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# 3 Measuring Gross Worker and Job Flows

Steven J. Davis and John Haltiwanger

## 3.1 Introduction

Market economies exhibit high rates of worker flows from one job to another and between employment and joblessness. The myriad forces that drive these flows fall into two broad categories: one associated with events or circumstances that induce workers to reallocate themselves among a given set of jobs and establishments and a second associated with events that alter the distribution of available jobs among establishments.

The first category encompasses job-to-job movements for reasons of career advancement, family relocation, job satisfaction, and quality of the worker-job match. It also encompasses labor force entry and exit for reasons of health, schooling, child rearing, family relocation, and retirement. The second category encompasses the many forces that impinge on the spatial distribution of labor demand such as the growth and decline of markets, the restructuring of firms and industries, changing patterns of domestic and foreign competition, and local changes in costs and the business environment. These forces drive establishment-level job creation and destruction, which in turn cause workers to change employers and shuffle between employment and joblessness. In this way, the second category of forces gives rise to both job and worker flows.

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This paper quantifies the magnitudes of job and worker flows, assesses the relative importance of the two broad categories of driving forces behind worker reallocation, and describes several key empirical regularities in the behavior of worker and job flows. We draw heavily on previous research to compile the empirical evidence, and we develop new evidence related to cyclical patterns in job and worker flows. Our treatment of evidence and data focuses almost exclusively on the United States.<sup>1</sup>

Previous studies use a variety of household, worker, establishment, and firm data sets to examine specific aspects of worker and job flows. Because there is no comprehensive source of information on worker and job flows in the U.S. economy, it is necessary to draw upon several different studies and data sets to assemble a fuller, more accurate picture of labor market flows. Available data sets differ, often greatly, in terms of sampling frequency, sampling unit, time period, and extent of regional and industrial coverage. We discuss these differences and assess the relative strengths and weaknesses of the available data sets. The worker and job flow concepts that can be measured also differ greatly among available data sets, sometimes in subtle ways. To clarify these differences, we spell out the relationships among alternative measures that appear in the literature.

In the concluding section, we discuss prospects for the development of new longitudinal employer-level data sets that would permit timely, detailed, and comprehensive measures of gross job flows. In this regard, we consider two sources of administrative records maintained by the U.S. government. Since these administrative records are already in place and are collected on an ongoing basis, they offer a relatively low cost vehicle for the construction of gross job flow statistics. We also discuss a third source of administrative records that holds open the promise of comprehensive, linked statistics on job flows *and* worker flows.

A few additional road signs to the organization of the paper may be helpful. Section 3.2 outlines several reasons to measure and study gross worker and job flows. Section 3.3 defines worker and job flow measures used in previous studies, spelling out the relationships among them. Section 3.4 describes the main U.S. sources of data on the various measures of worker flows and job flows. Section 3.5 compiles the evidence and synthesizes much of what we know about the empirical behavior of U.S. worker flows and job flows. Section 3.6 summarizes this synthesis in a bare-bones recital of facts and empirical regularities. Section 3.7 describes prospects for new sources of data on U.S. worker flows and job flows.

1. For evidence and references related to gross worker and job flows in other countries, see table 2.2 in Davis, Haltiwanger, and Schuh (1996), the January/June 1996 volume of *Annales d'Economie et de Statistique*, and Organization for Economic Cooperation and Development (1994, 1996).

### 3.2 Why Measure and Study Gross Worker and Job Flows?

There are many reasons to measure gross worker and job flows and to study their behavior. We sketch out a dozen reasons here. As a by-product, we draw attention to areas of research that exploit or have been stimulated by gross flow statistics, and we identify other potentially fruitful applications of data on labor market flows.

*Reasons for worker mobility.* The two broad categories of driving forces behind gross worker flows identified in the introduction lead to different theories of worker mobility. The first category leads to a focus on job shopping, match quality, and events that affect preferences regarding work. The second category leads to a focus on demand-side disturbances that induce shifts in the distribution of job opportunities across locations. Quantifying the relative importance of each set of reasons for worker flows—and measuring how the relative importance differs among groups of workers, among types of employers, and over time—helps to direct theorizing and policy making about worker mobility behavior and related phenomena.

*Unemployment and wage determination.* The magnitude of gross worker and job flows sheds light on the plausibility of alternative theories of unemployment and wage determination. For example, the large magnitude of gross job flows documented in previous studies underscores the empirical relevance of theories that model unemployment as a frictional phenomenon, that is, as a consequence of continual shifts in the structure of labor demand. By the same token, high rates of worker and job flows in all market economies and almost every industry and type of firm diminish the empirical relevance of theories that stress conflicts between static groups of employed insiders and jobless outsiders.

*Worker sorting and job assignment.* Many economic theories deal with assignment problems that arise when workers are imperfect substitutes in production, or when they differ in their ability or desire to work with cooperating factors. Assignment models underlie the analysis of several important topics in labor economics, including dual labor markets, equalizing differences in wage payments, labor market sorting based on comparative and absolute advantage, and the organization of workers into teams and hierarchies (see Sattinger 1993). Worker and job flows across locations are among the most important mechanisms by which the economy continually adjusts the assignment of workers to each other and to cooperating factors of production.

*Job tenure differences.* Job flow statistics shed light on the reasons for differences in job tenure distributions across industries, among different types of firms, and over time. For example, pronounced differences in job destruction

rates probably account for much of the differences in job tenure distributions by size of employer. Linked measures of worker and job flows would be especially useful for understanding why tenure distributions differ among groups of workers and how these differences relate to interactions between individual and employer characteristics.

*Local labor market spillovers.* Data on the geographic incidence and concentration of gross job flows greatly facilitate the study of wage and employment spillovers in local labor markets. Such data could be combined with information on defense contract awards, for example, to identify job creation and destruction events that are exogenous to local labor markets. One could then examine the impact of job creation and destruction events on wages, employment, gross worker flows, population, and the tax base in nearby and more distant labor markets.

*Employer life cycle dynamics.* Cross-sectional evidence on gross job flows sheds light on the life cycle dynamics of establishment-level and firm-level employment. For example, Davis and Haltiwanger (1992) find a strong, pervasive pattern of higher gross job flow rates at younger plants. This ubiquitous pattern highlights the connection between employer age and heterogeneity, and it provides strong support for the importance of selection effects in the evolution of industries and plants (Jovanovic 1982).

*Reallocation and productivity growth.* Recent studies by Baily, Hulten, and Campbell (1992), Baily, Bartelsman, and Haltiwanger (1996), and Olley and Pakes (1996) find that the reallocation of jobs and factor inputs from less efficient to more efficient plants accounts for a large fraction of industry-level productivity gains. More generally, data on gross job flows provide a tool for studying the connection between the reallocation process and the growth of productivity and wages.

*Reallocation and business cycles.* Time-series data on gross flows shed new light on the nature of business cycles and provide a window into the connection between recessions and the reallocation of workers and jobs. For example, evidence presented below for the U.S. manufacturing sector indicates that recessions are characterized by sharp jumps in job destruction rates but little change in job creation rates. This pattern holds in the U.S. manufacturing sector for every recession since 1937.<sup>2</sup>

*Search theories.* Evidence on the time-series properties of gross job flows has helped stimulate and guide a resurgence of research on dynamic equilibrium

2. As yet, available evidence is too sparse to confidently judge the prevalence of this pattern across industries and countries.

search theories and the role of search in aggregate fluctuations. Prominent examples include work by Andolfatto (1996), Blanchard and Diamond (1990), Caballero and Hammour (1994), Mortensen (1994a), and Mortensen and Pissarides (1993).

*Identification in time-series analysis.* Time-series data on gross job flows provide a new source of leverage for drawing inferences about the driving forces behind aggregate economic fluctuations. See, for example, Davis and Haltiwanger (1996) and Caballero, Engel, and Haltiwanger (1997).

*Lumpiness, heterogeneity, and aggregation.* The pervasiveness and magnitude of large-scale gross job flows underscore the dangers of reasoning about aggregate and industry-level dynamics from representative employer models. Large-scale heterogeneity among employers implies considerable scope for aggregation to smooth away even pronounced nonlinearities and asymmetries in firm-level and establishment-level employment dynamics. See Caballero (1992) and Hamermesh (1993, chap. 7). Furthermore, gross job flow data point to considerable lumpiness in establishment-level employment changes. Lumpiness and heterogeneity imply that aggregate employment dynamics are closely intertwined with the evolution of the cross-sectional distribution of establishment-level employment changes. See, for example, Caballero and Engel (1993).

*Quantitative theoretical analyses.* Data on gross job and worker flows have proved useful as inputs into quantitative theoretical analyses of firing costs (Hopenhayn and Rogerson 1993), the welfare implications of aggregate business cycles (Caballero and Hammour 1996), the efficiency of the reallocation process (Mortensen 1994b), and the asset value of a worker (Yashiv 1996).

### 3.3 Concepts and Definitions

Section 3.2 offers motivation for measuring and studying gross worker and job flows. In this section, we define several measures that have been adopted in previous work, and we spell out the relationships among them.

#### 3.3.1 Worker Flow Measures

We begin by defining a measure of gross worker reallocation:

*Gross worker reallocation at time  $t$  equals the number of persons whose place of employment or employment status differs between  $t - 1$  and  $t$ .*

A change in employment status means a transition from employment to non-employment, or vice versa. Gross worker reallocation can be measured by counting the number of persons who have either a different employment status or a different place of employment between two points in time.

It is important to distinguish this concept of gross worker reallocation from a widely used measure of worker turnover:

*Total turnover at time  $t$  equals the number of accessions plus the number of separations that occur during the interval from  $t - 1$  to  $t$ .*

Total turnover measures the gross number of labor market transitions, whereas gross worker reallocation measures the number of persons who participate in transitions. Differences between these two measures of labor market flows arise for two reasons. First, job-to-job movements induce twice as much total turnover as worker reallocation. To see this point, consider the example of two workers who exchange jobs and employers. Under the total turnover measure, this example involves four transitions: two separations and two accessions. Under the gross worker reallocation measure, two workers participate in the transitions. Other patterns of labor market flows induce equal-sized increments to total turnover and worker reallocation. For example, consider an unemployed and an employed worker who switch positions. This event involves two transitions—one separation and one accession—but it also involves two individuals.

A second difference arises from the different sampling methods that are often used to measure these two concepts of labor market flows. Some total turnover measures—for example, the well-known Bureau of Labor Statistics (BLS) turnover series—encompass all separations and accessions that occur during an interval of time. For example, if an individual is employed at the beginning of the time interval but undergoes a completed spell of temporary layoff and recall during the interval, that worker contributes two transitions to the total turnover measure: one separation and one accession.<sup>3</sup> In contrast, gross worker reallocation measures are typically based on changes in employment status and place of employment between two discrete points in time. Hence, the worker in the previous example contributes nothing to the measure of gross worker reallocation because he holds the same employment position at the beginning and end of the sampling interval.

The conceptual differences between gross worker reallocation and total turnover appear not to have been fully appreciated in the recent literature. Anderson and Meyer (1994) and Lane, Isaac, and Stevens (1993) construct total turnover measures, but they treat their measures as analogous to the measure of gross worker reallocation calculated by Davis and Haltiwanger (1992). The

3. The definition of total turnover stated in the text corresponds precisely to the sum of separations plus accessions as measured in the BLS turnover data, but it corresponds imperfectly to some other measures that appear in the literature under the name of turnover or job turnover. E.g., Anderson and Meyer (1994) use a measure of turnover that picks up some, but not all, of the layoff-recall events that are completed within the sampling interval. The turnover measure used by Lane, Isaac, and Stevens (1993) does not include any layoffs that are reversed within the sampling interval.

preceding remarks make clear that total turnover and gross worker reallocation are not analogous.

However, there is something to be learned by comparing the two quantities. To the extent that one can ignore or delete accessions and separations that are reversed within the sampling interval, the difference between total turnover and gross worker reallocation equals the number of job-to-job transitions that occur during the sampling interval. One can imagine using data on temporary layoffs and recalls to “correct” total turnover for the accessions and separations that are reversed within the interval.<sup>4</sup> Absent such a correction, one can still interpret the difference between total turnover and worker reallocation as an upper bound on the number of job-to-job transitions that occur during the interval.

### 3.3.2 Job Flow Measures

Much of this paper decomposes worker flows along a different line. As suggested in the introduction, there are two broad sets of driving forces behind gross worker reallocation—one associated with job reallocation and one associated with worker reallocation among a fixed set of jobs. To develop this decomposition, we begin by defining measures of gross job flows:

*Gross job creation at time  $t$  equals employment gains summed over all establishments that expand or start up between  $t - 1$  and  $t$ .*

*Gross job destruction at time  $t$  equals employment losses summed over all establishments that contract or shut down between  $t - 1$  and  $t$ .*

*Gross job reallocation at time  $t$  equals the sum of all establishment-level employment gains and losses that occur between  $t - 1$  and  $t$ . It equals the sum of job creation and destruction.*

Because they are cumulated from net establishment-level employment changes, these job flow measures omit job reallocation that takes the form of changes in the mix of employment positions within establishments.<sup>5</sup> In this respect, the job flow measures share a feature of the gross worker reallocation and total turnover measures, neither of which directly encompass internal labor mobility. Hence, all of the labor flow measures considered in this paper can be viewed as lower bounds on conceptually similar, but broader and more encompassing measures.

4. Temporary layoffs and recalls are likely to be the main source of separations and accessions that are reversed within the sampling interval.

5. Two recent studies provide some evidence on the magnitude of job reallocation within firms and plants. Based on a two-way classification into production and nonproduction positions, Dunne, Haltiwanger, and Troske (1997) find that intraplant job reallocation amounts to 12 percent of interplant job reallocation in the U.S. manufacturing sector over the 1972–88 period. Based on firms’ responses to the question “How many employees changed functions and/or changed departments within the organization?” Hamermesh, Hassink, and Van Ours (1996) find that intrafirm job reallocation amounts to 13 percent of interfirm job reallocation in a sample of Dutch firms in 1990.



However, at least some changes in the mix of jobs within establishments are likely to induce separations and accessions that enter into the measures of total turnover and gross worker reallocation. In this respect, the worker reallocation and total turnover measures are more inclusive than the job flow measures. Put another way, the gross job flow measures miss a portion of the changes in the structure of labor demand that underlie the demand-driven component of measured worker reallocation and total turnover. This matter seems minor, and we ignore it in the remainder of the paper.

### 3.3.3 Quantifying the Connection between Worker Flows and Job Flows

Given data that match workers to their employers and follow each over time, one can directly quantify the connection between worker flows and job flows. For example, one can calculate the fraction of worker accessions accounted for by job creation and the fraction of worker separations accounted for by job destruction. To the extent that such data encompass the entire economy—thereby precluding worker transitions into or out of the covered sector—one can directly calculate the fraction of gross worker reallocation accounted for by job reallocation. Lane et al. (1993) and Anderson and Meyer (1994) carry out such calculations using data for particular states, and Albaek and Sorensen (1995) do so using Danish data. While the data requirements are demanding, matched worker-employer longitudinal data make it feasible to precisely characterize the relationship between worker flows and job flows and to study changes over time and differences in this relationship among groups of workers and employers. As we discuss below in section 3.7, there are prospects for constructing comprehensive matched worker-employer data for the United States.

In the absence of suitable matched worker-employer data, one can place bounds on the amount of worker reallocation induced by the reshuffling of job opportunities as follows. Job reallocation equals the maximum amount of worker reallocation directly induced by the reshuffling of employment opportunities across locations. We say the “maximum amount” because some job-losing workers move from a shrinking establishment to a new job at a growing establishment within the sampling interval. Such workers are counted twice in the job reallocation measure—once in the job destruction column and once in the job creation column. To eliminate any possibility of double counting in quantifying the link between job and worker reallocation, we use the following measure:

*Minimum worker reallocation equals the larger of job creation or job destruction. It represents a lower bound on the amount of worker reallocation required to accommodate job reallocation.*

We can also obtain bounds on the number of workers who engage in reallocation among a given set of jobs. In particular, subtracting job reallocation (minimum worker reallocation) from the gross worker reallocation measure yields

a lower bound (upper bound) on the number of workers who engage in transitions among a given set of jobs.<sup>6</sup>

In short, we can assess the relative importance of the two broad categories of driving forces behind worker reallocation by combining independent data on worker flows and job flows. Data on worker flows provide a count of the number of workers who make labor market transitions; data on job flows provide bounds on the number of such transitions that occur because of changes in the spatial structure of labor demand.

To accurately assess the relative magnitude of the driving forces behind these transitions, it is essential to measure worker flows and job flows in comparable ways. The worker reallocation and gross job flow measures defined above involve changes in employment status, place of employment, or number of employees between two discrete points in time. In practice, we compare worker flows and job flows computed over sampling intervals of equal length.

This discussion should also make clear that comparisons between total worker turnover and job reallocation are *not* directly informative about the number of workers who make transitions because of job reallocation. Total turnover does not measure the number of workers involved in labor market transitions during an interval of time because it double counts job-to-job transitions. In addition, many turnover measures include transitions that are reversed within the sampling interval, but gross job flow measures do not include establishment-level employment changes that are reversed within the interval.

### 3.3.4 A Summary of Relationships among the Measures

We summarize the relationships among the various measures in a few declarative statements:

- Total turnover is the number of labor market transitions, that is, the sum of separations and accessions.
- Worker reallocation is the number of workers who make transitions.
- Job reallocation equals job creation plus job destruction.
- Job reallocation is an upper bound on the number of workers who participate in transitions that occur because of changes in the location of employment opportunities.
- Minimum worker reallocation, the larger of job creation and job destruction, is a lower bound on the number of workers who participate in transitions that occur because of changes in the location of employment opportunities.
- Job reallocation is a lower bound on the number of worker transitions (i.e.,

6. We recognize that not all job flows cleanly reflect changes in the spatial structure of labor demand. Suppose, e.g., that a well-matched worker quits because of a change in personal circumstances and that the employer chooses not to replace the worker because the expected net return from a new match is too low. In this scenario, the job flow event triggered by the quit reflects elements of both job matching and job reallocation. In practice, we count such events as worker reallocation induced by job reallocation.

total turnover) that occur because of changes in the location of employment opportunities.

- Total turnover minus worker reallocation is an upper bound on the number of job-to-job transitions.
- Total turnover, exclusive of separations and accessions reversed within the sampling interval, minus worker reallocation equals the number of job-to-job transitions.

### 3.4 Sources of Data on Worker and Job Flows

#### 3.4.1 CPS Gross Worker Flows

Many studies use gross worker flows tabulated from Current Population Survey (CPS) data on labor market status (employed, unemployed, or not in the labor force; see, e.g., Clark and Summers 1979; Abowd and Zellner 1985; Poterba and Summers 1986; Blanchard and Diamond 1989, 1990; Davis and Haltiwanger 1992; Davis et al. 1996). The gross worker flows are tabulated from matched monthly household surveys by counting persons who change labor market status between survey dates. These worker flow statistics are based on a comprehensive, national probability sample and are available at high frequency for a long time span (beginning in 1948), two very attractive features of the data.

Unfortunately, CPS-based statistics on gross worker flows suffer from important measurement-related problems. The misclassification of individual employment status generates large spurious gross flows between states. This problem is most serious for transitions between unemployment and out of the labor force, but it is also important for part-time workers, temporary workers, and workers on temporary layoff awaiting recall. Missing observations that are correlated with labor market status present another problem. Several studies develop adjustments to the published data for classification and other measurement error problems (e.g., Abowd and Zellner 1985; Poterba and Summers 1986). Adjustments for classification error are based on information contained in CPS reinterview surveys. Missing observations are allocated to labor market states by matching the time-series behavior of CPS data on stocks with the changes in stocks implied by the measured gross flows.

In addition to measurement problems, the data have other important limitations as well. First, the published CPS gross flow data contain limited information on worker characteristics and the reasons for worker flows. Second, the rotating nature of the CPS panel makes it impossible to follow individuals for more than four consecutive observations at monthly intervals or two consecutive observations at 12-month intervals. This aspect of the CPS sampling scheme precludes analysis of longer term worker mobility dynamics of the sort that can be carried out with other, smaller panel data sets (see, e.g., Loungani and Rogerson 1989). Third, the CPS has virtually no information on employer characteristics. Finally, it is impossible to measure direct job-to-job transitions.

### 3.4.2 Unemployment Insurance Administrative Data

Administrative data on individual worker and employer histories maintained by the unemployment insurance (UI) system have been used to measure both worker flows and job flows. Some studies use administrative data on employers in particular states to measure gross job flows (see, e.g., Brown et al. 1990; Leonard 1987; Troske 1993; Spletzer 1995). More recently, Anderson and Meyer (1994) measure both worker and job flows using the Continuous Wage and Benefit History (CWBH) database, which draws on UI administrative data for individual workers. The CWBH includes information on firm size and other employer characteristics in the individual worker records. In a similar fashion, Lane et al. (1993) have linked individual worker records with firm records for the state of Maryland to measure gross worker and job flows.

UI administrative data have several attractive features. First, they provide extensive coverage of the business and worker populations. Self-employed persons are the only important sector of the private economy outside the scope of the UI system. Second, the data are available at high frequency—monthly employment observations and quarterly payroll information. Third, and perhaps most important, the UI data offer the great advantage of being able to simultaneously measure gross worker flows and gross job flows and to link the two types of flows at the level of individual employers.

UI data on individual workers and employers are not in the public domain, which hampers their widespread use as a research tool, but several researchers have obtained data for particular states through various licensing arrangements. The UI data also present other difficulties and limitations, primarily involving historical records prior to 1992. Since several studies use these historical records and they remain an important research tool, it is worthwhile to briefly discuss weaknesses in these data.

The main problems arise from the ambiguous nature of a UI reporting unit in the pre-1992 data. In these data, the UI reporting unit may represent an entire firm, part of a firm (e.g., all activity within a particular industry in the state or county), or an individual establishment. In some cases, firms could and did alter the level of aggregation at which they reported information to the UI offices. Nonlinearities and experience rating in the UI tax schedule sometimes gave firms an incentive to change their reporting practices over time. As a related problem, because the employer identifier in the UI files could change as a result of corporate restructuring or a change in a firm's reporting practices, there are difficulties in creating longitudinal employer histories. The severity and exact nature of these problems vary among states and over time within states.

One approach to longitudinal linkage problems in UI data relies on the federal employer identification number (FEIN), which typically occupies a field on employer UI records. Unfortunately, FEIN identifiers suffer from many of the same problems as UI account numbers. That is, FEINs change with changes in corporate structure. Further, firms can and do have multiple FEINs

(both within and between states). Based on tabulations from the Bureau of the Census's Standard Statistical Establishment List and Company Organization Survey, among firms with more than one location, there are approximately 1.8 million establishments, 300,000 unique FEINs, and 200,000 firms.

The preceding remarks suggest two points to keep in mind about gross flow studies based on historical UI data. First, to the extent that longitudinal linkage problems are present, UI-based data overstate the magnitude of gross job flows and, perhaps, distort their timing. The seriousness of this problem varies among the states and probably diminished over time, but we are unaware of studies that quantify the extent or pattern of this source of measurement error. Second, job creation and destruction statistics constructed from historical UI data do not reflect purely establishment-level or purely firm-level employment changes, but a mixture of the two. Again, we are unaware of studies that carefully quantify this matter. (For further discussion, see Armington 1991, 1994; Brown et al. 1990; Spletzer 1995; Troske 1993.)

The state UI agencies and the BLS initiated a major effort to improve the UI business establishment list in 1990 and 1991. As of 1992, all states require multiestablishment employers with 10 or more employees at secondary work sites to file UI reports at the establishment level. The discussion in Spletzer (1995) suggests that compliance with the multiple work site reporting requirement is high and improving over time.<sup>7</sup> Spletzer also remarks on ongoing BLS-funded efforts to improve the quality of longitudinal linkages in UI data sets.

### 3.4.3 BLS Manufacturing Turnover Data

The BLS manufacturing turnover data (MTD) was once a major source of information on worker and job flows. Based on a monthly survey of manufacturing employers, the MTD yielded monthly rates of accessions and separations including a decomposition of accessions into new hires, recalls, and other accessions and a decomposition of separations into layoffs, quits, and other separations. The data are available from 1930 through 1981. The survey was terminated in 1981, apparently because of budgetary pressures and perceived problems with the survey.

These data have been a key source of information on job and worker flows for important studies by Woytinsky (1942), Lilien (1980), Akerlof, Rose, and Yellen (1988), Blanchard and Diamond (1989, 1990), and others. Despite the termination of the MTD survey, the data remain an important research tool because they allow time-series analysis of total worker turnover and its components. Blanchard and Diamond (1990) develop a methodology for using these series to estimate and study the cyclical behavior of job creation and job destruction. Below, we apply their methodology to the MTD to characterize the

7. Spletzer states that multiestablishment employers who filed as single units in 1993 (because of either noncompliance or small secondary work sites) account for 1.4 percent of all employer records. He does not report a corresponding employment percentage.

relationship between total turnover and job reallocation over the 1930–81 period.

While the MTD are valuable and informative, they have important limitations. First, they are restricted to manufacturing. Second, the survey was voluntary, and the sample overrepresented large manufacturing employers. Third, the MTD survey did not produce a longitudinal file of individual employers, and as a consequence, the data do not provide information about the persistence of the establishment-level employment movements that underlie the aggregated turnover statistics. Finally, and quite important at this point, the data terminate in 1981. For further discussion of these data, see Hall and Lilien (1979).

#### 3.4.4 Unemployment Flows Based on CPS Incidence and Duration Data

Many studies use CPS data on the incidence and duration of unemployment to measure flows into and out of unemployment (see, e.g., Davis 1987; Darby, Haltiwanger, and Plant 1985, 1986; Murphy and Topel 1987; Juhn, Murphy, and Topel 1991; Davis et al. 1996). Since the survey is conducted monthly, the flow into unemployment can be measured as the number of individuals who report an unemployment spell that has been ongoing for less than five weeks. The flow out of unemployment can be measured as the number of unemployed persons in the previous month minus the number of currently unemployed persons who report an unemployment duration of greater than five weeks.

This method has some advantages over the CPS gross worker flow data described above. The duration-based method generates unemployment flows that correspond to movements in the official unemployment rate because it uses the entire CPS sample. In addition, the duration-based method permits easy cross-tabulation of unemployment flows with individual demographic characteristics and reason for unemployment (temporary layoff, permanent layoff, quit, or entrant). In principle, one could construct the same cross-tabulations in the CPS gross worker flow data, but detailed tabulations are unavailable in the published data, and their construction requires individual-level data to be longitudinally linked across monthly surveys.

There are also important problems and limitations associated with the duration-based measures of unemployment flows. Imperfect recall and other sources of error in the reported duration of ongoing unemployment spells cause mismeasurement of flows into and out of unemployment. Another issue arises when using data on the classification of unemployment by reason. These data reflect responses to questions about prospects for recall during an ongoing unemployment spell. As emphasized by Katz and Meyer (1990), it is important to distinguish between *ex ante* temporary layoffs (worker expects to be recalled at the time of layoff) and *ex post* temporary layoffs (worker is recalled). The CPS-based data on unemployment by reason provide neither purely *ex ante* nor purely *ex post* measures of temporary layoff unemployment. As a consequence, changes over time in the CPS measure of workers on temporary layoff

partly reflect variations in the recall expectations of individual workers over the course of ongoing unemployment spells.

It is natural to ask how duration-based measures of unemployment flows compare to measures that rely on counting changes in employment status in longitudinally linked CPS files. Davis et al. (1996, chap. 6) shed some light on this matter by plotting quarterly data on unemployment inflows and outflows from 1968 to 1986 based on both measurement methods. For the latter method, they use the Abowd-Zellner adjusted gross worker flow data. The duration-based measures show a smaller variance over time and unemployment flow rates that are typically 10 to 20 percent higher than corresponding rates in the Abowd-Zellner data. The simple correlation between the two measures of unemployment inflow (outflow) rates is .92 (.93). Both sets of unemployment flow measures show pronounced seasonality.

#### 3.4.5 Dun and Bradstreet Data

Many early studies of job creation and job destruction are based on the Dun and Bradstreet Market Identifier (DMI) files (see, e.g., Birch 1979, 1987; Small Business Administration 1983, 1987, 1988, 1991). In principle, the DMI file represents a longitudinal database on individual employers that can be used to measure job creation and destruction on an annual basis for virtually all sectors of the U.S. economy. Unfortunately, while the Dun and Bradstreet database has many impressive attributes and represents an unparalleled source of information for many commercial purposes, it is not designed or maintained as a tool for statistical analysis of job creation and job destruction. Numerous studies have highlighted severe problems with the DMI files as a tool for measuring job creation and destruction or business births and deaths (see Armington and Odle 1982; Birch and McCracken 1983; Birley 1984; Howland 1988, chap. 2; Evans 1987; Aldrich et al. 1988; Small Business Administration 1983, 1987, 1988, 1991).

For the purpose of investigating the job creation process, the DMI files suffer from two key problems. First, there is an enormous discrepancy between U.S. total employment as tabulated from the DMI files and the corresponding employment figures produced by the BLS or the Bureau of the Census. In 1986, for example, total employment tabulated from the DMI files exceeds the corresponding BLS and Census Bureau figures by nine million persons (see Bureau of the Census 1986, 514). In an economy with roughly 110 million employees, a discrepancy of this magnitude raises serious doubts about the accuracy of any statistical portrait generated from the DMI files.

Second, the DMI files do not accurately track business births and deaths or other important employment events. The U.S. General Accounting Office (GAO) has analyzed the accuracy of the DMI files in accounting for mass layoffs, with particular emphasis on layoffs due to plant closures. The Small Business Administration provided the GAO with a sample of mass layoffs and

plant closures from the DMI files for the 1982–84 period.<sup>8</sup> The GAO study found that 81 percent of the mass layoff events in the DMI files were mistakenly identified. In reality, these 81 percent represented some other event, such as a change in ownership structure, not a mass layoff or plant closure.

The DMI files also inaccurately identify plant births. A study by Birley (1984) compares three alternative sources of data for identifying new firms: the DMI file, the ES-202 data generated from administrative records maintained by state unemployment insurance agencies, and the telephone directory. She finds that the DMI files failed to identify 96 percent of the new firms found in the ES-202 data. Using a similar methodology, Aldrich et al. (1988) find that the DMI files missed 95 percent of apparently new businesses in the ES-202 data and 97 percent of those in the telephone directory.

In short, previous research indicates that the DMI files are unsuitable for generating accurate job creation and destruction figures. Identifying plant births and deaths and tracking businesses over time is most difficult in the case of small employers.<sup>9</sup>

#### 3.4.6 Longitudinal Research Database

The Longitudinal Research Database (LRD), housed at the Center for Economic Studies at the Bureau of the Census, has been the source of several recent studies of gross job flows.<sup>10</sup> The LRD links plant-level data from the Census of Manufactures and Annual Survey of Manufactures (ASM) for the years 1963, 1967, and 1972–91. The data contain a wealth of information on firm and plant characteristics and permit construction of annual and quarterly measures of job creation and destruction for the U.S. manufacturing sector.

The LRD offers several key advantages relative to other data sets that have been used to measure U.S. job flows: a comprehensive sampling frame for a major sector of the U.S. economy, large probability-based samples that minimize sampling error, the incorporation of births into ongoing panels, a careful distinction between firms and establishments, and a careful distinction between ownership transfers and births and deaths of establishments. Through its economic censuses and the Company Organization Survey, the Bureau of the Census assigns individual establishments unique, time-invariant identifiers that enable accurate tracking of the activity at individual establishments over an extended period of time.

Another key advantage of the LRD is that the ASM (and other Census

8. The GAO defined a mass layoff as the dismissal of at least 20 percent of a plant's permanent workforce.

9. Since it is particularly ill suited for the study of small employers, it is ironic that the DMI files have been the source of many of the claims for the job-creating prowess of small businesses. See Davis et al. (1994, 1996) for further discussion of these issues.

10. See, e.g., Dunne, Roberts, and Samuelson (1989), Davis and Haltiwanger (1990, 1992, 1996), and Davis et al. (1996). Chapter 1 and the technical appendix in Davis et al. (1996) describe the LRD in detail.



Bureau surveys that can be linked to the ASM) contains a wealth of information about the characteristics of plants and firms, including industry, location, size, age, capital intensity, energy intensity, productivity, and wages. These employer characteristics can be cross-tabulated with measures of gross job flows. Thus the LRD can be used to provide a wide range of information about the characteristics of the employers that create and destroy jobs.

The LRD also has important limitations. Like the UI-based data sets, LRD data are not in the public domain. Currently, use is restricted to studies conducted at the Center for Economic Studies in Suitland, Maryland, or at the Research Data Center in the Census Regional Office in Boston. Second, the data are currently restricted to manufacturing establishments. (As discussed below in section 3.7, the LRD could be extended to nonmanufacturing sectors.) Third, the LRD excludes very small establishments that account for about 4 percent of manufacturing employment.<sup>11</sup> Fourth, the LRD contains very limited information about workers and worker characteristics, and it does not permit simultaneous measurement of worker and job flows.

### 3.5 An Overview of What We Know about Gross Worker and Job Flows

#### 3.5.1 Magnitudes

Table 3.1 presents estimated average rates of total turnover, gross worker reallocation, gross job reallocation, and minimum worker reallocation. The various estimates draw on different data sets, different sectors, different states, and different time periods, so that considerable care must be used in comparing and interpreting the results. All reported rates in table 3.1 are measured as percentages of employment. Annual rates reflect changes over twelve-month intervals, while quarterly rates mostly reflect changes over three-month intervals.<sup>12</sup> Since the MTD include no direct measures of job creation and destruction, we follow Blanchard and Diamond (1990) and estimate creation and destruction rates from information on separations and accessions.<sup>13</sup>

The annual worker reallocation measure in table 3.1 is drawn from Davis and Haltiwanger (1992).<sup>14</sup> We constructed this measure using two different

11. The precise size cutoff varies among industries and over time, but a reasonable rule of thumb is that the LRD sampling frame excludes establishments with four or fewer employees. Using UI data for West Virginia over the period 1990–94, Spletzer (1995) reports that including establishments with fewer than five employees raises the annual job creation (destruction) rate in manufacturing from 4.38 (5.00) percent to 4.45 (5.07) percent.

12. The quarterly MTD figures are cumulated from monthly rates. The CWBH figures designated “total” include employment transitions that are reversed within the quarter, as discussed below.

13. We describe the methodology in section 3.5.3 below.

14. Table 3.2 below presents decompositions of quarterly worker reallocation. However, the measures of worker reallocation used for that purpose are obtained by adjusting total turnover figures for direct job-to-job transitions.

**Table 3.1** Estimated Average Rates of Worker and Job Flows (percentages of employment)

| Data Set                                                                    | Sectoral Coverage       | Annual | Quarterly |
|-----------------------------------------------------------------------------|-------------------------|--------|-----------|
| <i>Worker Reallocation</i>                                                  |                         |        |           |
| CPS                                                                         | All                     | 36.8   |           |
| Several                                                                     | All                     |        | 26.2      |
| <i>Total Turnover</i>                                                       |                         |        |           |
| CWBH                                                                        | All—Total               |        | 43.6      |
| CWBH                                                                        | Manufacturing—Total     |        | 49.3      |
| CWBH                                                                        | All—Permanent           |        | 31.6      |
| CWBH                                                                        | Manufacturing—Permanent |        | 26.3      |
| UI-MD                                                                       | All                     |        | 34.3      |
| UI-MD                                                                       | Manufacturing           |        | 22.8      |
| MTD                                                                         | Manufacturing           |        | 20.9      |
| <i>Job Reallocation</i>                                                     |                         |        |           |
| LRD                                                                         | Manufacturing           | 19.4   | 10.7      |
| CWBH                                                                        | All—Permanent           | 21.2   | 13.4      |
| CWBH                                                                        | Manufacturing—Permanent | 21.6   | 12.0      |
| UI-MD                                                                       | All                     |        | 12.0      |
| UI-MD                                                                       | Manufacturing           |        | 10.0      |
| MTD                                                                         | Manufacturing           |        | 11.1      |
| <i>Minimum Worker Reallocation Required to Accommodate Job Reallocation</i> |                         |        |           |
| LRD                                                                         | Manufacturing           | 11.7   | 6.2       |
| CWBH                                                                        | All—Permanent           | 11.3   | 8.1       |
| MTD                                                                         | Manufacturing           |        | 6.5       |

*Sources:* CPS, based on tabulations from the Current Population Survey reported in Hall (1982) for 1978 and in Davis and Haltiwanger (1992) for the period 1968–87; see the text for details. CWBH, tabulations from the Continuous Wage and Benefit History files reported in Anderson and Meyer (1994) for the period 1979–83. UI-MD, tabulations of Unemployment Insurance administrative data for the state of Maryland reported in Lane, Isaac, and Stevens (1993) for the period 1986–91. LRD, tabulations from the Longitudinal Research Database reported in Davis, Haltiwanger, and Schuh (1996) for the period 1972–88. MTD, authors' calculations based on BLS manufacturing turnover data for 1972–81; see the text for an explanation of how these data are used to calculate job reallocation figures. See the text for an explanation of how the quarterly worker reallocation rate is calculated.

pieces of information available from the CPS. First, Hall (1982) reports that 28.2 percent of employment in 1978 represents workers with job tenure of 12 months or less. Second, our tabulations of March-March matched CPS files in Davis and Haltiwanger (1992) find that the number of currently jobless persons who were employed 12 months earlier averages 8.6 percent of employment over the 1968–87 period. Summing these two pieces, the total number of persons who currently have a different job or employment status than they had 12 months earlier equals 37 percent of employment.

Several measures of total turnover are available on a quarterly basis. Anderson and Meyer (1994) report two different measures constructed from the CWBH. Their “total” measure of quarterly turnover includes workers who were temporarily laid off and recalled within the same quarter, if they can

detect such transitions from the payment of unemployment benefits. As such, their measure of quarterly total turnover includes some layoff-recall events that transpire within the quarter. This feature of their total measure complicates comparisons to worker and job flow measures based on changes between discrete points in time. However, Anderson and Meyer also report a “permanent” turnover measure that excludes turnover associated with layoff spells that end in recall. Since their definition of temporary turnover includes layoff spells that end in recall within the quarter *and* some layoff-recall spells that overlap more than one quarterly interval, their permanent turnover measure omits some turnover events that are included in measures from, say, the Maryland UI data. Nonetheless, the permanent total turnover estimates from Anderson and Meyer more closely correspond to the total turnover estimates from Lane et al. (1993). This similarity suggests that much of the temporary turnover measured by Anderson and Meyer actually occurs within the quarter.<sup>15</sup>

In any case, total turnover is quite large even when temporary turnover is excluded. According to table 3.1, total turnover amounts to about 33 percent of employment per quarter, taking the simple mean of the UI-MD and (permanent) CWBH rates for the private sector. Total turnover rates are lower in manufacturing than in the rest of the economy. Using this total turnover figure, a crude estimate of quarterly worker reallocation can be generated by considering the evidence on direct job-to-job transitions in Akerlof et al. (1988) and Blanchard and Diamond (1990). They estimate that between 30 and 50 percent of all separations (and accessions) are associated with direct job-to-job movements. Taking the midpoint of this range, 40 percent of total turnover reflects direct job-to-job transitions, which in turn implies that the total turnover rate of 33 percent translates into a worker reallocation rate of about 26 percent.<sup>16</sup> That is, roughly one worker in four experiences a change in employer or employment status each quarter. By comparing the annual and quarterly worker reallocation figures, it is clear that many workers experience repeated transitions during the year or transitions that are reversed within the year.

The third panel of table 3.1 reports estimates of the job reallocation component of worker flows. Annual job reallocation rates range from 20 to 30 percent, and quarterly rates range from 10 to 13 percent. The manufacturing sector appears to have lower rates of job reallocation than other sectors, but the differences are not dramatic. In this regard, there is less variation between manufacturing and nonmanufacturing in job reallocation rates than in total turnover rates. It follows that worker reallocation activity for reasons other than job creation and destruction plays the dominant role in explaining differences in total turnover rates. Finally, comparing the quarterly job reallocation rates to

15. Aside from differences in measurement procedures, differences in sample selection criteria between the two studies make us reluctant to give too much weight to this sort of comparison.

16. We arrive at this figure by calculating  $.33[1 - (1/2)(.40)] = .264$ . This calculation adjusts for the fact that each person who experiences a job-to-job transition is counted twice in the turnover measure, once as a separation and once as an accession. See section 3.3.

**Table 3.2**                    **Decompositions of Total Turnover and Worker Reallocation**

| Total Turnover (Number of Worker Transitions) Accounted for by Job Reallocation (%) |                         |        |  |                  |  |
|-------------------------------------------------------------------------------------|-------------------------|--------|--|------------------|--|
| Data Set                                                                            | Sectoral Coverage       | Annual |  | Quarterly        |  |
| CWBH                                                                                | All—Permanent           |        |  | 42               |  |
| CWBH                                                                                | Manufacturing—Permanent |        |  | 46               |  |
| UI-MD                                                                               | All                     |        |  | 35               |  |
| UI-MD                                                                               | Manufacturing           |        |  | 44               |  |
| LRD/MTD <sup>a</sup>                                                                | Manufacturing           |        |  | 53 (lower bound) |  |

| Worker Reallocation (Number of Workers Engaged in Transitions)<br>Accounted for by Job Reallocation (%) |                         |             |             |             |             |
|---------------------------------------------------------------------------------------------------------|-------------------------|-------------|-------------|-------------|-------------|
| Data Set                                                                                                | Sectoral Coverage       | Annual      |             | Quarterly   |             |
|                                                                                                         |                         | Lower Bound | Upper Bound | Lower Bound | Upper Bound |
| CWBH                                                                                                    | All—Permanent           | 31          | 58          | 32          | 53          |
| CWBH                                                                                                    | Manufacturing—Permanent |             | 59          |             | 57          |
| UI-MD                                                                                                   | All                     |             |             |             | 55          |
| MTD                                                                                                     | Manufacturing           |             |             | 37          | 66          |
| LRD                                                                                                     | Manufacturing           | 32          | 53          | 37          | 66          |

*Sources:* See sources for table 3.1.

*Notes:* All annual decompositions of worker reallocation use the CPS-based figure for worker reallocation reported in table 3.1. All quarterly decompositions of worker reallocation are based on assuming that 40 percent of all separations are direct job-to-job transitions. This assumption yields an estimate of worker reallocation equal to four-fifths of total turnover.

<sup>a</sup>The LRD/MTD-based decomposition of quarterly total turnover uses the MTD figure for total turnover and the LRD figure for job reallocation.

the annual rates indicates that a significant fraction of quarterly job reallocation reflects establishment-level employment changes that are reversed within the year. We return to this matter below.

### 3.5.2 The Contribution of Job Reallocation to Total Turnover and Worker Reallocation

Table 3.2 reports decompositions of total turnover and worker reallocation. The table entries show the percentage of worker transitions and the percentage of workers involved in transitions accounted for by job creation and destruction activity.<sup>17</sup> Since the LRD does not yield an estimate of total turnover, the LRD/MTD entry in the top panel relies on estimates of total turnover from the MTD. Since the MTD turnover measure includes layoff spells that end in recall within the quarter, the LRD/MTD entry should be interpreted as a lower bound on the

17. Table 3.2 uses Anderson and Meyer's "permanent" total turnover measure because it is more suitable for comparison with job reallocation statistics based on establishment-level employment changes between two discrete points in time.

percentage of worker transitions in the manufacturing sector that occur because of shifts in the location of employment opportunities (i.e., because of job reallocation activity).

Depending on the data source and sectoral coverage, job reallocation accounts for 35 to 46 percent or more of quarterly total turnover. Although job reallocation rates tend to be lower than average in manufacturing, job reallocation accounts for a higher fraction of total turnover in manufacturing. Thus, as we inferred above, the other forces driving total turnover play a smaller role in the manufacturing sector.<sup>18</sup>

Our decomposition of worker reallocation takes into account the fact that job reallocation represents an upper bound on the number of workers induced to change employers or employment status by job reallocation. Thus both the upper bound and lower bound decompositions described in section 3.3 are reported. For the annual decompositions, all reported estimates are based on the CPS figure for worker reallocation. For the quarterly decompositions, the reported estimates are based on constructing worker reallocation estimates from the total turnover figures under the assumption that 40 percent of all separations and accessions reflect direct job-to-job transitions.

The various data sets yield a consistent picture of the contribution of job reallocation to worker reallocation. The lower bound estimates are all around one-third. The upper bound estimates are between one-half and two-thirds. Simply put, job reallocation accounts for between one-third and two-thirds of total worker reallocation.

Two observations provide further perspective on the magnitude of job reallocation's contribution to worker reallocation. First, the preceding calculation neglects secondary waves of worker reallocation initiated by job creation and destruction. For example, a person who quits an old job in favor of a newly created job potentially creates a chain of further quits as other workers reshuffle across the set of available job openings. It follows that the direct plus indirect contribution of job reallocation to worker reallocation exceeds the one-third to two-thirds figure derived above.<sup>19</sup>

18. Anderson and Meyer (1994) draw a different inference when they use their estimate of total turnover including temporary turnover. Temporary turnover as they define it is disproportionately important in manufacturing. Accordingly, they find that permanent job reallocation accounts for a smaller fraction of total turnover (including temporary turnover) in manufacturing than in other sectors. We find it somewhat difficult to interpret this calculation when it is based on job and worker transitions measured under different sampling procedures. I.e., the job reallocation estimate only reflects changes in employment that occur from one point in time to another three months later, but their estimate of total turnover includes temporary transitions that reverse themselves within the three-month interval.

19. Hall (1995) pursues the implications of this idea for unemployment rate dynamics over the business cycle. He argues that the burst of permanent job destruction at the onset of recessions begets further waves of accessions and separations, since workers whose jobs are destroyed seek new matches, and new matches are subject to higher termination rates than the typical existing match. He presents supporting evidence that the observed persistence in unemployment rate dynamics is closely linked to the slow rebuilding of employment relationships after the sharp episodes of primary job loss at the onset of recessions.

Second, a certain amount of worker reallocation inevitably arises from life cycle considerations as old workers retire and young workers enter the workforce. If the typical person works 45 years, then retirement and initial labor force entry directly cause transitions between employment and nonemployment equal to about 4.4 percent of the workforce in a typical year. It follows from our figure for annual worker reallocation that simple life cycle effects account for roughly 12 percent of annual worker reallocation. After accounting for job reallocation and life cycle effects, the residual amount of worker reallocation equals 13 to 21 percent of employment, or 35 to 56 percent of annual worker reallocation (using the LRD estimates of job reallocation). This component of worker reallocation reflects temporary exits from the workforce and the sorting and resorting of workers across existing jobs for a variety of reasons. Thus, according to our estimates, these supply-side reasons for worker reallocation are neither more nor less important than shifts over time in the locational distribution of job opportunities.

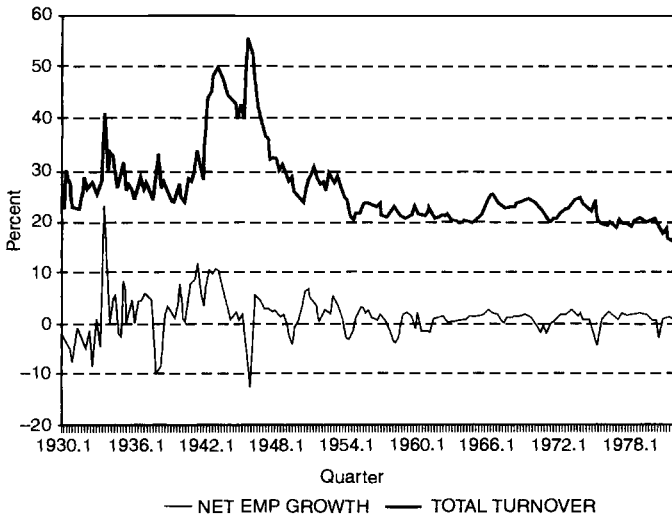
### 3.5.3 Cyclicality

In this subsection, we briefly characterize the cyclical behavior of job creation, job destruction, and total turnover. We also decompose the cyclical variation in total turnover into a component due to job reallocation and a component due to other factors. We focus on the cyclical variation of total turnover rather than worker reallocation because the BLS MTD provide high-frequency observations on total turnover for an extended period of time. Comparable time-series data on U.S. worker reallocation rates are not available. Because of limited time-series data for other sectors, we restrict our attention to the manufacturing sector.

Figure 3.1 depicts total turnover and net employment growth for the U.S. manufacturing sector from 1930:1 to 1981:1.<sup>20</sup> Total turnover was higher in the 1930s than in the post-World War II period, but turnover was even higher during World War II. The correlation between the rates of total turnover and net employment growth equals .31 over the sample period, but the cyclical relationship between these two variables does not appear stable over time, an issue we address further below.

As we noted above, the BLS MTD do not yield direct estimates of job creation and destruction. The MTD-based figure for job reallocation that appears in table 3.1 relies on a procedure suggested by Blanchard and Diamond (1990). Their methodology requires an estimate for the fraction of quits that are replaced. Given such an estimate, one computes gross job destruction as the sum

20. MTD accession and separation data exhibit pronounced seasonality, and the nature of the seasonality varies over time. Thus, following Blanchard and Diamond (1990), we used the Census X11 seasonal adjustment procedure on these series to allow for time variation in the nature of the seasonality. To aid in the comparison of the job creation and destruction estimates from the MTD and the LRD, we also seasonally adjusted the LRD-based figures for job creation and destruction using the X11 procedure for the analysis in this section.



**Fig. 3.1 Total turnover and net employment growth rates in U.S. manufacturing sector, quarterly, 1930–81**

*Source:* Authors' tabulations of the BLS manufacturing turnover data.

of layoffs and (1 minus the quit replacement rate) times the number of quits. One computes gross job creation as new hires plus recalls minus the quit replacement rate times the number of quits.<sup>21</sup>

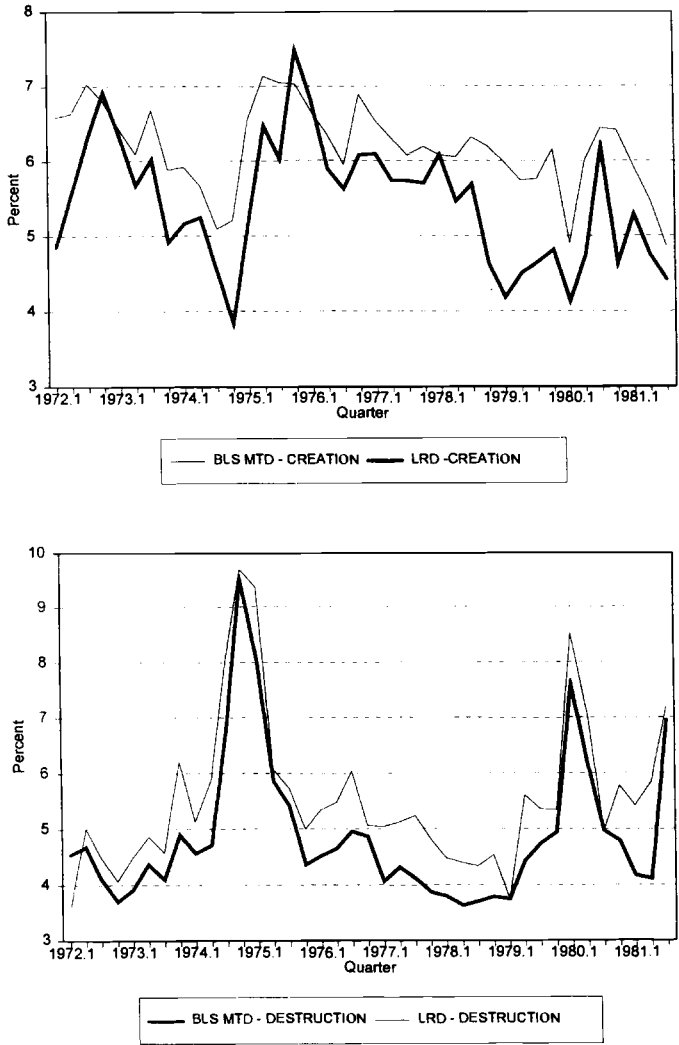
Based on a one-time BLS survey in 1972, Blanchard and Diamond assume that 85 percent of quits are replaced. While this estimate seems reasonable, no direct evidence on time variation in the quit replacement rate is available. Lacking such evidence, we assume a constant 85 percent quit replacement rate to generate job creation and destruction rates over the entire MTD sample period. If the true replacement rate is procyclical (a plausible conjecture), the 85 percent assumption leads us to understate the increase in job destruction in recessions and to overstate the increase in job creation in booms. It also leads us to understate the relative amplitude of fluctuations in job destruction.<sup>22</sup>

To gauge the accuracy of MTD-based estimates of job creation and destruction rates, figure 3.2 reports the quarterly job creation and destruction figures

21. Unlike Blanchard and Diamond, we do not make an adjustment for changes in the number of vacancies in our measure of job creation. Instead, as in most other studies, we define job creation as the creation of newly filled employment positions. In contrast, Blanchard and Diamond (1990) attempt to measure the creation of new employment positions, whether filled or not. Elsewhere, we have examined the behavior of job creation with the vacancy adjustment over the period 1951–81 (see Davis et al. 1996, fig. 5.6). The vacancy adjustment does not change the basic properties of the job creation series.

22. To see these points, assume that the MTD measure layoffs, new hires, recalls, and quits without error. Then the true destruction rate is related to the MTD-based measure according to

$$D = \tilde{D} + (\tilde{\theta} - \theta)Q,$$



**Fig. 3.2 Gross job creation and job destruction rates in U.S. manufacturing sector, quarterly, 1972:2–81:1**

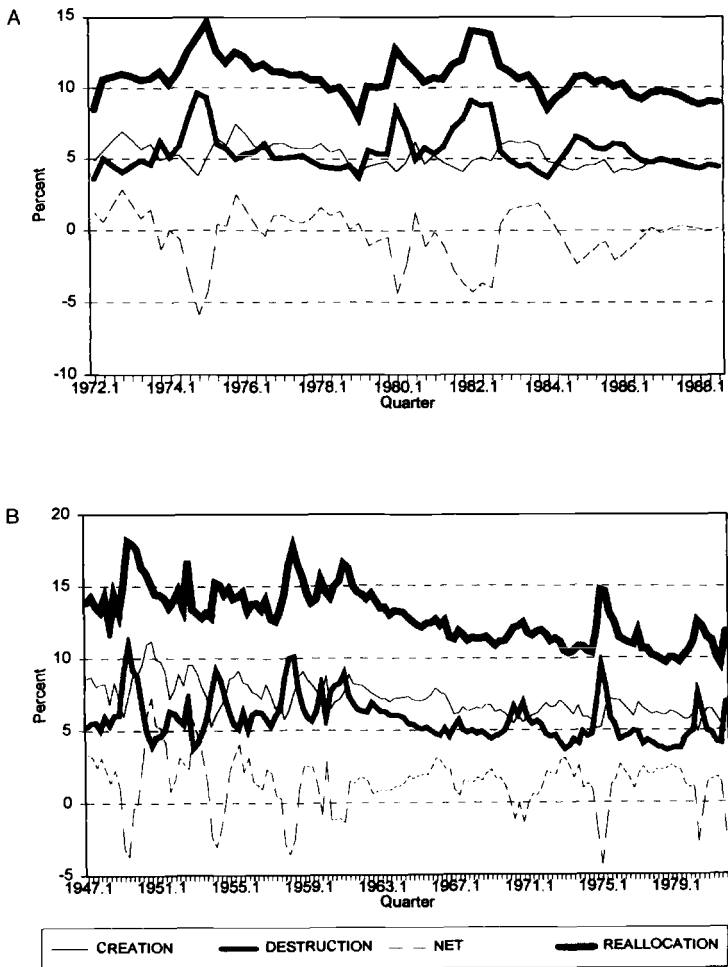
Source: Authors' calculations from the BLS manufacturing turnover data (MTD) and Longitudinal Research Database (LRD) tabulations in Davis, Haltiwanger, and Schuh (1996).

where  $\theta$  denotes the true quit replacement rate,  $Q$  denotes the quit rate, and a tilde indicates a measured quantity. Likewise, the true and measured creation rates satisfy

$$C = \tilde{C} + (\tilde{\theta} - \theta)Q.$$

If we specify a constant value for  $\tilde{\theta}$  when the true quit replacement rate is procyclical, the statements in the text about cyclical measurement error follow immediately.

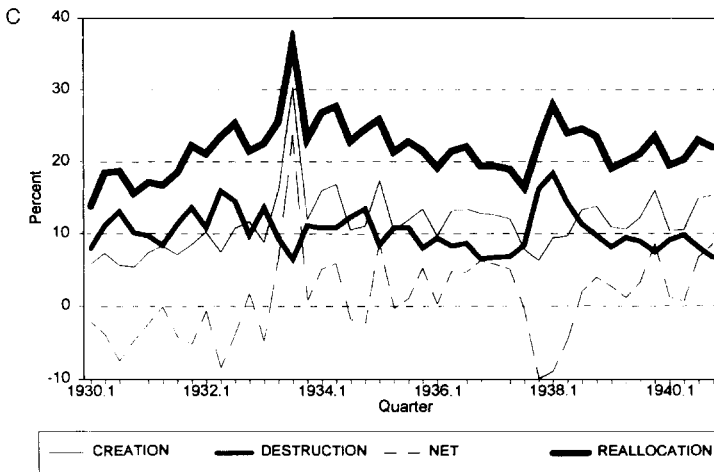




**Fig. 3.3 Gross and net job flow rates in U.S. manufacturing sector, quarterly, 1930–81**

*Source:* Authors' calculations from the BLS manufacturing turnover data (MTD) and Longitudinal Research Database (LRD) tabulations in Davis, Haltiwanger, and Schuh (1996).

*Note:* (A) LRD data; (B), (C) MTD data.



for the 1972–81 period of overlap between the MTD and LRD. Aside from an incorrect assumption about the quit replacement rate, three other factors lead to differences between LRD-based and MTD-based figures for job creation and destruction. First, the quarterly LRD estimates reflect changes over three-month intervals in point-in-time measures of employment levels, whereas the MTD figures reflect cumulative monthly flows over the quarter. Second, the MTD figures include temporary layoff spells that ended in recall within the month. Third, the sample frames for the MTD and the LRD differ.

Despite these differences, the job creation rates and, especially, the job destruction rates computed from the two different data sources exhibit similar levels and similar patterns of time variation. The correlation between the two job creation (destruction) rates is .76 (.95). Thus figure 3.2 suggests that we can use the MTD to characterize the behavior of job creation and destruction rates over a long time period that predates the LRD sample period.

Figure 3.3A displays LRD-based quarterly rates of job creation, job destruction, job reallocation, and net employment growth in the manufacturing sector for the 1972–88 period. Figures 3.3B and 3.3C display MTD-based figures for the 1947–81 and 1930–40 periods. Table 3.3 reports summary statistics on correlations and time variability for turnover and job flow rates.

As emphasized by Davis and Haltiwanger (1990, 1992), figure 3.3A and table 3.3 show that over the 1970s and 1980s job creation and job destruction are negatively correlated, job destruction varies much more over the cycle than job creation, and job reallocation varies countercyclically. (Here, we take the net employment growth rate as the indicator of the business cycle.) Figure 3.3B and the statistics in table 3.3 indicate that these basic patterns hold for the U.S.

**Table 3.3**                    **Cyclical Properties of Gross Flows in Manufacturing Sector**

| Data Set | Time Period | Correlation of<br>Creation and<br>Destruction | Variance Ratio<br>of Destruction<br>to Creation | Correlation of Net<br>Employment Growth and<br>Reallocation | Correlation of Net<br>Employment Growth and<br>Total Turnover | Correlation of Net<br>Employment Growth and<br>Other Turnover |
|----------|-------------|-----------------------------------------------|-------------------------------------------------|-------------------------------------------------------------|---------------------------------------------------------------|---------------------------------------------------------------|
| LRD      | 1972:2–88:4 | –.35                                          | 2.96                                            | –.52                                                        |                                                               |                                                               |
| LRD      | 1972:1–81:4 | –.47                                          | 2.73                                            | –.51                                                        |                                                               |                                                               |
| MTD      | 1930:1–81:4 | .22                                           | .68                                             | .19                                                         | .31                                                           | .22                                                           |
| MTD      | 1972:1–81:4 | –.43                                          | 5.27                                            | –.72                                                        | .03                                                           | .38                                                           |
| MTD      | 1947:1–81:4 | .09                                           | 1.35                                            | –.15                                                        | .29                                                           | .40                                                           |
| MTD      | 1930:1–40:4 | –.45                                          | .43                                             | .44                                                         | .46                                                           | –.07                                                          |

*Sources:* See sources for table 3.1.

manufacturing sector over the entire post–World War II period, but the patterns are less pronounced in the earlier period. In particular, figure 3.3 makes clear that job creation was more volatile in the 1950s than in later periods.

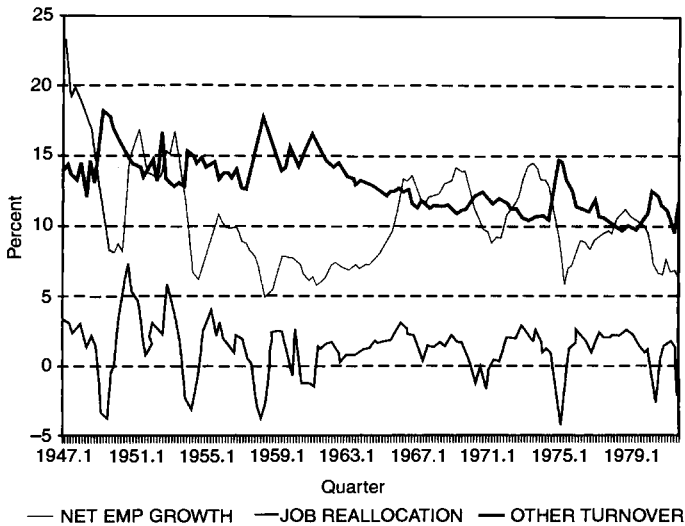
The 1930s offer what at first glance appears to be a very different picture. Based on the correlations reported in table 3.3 for the 1930s, job creation and job destruction are positively correlated, job creation varies more over the cycle than job destruction, and job reallocation is procyclical. However, careful examination of figure 3.3C reveals that these different patterns are largely driven by the extremely sharp rise in job creation in the summer of 1933. Figure 3.1 makes clear that this quarter yielded by far the highest net employment growth rate over the 1930–81 period. As emphasized by Woytinsky (1942, esp. 48, diagram VIII), the remarkably high employment growth rate in the summer of 1933 must be interpreted in the context of the behavior of employment over the previous four years. By spring 1933, employment in manufacturing had fallen to 60 percent of its 1929 level. The sharp increase in employment in summer 1933 brought employment up to slightly more than 70 percent of its 1929 level. Employment in manufacturing did not return to its 1929 level until 1937. While this extreme episode can hardly be dismissed, we note that the recession in 1937–38 exhibits the typical post–World War II pattern: a sharp increase in job destruction that coincides with a comparatively mild decline in job creation.

We now use the MTD measures to decompose the time variation in total turnover into a component due to job reallocation and a component due to other factors. Figure 3.4 depicts job reallocation, other turnover (measured as the difference between total turnover and job reallocation), and net employment growth in the manufacturing sector for the 1947–81 period.<sup>23</sup> Table 3.3 reports correlations involving these series over alternative time periods.<sup>24</sup>

Figure 3.4 and table 3.3 suggest the following characterization of the cyclical variation in the components of total turnover. Job reallocation is countercyclical: during recessions the economy intensifies the pace at which it reallocates employment positions among establishments. The number of worker transitions induced by job reallocation activity rises during recessions and declines during expansions. In contrast, the number of worker transitions (between employers and between employment and joblessness) induced by other factors fluctuates procyclically. In short, these two conceptually distinct com-

23. Fig. 3.4 focuses attention on the post–World War II time period because we are less comfortable with our constant quit replacement rate assumption over the earlier period.

24. Close inspection of fig. 3.4 reveals that there is a mild downward trend in both job reallocation and job creation over the post–World War II period. Thus the simple correlations reported in table 3.3 in part reflect this low frequency variation. Davis and Haltiwanger (1996) examine the impact of trends on such simple correlations using similarly constructed job creation and destruction data for the 1947:1–88:4 period. After linear detrending, they find that the correlation between net employment growth and job reallocation is  $-.52$  for the 1947:1–88:4 period and  $-.65$  for the 1972:2–88:4 period. These findings suggest that the countercyclical pattern of job reallocation in U.S. manufacturing is pervasive for the entire post–World War II period.



**Fig. 3.4 Job reallocations, other worker turnover, and net employment growth in U.S. manufacturing sector, quarterly, 1947:1–81:1**

*Source:* Authors' calculations from the BLS manufacturing turnover data.

ponents of total turnover exhibit sharply different cyclical behavior. Having drawn this conclusion, we wish to remind the reader that job reallocation provides a lower bound on the number of worker transitions that occur because of changes in the location of employment opportunities. (See section 3.3.) Thus our inferences about the cyclical variation in the decomposition of total turnover rest on the assumption that the tightness of the bound does not vary too much over the cycle.

Interestingly, manufacturing job reallocation has become increasingly countercyclical during the post–World War II period. In contrast, manufacturing turnover due to other forces has maintained the same degree of procyclicality over this period. Consequently, total manufacturing turnover has become less procyclical over the post–World War II period and by the 1970s is essentially acyclical (the correlation of total turnover and net employment in the 1970s is .03).

### 3.5.4 More on the Connection between Job Flows and Worker Flows

The preceding sections develop several facts about the connection between worker flows and job flows, but they also leave many gaps in our statistical portrait. This subsection looks at the connection along several dimensions in order to fill in some of the gaps. We examine the persistence and concentration of job flows and the associated implications for worker flows. We also consider

**Table 3.4** Average Persistence Rates for Job Creation and Destruction in Manufacturing Sector

| Horizon      | Annual Measures,<br>1972–88 |             | Quarterly Measures,<br>1972:2–88:4 |             |
|--------------|-----------------------------|-------------|------------------------------------|-------------|
|              | Creation                    | Destruction | Creation                           | Destruction |
| One quarter  |                             |             | 67.8                               | 72.3        |
| Two quarters |                             |             | 50.4                               | 58.9        |
| One year     | 70.2                        | 82.3        | 37.7                               | 59.2        |
| Two years    | 54.4                        | 73.6        | 22.6                               | 38.4        |

Source: Tabulations from the Longitudinal Research Database reported in Davis, Haltiwanger, and Schuh (1996).

the connection between job flows and unemployment flows.<sup>25</sup> Data limitations restrict much of our discussion in this section to the manufacturing sector.

#### *Persistence of Job Flows*

How persistent are the plant-level employment changes that underlie the job creation and destruction figures? The persistence of plant-level employment changes bears directly on the nature of the worker reallocation associated with job reallocation. To the extent that job creation and destruction represent short-lived employment changes, the changes can be implemented largely through temporary layoffs and recalls. To the extent that plant-level employment changes are persistent, they must be associated with long-term joblessness or worker reallocation across plants.

In thinking about how to measure persistence, we stress that our focus is on the persistence of the typical newly created or newly destroyed job. This focus is distinct from a focus on the persistence of the typical existing job or the persistence of establishment size. In line with our focus, we measure persistence according to the following definitions:

*The N-period persistence of job creation is the percentage of newly created jobs at time  $t$  that remain filled at each subsequent sampling date through time  $t + N$ .*

*The N-period persistence of job destruction is the percentage of newly destroyed jobs at time  $t$  that do not reappear at any subsequent sampling date through time  $t + N$ .*

Table 3.4 summarizes the persistence properties of job creation and destruction over various horizons based on the LRD. In the annual data, roughly seven in ten newly created jobs survive for at least one year, and roughly eight in ten newly destroyed jobs fail to reappear one year later. After two years, the

25. Davis et al. (1996) provide a more thorough treatment of these topics.

persistence of annual job creation and destruction falls to 54 and 74 percent, respectively. The most important aspect of these results is that the annual job creation and destruction figures largely reflect persistent plant-level employment changes.

The quarterly job flow figures show much smaller persistence rates than the annual figures. There are two reasons for this discrepancy. First, transitory plant-level employment movements, including seasonal movements, are much more likely to enter into the calculation of gross job flows over three-month, as opposed to twelve-month, intervals. Second, over any given horizon, there are fewer sampling dates in the annual data than in the quarterly data. Thus newly destroyed and newly created jobs must meet more stringent criteria in the quarterly data to satisfy the concept of persistence specified in the definitions above.

These remarks also reconcile the high persistence of annual job creation and destruction with some well-known facts about the importance of temporary layoffs in the U.S. manufacturing sector. For example, Lilien (1980, table III) uses the MTD to calculate that 60 to 78 percent of all manufacturing layoffs ended in recall during the years 1965–76. He also reports that 92 percent of manufacturing unemployment spells ending in recall last three months or less. Most of these short-duration temporary layoffs are not captured by annual job creation and destruction measures.

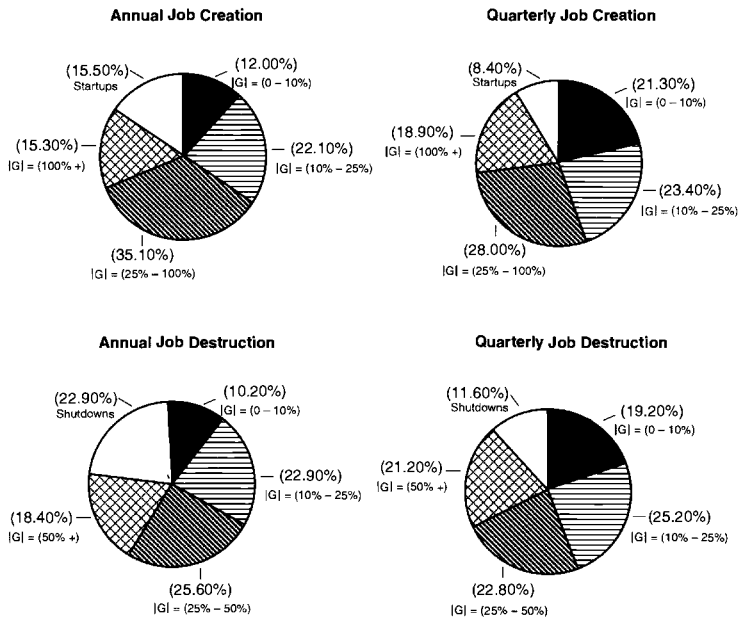
### *Concentration of Job Flows*

What role do plant births and deaths play in the creation and destruction of jobs? More generally, how are job creation and destruction distributed by plant-level employment growth rates? Do job creation and destruction primarily involve mild expansions and contractions spread among a large number of plants, or wrenching and dramatic changes at a few plants? The consequences of job creation and destruction for workers and for the local communities in which they reside depend, in large part, on the answers to these questions.

Based on the LRD, figure 3.5 displays simple pie charts that condense information on the distribution of annual and quarterly job creation and destruction into a small number of growth rate intervals. Figure 3.5 reveals that shutdowns account for 23 percent of annual job destruction, while start-ups account for 16 percent of annual job creation.<sup>26</sup> The message is plain: much job creation and destruction in the manufacturing sector involve dramatic events such as the start-up of a new plant or the death of an old plant.

To elaborate on this point, figure 3.5 also shows that two-thirds of annual job creation and destruction occur at start-ups, shutdowns, and continuing

26. Shutdowns and start-ups account for smaller fractions in the quarterly data for two reasons: (1) these events may require more than a single quarter to complete, and (2) transitory plant-level employment movements account for larger fractions of job creation and destruction in the quarterly data, as shown in the preceding sections. These transitory events are unlikely to involve complete plant shutdowns.



**Fig. 3.5 Concentration of job creation and job destruction in U.S. manufacturing sector, 1973-88**

*Source:* Tabulations from the Longitudinal Research Database as reported in Davis, Haltiwanger, and Schuh (1996, fig. 2.3).

*Note:* The pie charts summarize the distributions of creation and destruction by plant-level growth rates. The numbers in parentheses indicate share of the total. The growth rates in the figure ( $G$ ) are the conventional measure.

plants that expand or contract by at least a quarter of their initial workforce. The dramatic, highly publicized character of much job creation and destruction activity in the manufacturing sector also reflects the concentration of manufacturing employment at large plants. In 1986, the average manufacturing employee worked at a facility that had nearly 1,600 workers (Davis and Haltiwanger 1991, fig. 4.B).<sup>27</sup> Thus manufacturing employment is concentrated at large plants, and manufacturing job creation and destruction are concentrated at plants that experience large percentage changes in employment.

These two facts about concentration explain why job creation and destruction at manufacturing plants often have important effects on nearby communities. A dramatic employment reduction at a single large plant can flood the local labor market, which increases the economic hardship that falls on each

27. Davis (1990) provides summary statistics on the distribution of employees by establishment size for about 20 manufacturing and 60 nonmanufacturing industries that cover the nonfarm private sector of the U.S. economy. These statistics confirm that employment at large establishments is more important in manufacturing industries than in most nonmanufacturing industries.



job loser (see, e.g., Carrington 1993). Conversely, a sharp employment increase at a single plant can induce an in-migration of workers and their families that strains the capacity of the local community to provide certain public and private goods such as schooling, housing, roads, and sewers.

The facts on the concentration and persistence of gross job flows also shed light on the connection between job reallocation and worker reallocation. Since only one-third of job destruction is accounted for by establishments that shrink by less than 25 percent over the span of a year, the bulk of job destruction cannot be accommodated by normal rates of worker attrition resulting from retirements and quits. In other words, most of the job destruction represents job loss from the point of view of workers. Since annual job creation and destruction primarily reflect persistent establishment-level employment changes, the bulk of annual job creation and destruction cannot be implemented by temporary layoff and recall policies. Hence, most of the job destruction reflects permanent job loss that leads to a change in employer, a long-term unemployment spell, exit from the labor force, or some combination of these events. These inferences about the connection between job reallocation and worker reallocation reflect evidence for the manufacturing sector only; the extent to which similar characterizations hold for nonmanufacturing sectors of the U.S. economy is a largely unaddressed question.

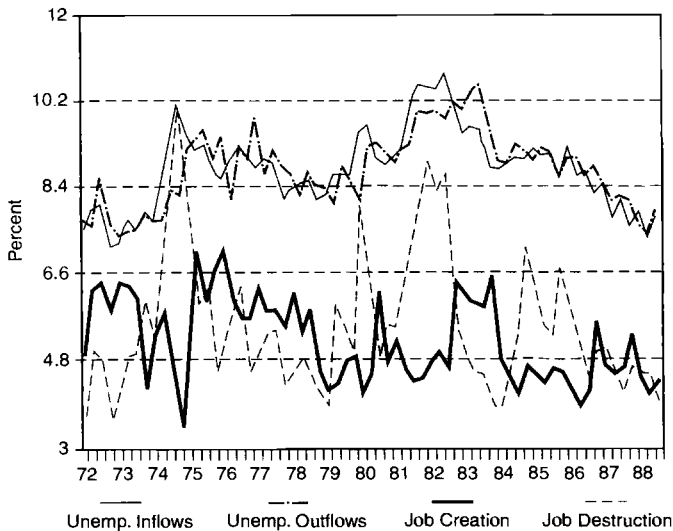
#### *Connection to Unemployment*

Figure 3.6 provides information about the cyclical variation in unemployment flows and gross job flows. The unemployment flows are based on the CPS unemployment incidence and duration data, and the job flows are based on the LRD.<sup>28</sup> These time-series patterns show that unemployment inflows account for most of the cyclical variation in unemployment. During recessions, unemployment inflows rise dramatically. Unemployment outflows also rise during recessions, but by less than their counterparts and not until later in a recession.

Figure 3.6 shows that the connection between job destruction and worker flows is stronger than that between job creation and worker flows. Job destruction and unemployment inflows rise sharply during recessions, and they exhibit a high contemporaneous correlation (.71). Looking at the other side of the flows, unemployment outflows show only weak positive correlation with job creation (.16).

The figure illustrates the mirror-image quality of unemployment flow dy-

28. This figure combines information on CPS-based unemployment flows for the aggregate economy with the LRD-based job creation and destruction measures for the manufacturing sector. The difference in sectoral coverage naturally raises concerns about comparability. On this matter, the correlation between the aggregate unemployment rate and the manufacturing unemployment rate is .92, where the manufacturing unemployment rate equals the number of unemployed persons who previously worked in the manufacturing sector divided by the sum of that number and manufacturing employment. The close relationship between aggregate unemployment and manufacturing unemployment mitigates concerns that arise from using worker and job flow statistics that differ in scope of sectoral coverage.



**Fig. 3.6 Unemployment flows and job flows, quarterly, 1972:2–88:4**

*Sources:* Authors' calculations of unemployment flows for the entire U.S. economy from the Current Population Survey. Longitudinal Research Database tabulations of job creation and destruction for the U.S. manufacturing sector from Davis, Haltiwanger, and Schuh (1996).

*Note:* Job creation and destruction are measured as percentages of employment; unemployment flows are measured as percentages of the labor force.

namics and job flow dynamics. We have already seen that job destruction rises sharply in recessions, whereas job creation displays much more modest variation over the business cycle. In a similar manner, the unemployment inflows rise sharply in recessions. But the component most closely related to job creation—unemployment outflows—changes relatively little over the business cycle.

This picture of a tight connection between job flows and unemployment flows is further enhanced by consideration of the evidence on unemployment flows by reason of unemployment (table 3.5) and by demographic characteristics. We do not present a detailed analysis of the evidence here, but findings presented elsewhere suggest the following characterization.<sup>29</sup> During good times, unemployment is dominated by entrants, quitters, and young people. These workers transit across states of the labor market to accommodate life cycle entry and exit and normal search for a suitable job match. During recessions, increases in unemployment are dominated by permanent and temporary layoffs as firms restructure their employment positions. These layoffs are accompanied by an increase in the share of unemployment of prime-aged work-

29. Chap. 6 of Davis, Haltiwanger, and Schuh (1996) presents an in-depth analysis of the connection between job flows and unemployment by reason and by demographic characteristics.

Table 3.5 Cyclical Changes in Unemployment by Reason for All Workers

| Reason                 | Fraction of Change in Unemployment<br>Due to Reason |                     |
|------------------------|-----------------------------------------------------|---------------------|
|                        | Trough to Peak                                      | Peak to Trough      |
|                        | <i>Average for 1970:11-92:12</i>                    |                     |
| Temporary layoffs      | 0.58                                                | 0.32                |
| Permanent layoffs      | 0.33                                                | 0.46                |
| Quits                  | -0.06                                               | 0.02                |
| Entrants               | 0.14                                                | 0.21                |
| Change in unemployment | -2.7                                                | 2.8                 |
|                        | <i>1970:11-75:3</i>                                 |                     |
|                        | <i>1970:11-73:11</i>                                | <i>1973:11-75:3</i> |
| Temporary layoffs      | 0.50                                                | 0.44                |
| Permanent layoffs      | 0.29                                                | 0.40                |
| Quits                  | -0.18                                               | 0.00                |
| Entrants               | 0.38                                                | 0.16                |
| Change in unemployment | -1.0                                                | 4.6                 |
|                        | <i>1975:3-80:7</i>                                  |                     |
|                        | <i>1975:3-80:1</i>                                  | <i>1980:1-80:7</i>  |
| Temporary layoffs      | 0.44                                                | 0.19                |
| Permanent layoffs      | 0.42                                                | 0.26                |
| Quits                  | 0.03                                                | 0.05                |
| Entrants               | 0.11                                                | 0.50                |
| Change in unemployment | -2.3                                                | 1.0                 |
|                        | <i>1980:7-82:11</i>                                 |                     |
|                        | <i>1980:7-81:7</i>                                  | <i>1981:7-82:11</i> |
| Temporary layoffs      | 1.11                                                | 0.32                |
| Permanent layoffs      | 0.08                                                | 0.65                |
| Quits                  | -0.05                                               | -0.05               |
| Entrants               | 0.14                                                | 0.09                |
| Change in unemployment | -0.5                                                | 3.0                 |
|                        | <i>1982:11-91:3</i>                                 |                     |
|                        | <i>1982:11-90:7</i>                                 | <i>1990:7-91:3</i>  |
| Temporary layoffs      | 0.28                                                | 0.46                |
| Permanent layoffs      | 0.54                                                | 0.67                |
| Quits                  | -0.03                                               | -0.02               |
| Entrants               | 0.21                                                | -0.11               |
| Change in unemployment | -4.9                                                | 1.6                 |

Source: Tabulations from the Current Population Survey reported in Davis, Haltiwanger, and Schuh (1996).

ers (especially men), most of whom have considerable work experience and strong attachment to the labor force.<sup>30</sup>

This interpretation of unemployment rate dynamics offers an interesting parallel to the details of job flow dynamics documented in Davis et al. (1996). Job

30. Young workers also face increased layoffs in recessions. However, unemployment and unemployment inflows of prime-aged workers rise disproportionately.

flows in good times are dominated by the creation and destruction of jobs among relatively young and small plants. These younger and smaller plants are, like young workers, trying to determine whether and where they fit into the marketplace. During recessions, older and larger plants experience sharply higher job destruction rates, so that their contribution to the job and worker reallocation process rises. This time of intense job destruction by older and larger plants coincides with the rise in layoff unemployment, especially among prime-aged workers.<sup>31</sup>

### 3.6 A Collection of Facts about Worker Flows and Job Flows

This brief section lists several empirical findings related to the behavior of U.S. worker flows and job flows. The list offered below simply collects and restates, sans qualifications and caveats, the main empirical results developed in the preceding section. The symbol “(M)” designates findings drawn from data limited to the manufacturing sector.

- Total worker turnover, the sum of accessions and separations, amounts to about one-third of employment per quarter.
- Roughly one worker in four experiences a change in employer or employment status (employed vs. not employed) each quarter.
- The number of persons who change employer or employment status in a typical year amounts to about 37 percent of employment.
- Average annual job reallocation rates (sum of creation and destruction rates) range from 20 to 30 percent of employment depending on industrial sector, region, and time period.
- Average quarterly job reallocation rates range from 10 to 13 percent of employment.
- Annual job creation and destruction figures largely reflect persistent plant-level employment changes. For example, roughly seven in ten newly created jobs survive for at least one year, and roughly eight in ten newly destroyed jobs fail to reappear one year later. (M)
- Job flows are spatially concentrated: Two-thirds of annual job creation and destruction occur at start-ups, shutdowns, and continuing plants that expand or contract by at least a quarter of their initial workforce. Shutdowns alone account for nearly one-quarter of job destruction. (M)
- Job reallocation accounts for 35 to 46 percent or more of total turnover (number of worker transitions) in quarterly data.
- The rate of job reallocation is moderately smaller but accounts for a much larger fraction of total turnover in the manufacturing sector.
- Job reallocation accounts for between one-third and two-thirds of all persons

31. We believe that older plants disproportionately employ older workers, but we know of no direct evidence on this matter.

who change employer or employment status over both three-month and twelve-month intervals.

- The simple correlation between quarterly rates of total turnover and net employment growth equals .31 over the 1930–80 period, but the cyclical behavior of turnover is not stable over this time period. (M)
- Job creation and destruction are negatively correlated, and job destruction varies more over the cycle than job creation. These patterns hold for the entire postwar period but are less pronounced in the 1950s and 1960s. (M)
- The number of worker transitions induced by job reallocation activity rises during recessions and declines during expansions. (M)
- In contrast, the number of worker transitions induced by other factors fluctuates procyclically. (M)
- Job destruction and unemployment inflows rise sharply during recessions, and they exhibit a high contemporaneous correlation (.71). Looking at the other side of the flows, unemployment outflows show only a weak positive correlation (.16) with job creation. (M)
- During expansions, unemployment is dominated by entrants, quitters, and young persons.
- During recessions, increases in unemployment are dominated by permanent and temporary layoffs. These layoffs are accompanied by an increase in the share of unemployment accounted for by prime-aged workers (especially men), most of whom exhibit strong attachment to the labor force.
- During expansions, gross job flows are dominated by the creation and destruction of jobs among relatively young and small plants. (M)
- During recessions, older and larger plants experience sharply higher job destruction rates, so that their contribution to the job and worker reallocation process rises. (M)

### 3.7 New Sources of Data on Gross Job and Worker Flows

In the preceding sections, we have synthesized and summarized much of what we know about the dynamics of worker flows and job flows, drawing on various data sets and studies. While we have learned a great deal about the dynamics of the labor market from existing data, our understanding is clearly incomplete. U.S. statistical agencies do not currently produce timely, comprehensive worker and job flow statistics for the U.S. economy. The economic and policy importance of the dynamics of the labor market constitute a *prima facie* argument for developing longitudinal business-level and worker-level databases that permit more timely, comprehensive, and detailed measures of worker and job flows. This section discusses possible paths toward that objective.<sup>32</sup>

In the ensuing discussion, we limit attention to the potential uses of existing administrative record databases, because they offer an inexpensive means of

32. This section draws heavily on chap. 8 of Davis et al. (1996).

constructing statistics on gross job and worker flows. Within that constraint, our discussion ranges from general remarks about methods for measuring gross flows to specific remarks about the advantages and disadvantages of particular data sources. The specific remarks serve to delineate reasonable objectives for data construction and to highlight some of the issues that must be confronted in developing longitudinal business-level databases.

### 3.7.1 Standard Statistical Establishment List

The Standard Statistical Establishment List (SSEL) merits serious consideration as a comprehensive source of statistics on annual gross job flows. The SSEL is a master establishment list of all businesses with at least one employee in the United States. The Bureau of the Census maintains the SSEL using Internal Revenue Service administrative records and drawing heavily on information contained in the bureau's annual Company Organization Survey (COS). Currently, the Bureau of the Census uses the SSEL to define the statistical sampling frame for its many economic censuses and surveys of individual businesses.<sup>33</sup> Initial efforts to construct gross job flow statistics from the SSEL have been under way at the Bureau of the Census since 1993.

The SSEL offers important advantages as a potential source of job creation and destruction statistics. First, as with the LRD, establishments (i.e., physical locations) constitute the observational units. Second, the SSEL is suitable for tracking individual establishments over time in a way that correctly treats mergers, births and deaths, and transfers of ownership and control. These strengths of the SSEL stem in large part from its reliance on the COS.

The COS provides information about the ownership and operational control of production and nonproduction facilities, information that enables the Census Bureau to distinguish between establishments and enterprises. In the SSEL, as in the LRD, an enterprise is either a single establishment owned and operated by a single-unit firm or the set of establishments under the ownership and operational control of the same firm.<sup>34</sup> Thus the SSEL offers the promise of circumventing the spurious linkage problems that potentially compromise efforts to track individual establishments through time, to distinguish between establishments and enterprises, and to accurately measure gross job flows.<sup>35</sup>

33. Bureau of the Census (1979) describes the use of the SSEL as a sampling frame for Census Bureau surveys.

34. During intercensal years the sample frame of the COS is the set of multiunit companies with at least 50 employees in the previous economic census. Consequently, new establishments born in an intercensal year and affiliated with establishments classified as single-unit establishments in the previous census will not be properly linked to their parent firms until the subsequent census. Similarly, new establishments affiliated with companies that had fewer than 50 employees in the previous census will not be properly linked to their parent firms until the subsequent census. This feature of the COS does not affect the quality of the longitudinal establishment linkages in the SSEL, but it does affect the quality of the enterprise identifiers. As such, it affects, e.g., the ability to track employment growth by enterprise size (as opposed to establishment size). See Bureau of the Census (1979) for further discussion of how the COS is used to maintain the SSEL.

35. The SSEL contains a variety of establishment and enterprise identifiers (e.g., the Census Bureau identification number, the federal taxpayer identification number, and the permanent plant

Spurious job flows can arise when longitudinal links are incorrectly broken because of simple processing errors or because of changes in ownership, corporate status, business name or address, or employer taxpayer identification number.

The SSEL contains annual data on employment and payroll plus information on location, industry, and establishment age. The SSEL for any given year becomes available in the subsequent year, so that gross job flow statistics by detailed industry, state, local area, establishment and enterprise size, establishment and enterprise wage level, and establishment age could be made available on a yearly basis with a lag of approximately nine to twelve months. In addition, the SSEL could be linked to the many business censuses and surveys conducted by the Bureau of the Census. In this way, it would be feasible to provide gross job flow statistics broken down by a wealth of other establishment and enterprise characteristics including sales, investment, input usage, inventories, international trade involvement, and technology usage.

### 3.7.2 Bureau of Labor Statistics ES-202 Data Set

The BLS ES-202 data set also merits serious consideration as a comprehensive source of gross job flow statistics for the U.S. economy. This data set reflects quarterly reports on monthly employment and quarterly payroll for all employers covered by either state UI laws or the unemployment compensation program for civilian federal employees. According to Department of Labor (1995), the ES-202 data cover 98 percent of U.S. civilian employees. The only large sectors excluded from the ES-202 universe are the self-employed and the armed forces.

The ES-202 data set closely parallels the SSEL in scope, content, and use as a sample frame. (The ES-202 data set serves as the statistical sampling frame for most BLS establishment surveys, just as the SSEL serves as the sampling frame for most Census Bureau establishment surveys.) As we discussed in sections 3.4 and 3.5, several researchers have already used the UI component of the ES-202 data set to create longitudinal files and analyze job flow behavior in selected states. We also discussed several important features of UI data in section 3.4.2 that are pertinent to the discussion here, but which we do not repeat.

Two important advantages of the BLS ES-202 data set, relative to the SSEL, are its greater timeliness and frequency. Employment and payroll information become available approximately five months after the end of each calendar quarter (Manser, chap. 1 in this volume). Thus gross job flow statistics computed from ES-202 data could be released on a quarterly rather than yearly basis and with a shorter time lag than statistics calculated from the SSEL. Unlike the SSEL, the ES-202 data provide the grist for monthly statistics on

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number) that facilitate longitudinal and cross-sectional linkages. Other information in the SSEL such as company and establishment names, street address, and detailed industry and location codes can be used to verify the linkages and enhance their quality. See Bureau of the Census (1979) for a discussion of how the various identifiers in the SSEL are created.

gross job flows. In sum, the ES-202 data could be used to generate monthly gross flows on a comprehensive, nearly real-time basis broken down by industry, geographic area, and employer size. For policymakers (e.g., the monetary authorities) and business forecasters who rely heavily on high-frequency, real-time economic indicators, monthly gross job flow statistics with a short reporting lag would be of great interest. Monthly job flow data would also be useful in research on business cycles and other topics. Finally, job flow data generated from the ES-202 data could be linked to BLS surveys that provide employer-level information on occupational structure, wages, and employee benefits.

### 3.7.3 A National Wage Records Database

A key advantage of UI-based data involves prospects for simultaneously measuring worker and job flows from a longitudinal employer-worker database that links workers to employers. In addition to the employer records that enter into the BLS ES-202 data set, the individual states maintain quarterly earnings records for individuals at UI-covered firms to assess eligibility and compute benefit amounts for UI claimants.<sup>36</sup> These records contain information suitable for following individuals over time and for identifying their employers. A current BLS initiative is considering how these records might be combined into a national wage records database (NWRD) that would be useful for measuring job flows, worker flows, and related concepts.<sup>37</sup>

Unlike the SSEL and the BLS ES-202 data, the NWRD offers the prospect of comprehensive statistics on job flows *and* worker flows. Because individual workers could be linked to individual employers, this database also offers much greater scope for describing and analyzing the connection between worker and job flows.<sup>38</sup> In addition, a wealth of information in the many BLS employer surveys could be linked to the NWRD and used to gain additional insight into the behavior of worker flows and job flows.<sup>39</sup>

The NWRD would be constructed from the same data collection system as the UI component of the BLS ES-202 data. Consequently, it would be subject to the same cross-sectional and longitudinal linkage problems as the ES-202 data. Relative to its enormous value as a tool for research and policy analysis, however, these shortcomings of a UI-based longitudinal employer-worker data set are minor.

36. The states also maintain individual-level files that track UI claims and benefit payments.

37. This initiative was the focus of an April 1994 BLS conference held in Washington, D.C.

38. As discussed in section 3.4, two research teams have already used the type of data envisaged for the NWRD to simultaneously measure worker and job flows. See Lane et al. (1993) and Anderson and Meyer (1994). Both studies expand our knowledge of labor market dynamics, and they demonstrate the feasibility and value of using a UI-based linked employer-worker database as a research tool. Jacobson, LaLonde, and Sullivan (1993) use NWRD-type data to examine the costs of job loss.

39. Manser (chap. 1 in this volume) summarizes the many surveys of labor market behavior carried out by the BLS.



### 3.7.4 Possibilities and Practicalities

The preceding discussion makes clear that administrative data already exist at both the Bureau of the Census and the BLS that could be used to measure gross job flows in a timely, comprehensive, and detailed manner. Converting these administrative records into operational longitudinal data files would require considerable effort and resources, but the costs would be small relative to alternative approaches that require major new surveys or other data sources.

The administrative records data at the BLS and Census Bureau offer distinct advantages and disadvantages that reflect differences in the history and mission of the two bureaus. Data at the Bureau of the Census offer greater scope for spelling out the connection between job flows and employer characteristics. Data at the BLS offer the prospect of directly linking job flows to worker flows and worker characteristics.

Ideally, data from both bureaus would be combined so as to simultaneously link job flows to employer characteristics, worker flows, and worker characteristics. Although the current institutional structure of the statistical bureaus stands in the way of efforts to pool data resources, we strongly advocate cooperative agreements and mechanisms that facilitate the sharing of survey and administrative record data on individual businesses. Such data-sharing arrangements would greatly enhance the value of both Census Bureau and BLS data as tools for economic research and policy evaluation. By providing each bureau with an alternative business universe, data-sharing arrangements would also facilitate the identification of problems with existing statistical sampling frames and, over time, lead to improvements in the accuracy of published statistics.<sup>40</sup>

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40. Manser (chap. 1 in this volume) also remarks on the potential benefits of data-sharing arrangements between the Census Bureau and BLS.

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## Comment Bruce D. Meyer

This chapter provides a nice summary of many dimensions of the recent research on worker and job flows. The authors are the central pioneers and popularizers of this area of research. The chapter will be a classic reference, particu-

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larly for the five topics that the authors summarize: (1) reasons for studying worker and job flows, (2) concepts and definitions, (3) current data sources, (4) current knowledge, and (5) new data sources. The chapter clarifies many concepts and provides a wealth of facts. It also provides many insights about what future research could examine.

While I will comment on each of the five topics in order, my principal concern is that the concepts and definitions used throughout the chapter are partly driven by the characteristics of the data source with which the authors are most familiar, the Longitudinal Research Datafile (LRD). Their choices are quite natural in their context but may differ from ideal ones, and in other data sets different definitions will be more appropriate. This distinction should be kept in mind when reading the chapter.

In the first section of the chapter the list of reasons provided for why we should study worker and job flows will undoubtedly lengthen as research progresses. For example, several new areas of study would be possible with individual wage records that would be part of a proposed national wage records database. We have begun to see some of these types of analyses done for single states or groups of states. Such data would allow the examination of the costs of job displacement as has been done for Pennsylvania by Jacobson, LaLonde, and Sullivan (1993). They would also allow an examination of the returns to tenure and mobility (Topel and Ward 1992; Altonji and Shakotko 1987), the effects of job destruction on geographic and industry mobility of workers, and other issues.

The section on concepts and definitions is very useful because it defines and discusses various turnover and worker reallocation concepts. One of the main motivations for these concepts seems to be that decreases in employment at the establishment level are a good measure of jobs destroyed as a result of demand changes, while increases in employment at the establishment level are a good measure of jobs created as a result of demand changes. It should be clear that this relationship is only an approximation. Jobs can be created and destroyed within an establishment with constant employment. Technological change may involve a change in the composition of the workforce but not its size. In addition, declines in employment are due to factors besides demand changes, such as quits from small establishments or exits by groups of people from professional practices to establish their own practices. Last, some movements of workers between nearby establishments within a firm may have little to do with total employment or unemployment and should not be called job creation or destruction.

Many of the necessary complications in the concepts and definitions emphasized in the chapter come from the distinction between counting workers and counting jobs. This distinction leads to great effort by the authors to calculate the fraction of workers changing jobs who change jobs as a result of job creation or destruction. Emphasizing this number raises several concerns. First, this number is not nearly as interesting as its components, that is, what fraction of people who leave or lose their jobs do so because of job destruction and

what fraction of those who find new jobs get newly created jobs. When one combines jobs lost and jobs gained, one is, in many situations, combining very different things. Since jobs are often lost for different reasons than they are gained, it is often better to analyze the two separately. Second, suppose 100 people separate from jobs: 50 lose jobs when plants shut down, while the other 50 quit. Also suppose that all workers find new jobs, one-half in new plants and one-half in the jobs vacated by those that quit. *The fraction of people who change jobs as a result of job creation or destruction depends on which workers take the jobs in the new plants.* The fraction could be anywhere between .5 and 1.0 in this example. It is not intuitive that we should care about which workers find jobs in which plants. We are better off knowing that one-half of separations are due to job destruction and one-half of new hires are due to job creation. This anomaly adds to my suspicion that the combined number is not that important. Finally, we cannot measure the concept very well, as I discuss below.

In the discussion of temporary separations, it is not clear to me that temporary layoffs between time  $t - 1$  and  $t$  should be ignored. Most data examined by the authors do not measure temporary layoffs. The authors deal with temporary changes by looking at the persistence of job creation and destruction, that is, the extent to which employment does not return to its old level. This approach is only indirect, because in large part we care about flows of workers. The time periods for persistence examined by the authors, one to three years, may be short from the perspective of a firm, but if a decline in employment lasts six months it may mean that workers must move on to new permanent jobs at a different firms if they cannot be without jobs for six months. We care about whether the same workers are able to return to their old jobs; this is a more natural measure of permanence. Using matched data on firms and workers, such as unemployment insurance data, one can directly examine if changes in employment lead to permanent job loss for workers.

The authors emphasize changes between discrete times rather than flows over an interval in their concepts and definitions. This choice misses many separations, though it may focus attention on events (separations, employment declines) that are more important, that is, those that are permanent and involve greater losses in investment. However, if one is studying the costs of separations, such as hiring and training costs, one may prefer flow measures that include all job separations rather than changes between discrete times.

The section on current sources of data is extremely useful, and I only have a few comments. The authors are too kind when discussing the accuracy of the CPS gross flow and length of employment and unemployment data. The authors acknowledge large problems with measurement error and missing observations in the gross flow data and note that adjustment methods have been proposed to correct these problems. While the methods that have been proposed are clear improvements (Abowd and Zellner 1985; Poterba and Summers 1986; Fuller and Chua 1985), they are approximations, and the different methods yield very different numbers. As for CPS spell measures, Poterba and

Summers (1984) find an enormous amount of measurement error in CPS unemployment spell lengths. On the other hand, concerning the discussion of unemployment insurance records, the evidence that we have on spurious federal employer identification number changes indicates that they are not a major problem. An upper bound on the extent of spurious changes is obtained in Anderson and Meyer (1994) by looking at the fraction of people who separate but do not have an SIC change or big employment change. This fraction is small.

The next section examines what we know about worker and job flows. This section is a wonderful summary and synthesis of the literature. My only comment is related to my qualms mentioned above about the emphasis given to measuring the fraction of worker reallocation due to job reallocation. We cannot measure this number with much precision, as the estimates provided here indicate that the fraction is between 35 and 56 percent. Even this calculation requires merging data with different industry coverage, timing, and definitions. The imprecision in measuring this concept makes me further doubt its utility. On the other hand, we can precisely measure the fraction of separations due to job destruction and the fraction of new hires due to job creation in matched firm and worker data such as unemployment insurance records.

The final section on new data sources is very instructive on the new research that could be done with existing administrative databases. This section is an exciting list of research areas that may expand in the future. I might also add that some questions might be answered by good personnel records and organization charts for a few firms. I would put in this category information on the importance of changes in the mix of jobs within establishments, the implications of temporary changes in employment of different durations for permanent worker separation from a firm, and the importance of movements of personnel between establishments within a given firm.

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