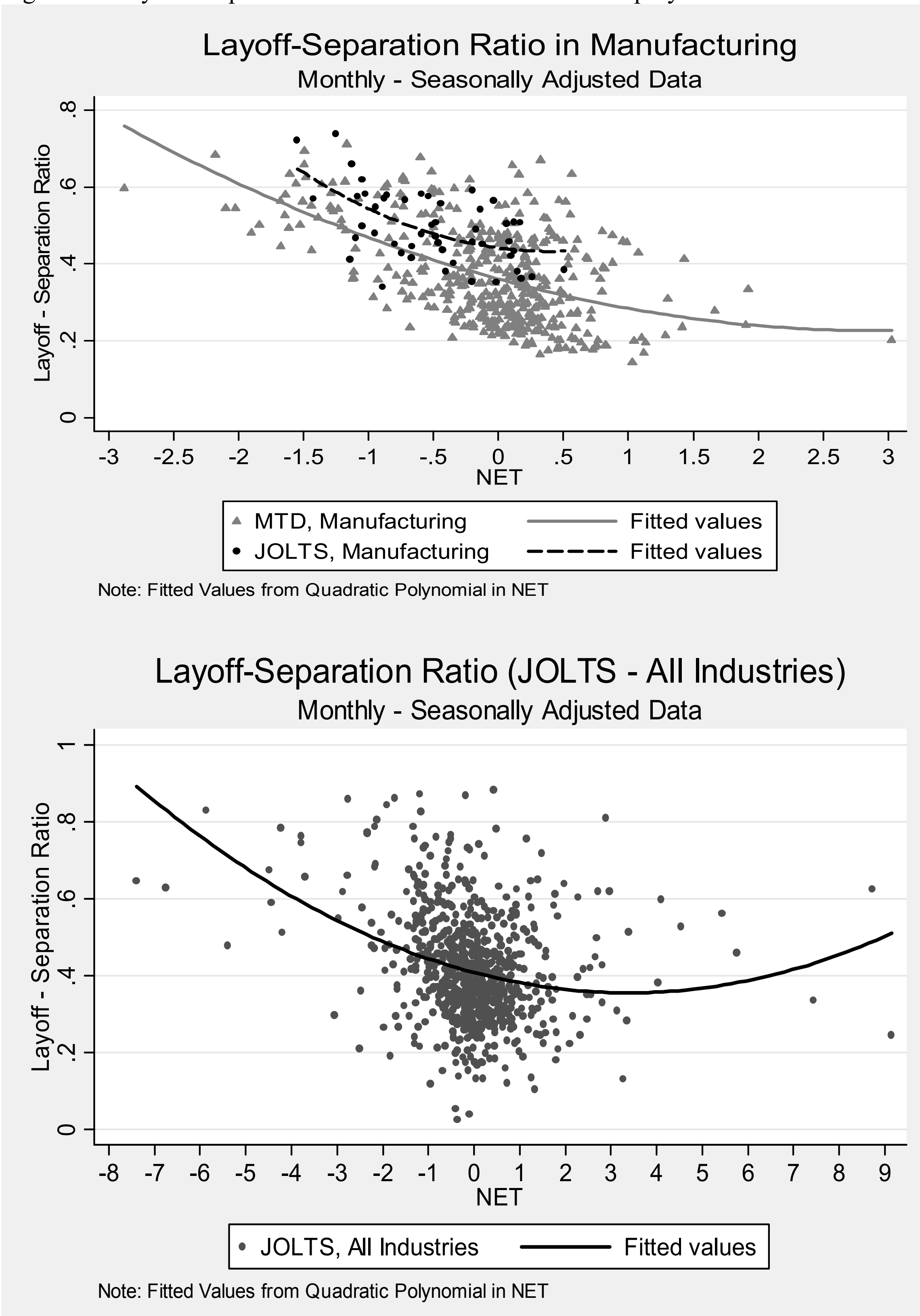


Table 1. Job and Worker Flow Rates, Monthly and Quarterly

A. Job Flow Rates *Data Source*	*Time Period*	*Sampling Interval*	*Job Creation*	*Job Destruction*
JOLTS, continuous units	December 2000 – January 2004	Monthly	1.5	1.5
BED	March 1990 – June 2003	Quarterly	8.0	7.7
B. Worker Flow Rates *Data Source*	*Time Period*	*Sampling Interval*	*Hires*	*Separations*
JOLTS, continuous units	December 2000 – January 2004	Monthly	3.2	3.1
LEHD, selected states, full-quarter cases	1993:2 to 2003:3,	Quarterly	13.2	10.7
LEHD, selected states, cumulative flows	1993:2 to 2003:3	Quarterly	25.0	24.0

Notes: All data sources exclude the farm sector, and the BED and LEHD are also limited to the private sector. The "full-quarter cases" in the LEHD restrict attention to separated workers who were employed in the quarter prior to separation and to hires who remained employed in the following quarter. The JOLTS data are national, and the LEHD data cover ten states.

Source: Authors' tabulations of BED, JOLTS and LEHD micro data.

Table 2. Labor Market Flows by Industry

A. Average Quarterly Job Flow Rates in the BED, 1990:2 – 2003:2

	Job Creation	*Job Destruction*	*Net Growth*
Total Private	8.0	7.7	0.3
Resources	19.7	19.8	-0.1
Construction	14.3	14.0	0.4
Manufacturing	4.9	5.3	-0.4
Wholesale Trade	6.8	6.7	0.1
Retail Trade	8.1	7.9	0.2
Transportation & Utilities	6.7	6.4	0.3
Information	6.9	6.6	0.3
Financial Activities	6.7	6.4	0.3
Professional & Business Services	9.9	9.1	0.8
Education & Health	5.6	4.9	0.7
Leisure & Hospitality	10.9	10.4	0.5
Other Services	8.9	8.6	0.3

B. Average Monthly Labor Flow Rates in JOLTS, December 2000 to January 2004

					Layoffs & Discharges Per	
	Hires	*Separations*	*Quits*	*Layoffs & Discharges*	*Quit*	*Destroyed Job*
Total Nonfarm	3.2	3.1	1.7	1.1	0.7	0.8
Resources	3.0	3.1	1.2	1.4	1.5	0.9
Construction	5.4	5.6	2.1	3.3	1.7	1.0
Manufacturing	2.1	2.7	1.1	1.3	1.2	0.8
Wholesale Trade	2.3	2.5	1.3	1.0	0.8	0.7
Retail Trade	4.3	4.2	2.7	1.3	0.5	0.7
Transportation & Utilities	2.5	2.7	1.3	1.1	0.9	0.8
Information	2.0	23	1.3	0.9	0.7	0.7
Financial Activities	2.2	2.1	1.2	0.6	0.6	0.6
Professional & Business Services	3.9	3.5	1.9	1.4	0.8	0.9
Education & Health	2.7	2.3	1.5	0.7	0.4	0.8
Leisure & Hospitality	6.2	6.0	4.0	1.8	0.4	0.7
Other Services	3.1	3.0	1.8	1.0	0.6	0.7
Government	1.5	1.2	0.6	0.4	0.6	0.7

Note: The Resources industry group in the JOLTS data excludes most agriculture.
Source: Authors' tabulations of BED and JOLTS micro data.

Table 3. Three Statistical Models for Movements in Worker Flow Rates

	Hires	Separations	Quits	Layoffs
Variance of Monthly Rates (Jan. 2001 – Jan. 2004)	0.237	0.159	0.100	0.025
Percent Explained by:				
(1) Time-invariant micro relationships and changes in cross-sectional density	38	42	11	80
(2) Linear regression on the net employment growth rate	37	6	1	51
(3) Linear regression on job creation and destruction rates	92	88	67	76

Notes: The top row shows the variance of aggregate monthly worker flow rates, not seasonally adjusted, as computed by the authors from continuous units in JOLTS. Statistical model (1) generates predicted worker flows using the pooled-sample fitted micro relationships displayed in Figures 11 and 12 and the observed time series for the cross-sectional growth rate density. Model (2) generates predicted worker flows from linear time-series regression models of the indicated worker flow rate on the aggregate employment growth rate. Model (3) generates predicted worker flows from linear time-series regression models of the indicated worker flow rate on the JOLTS-based job creation and job destruction rates.

Source: Authors' estimates and calculations with JOLTS data.

Table 4. Aggregate Worker Flows and Time Variation in the Micro Relations

Data for January 2001 to January 2004	Hires	Separations	Quits	Layoffs
12 high growth months	3.45	2.97	1.73	1.02
12 low growth months	2.91	3.31	1.76	1.33
Values Generated by the Pooled-Sample Cross-Sectional Growth Rate Density And Micro Relations Fit to:				
12 high growth months	3.21	3.16	1.79	1.14
12 low growth months	3.11	3.06	1.67	1.17

Notes: The top panel shows the average monthly worker flow rates, not seasonally adjusted, as computed by the authors from continuous units in JOLTS for the indicated months. The lower panel shows the worker flow rates generated by the pooled-sample cross-sectional growth rate density and micro relations fit to data for the indicated months.

Source: Authors' estimates and calculations with JOLTS data.