

## Measuring job and establishment flows with BLS longitudinal microdata

*A forthcoming BLS database is capable of generating high-quality, timely information on job creation, job destruction, and the life cycle of establishments*

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The relatively recent development of longitudinal establishment data sets has generated considerable excitement in both the academic and the statistical communities. The descriptive statistics coming out of these data sets illustrate the large amount of volatility at the individual establishment level that underlies the smooth time series of aggregate employment growth. This finding not only has stimulated the review and updating of existing labor market theories, but also has motivated U.S. statistical agencies to produce longitudinal job flow statistics from their administrative data sets. This article describes a new longitudinal database from the Bureau of Labor Statistics that has the potential for enhancing microdata research into topics such as job creation, job destruction, and the life cycle of establishments.

The literature on the demand for labor in general and on gross job flows in particular has flourished during the past decade. Perhaps the most important finding discussed is the tremendous heterogeneity in establishment-level employment changes that is evident in the job creation and job destruction statistics underlying net employment growth. For example, using data spanning much of the 1970s and 1980s, Steven J. Davis, John C. Haltiwanger, and Scott Schuh report that, on average, 5.5 percent of manufacturing jobs were destroyed and 5.2 percent created over a 3-month interval.<sup>1</sup> The -0.3-percent difference between these two statistics is the average net employment growth per quarter.

Despite all that we have learned about the labor market from the aforementioned literature, the

call for better data always resonates. Three aspects of existing data are often mentioned. First, much of the early work using U.S. data was restricted to the manufacturing sector.<sup>2</sup> Recent research using unemployment insurance data from various States, however, has illustrated how job creation and job destruction in manufacturing may not be representative of other industries.<sup>3</sup> Second, the existing empirical work on job flows, either by choice or by necessity, is largely based upon data that exclude the smallest establishments. Small plants with fewer than five employees, for example, are not in the sample frame of the Annual Survey of Manufactures used by Davis and Haltiwanger,<sup>4</sup> manufacturing plants with fewer than five employees from the Census of Manufactures are excluded from Timothy Dunne, Mark J. Roberts, and Larry Samuelson's analysis,<sup>5</sup> and the sample used by Patricia M. Anderson and Bruce D. Meyer includes only firms with at least 50 employees.<sup>6</sup> Finally, many of the existing studies use annual data, whereas the ideal data for studying gross job flows would be quarterly or perhaps even monthly. Data at these high frequencies are necessary for analyzing seasonal patterns in employment growth or for analyzing the short-run employment growth immediately following business "birth" and immediately preceding business "death."

The longitudinal database introduced in this article is not subject to any of the three limitations just mentioned. The microdata from which the database is constructed are the unemployment insurance reports that employers in the United States are required to file with the States.

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These data are essentially a quarterly census of establishments in all industries, which implies that the job creation and job destruction statistics derived from the longitudinal database have the potential to be valuable economic indicators published by statistical agencies of the U.S. Government.

In the next section, job creation and job destruction are defined, and the relation between these new statistics and those already published by the Bureau of Labor Statistics is described. Following that, a detailed description is given of the unemployment insurance microdata and the construction of the longitudinal data set. Because it is desirable to distinguish among establishments that are expanding, contracting, opening, and closing, special attention is given to the longitudinal linkage algorithm used to minimize the incidence of spurious births and deaths. In the final section of the article, several tables are presented that highlight job creation and job destruction statistics across industries.

### Concepts and definitions

The cross-sectional, or “snapshot,” employment statistics that are published by the Bureau of Labor Statistics are invaluable to policymakers, researchers, and the business community. However, comparing aggregate employment levels at two points in time only states the net change in employment and does not inform us either of how many establishments are expanding or contracting or by how much they are expanding or contracting. This state of affairs is easily illustrated.

Suppose that payroll employment was 108.2 million jobs in September 1999 and 109.2 million jobs in December 1999. Then net employment grew by 1 million jobs during the quarter. This net figure is consistent with many scenarios, including any of the following three: (1) one million jobs were created and none were destroyed, (2) 9 million were created and 8 million were destroyed, and (3) 109.2 million were created and 108.2 million were destroyed. The first scenario illustrates a labor market in which no employer decreased the size of his or her establishment and all employment growth is attributable to establishments either opening or expanding. The third scenario illustrates a labor market in which all establishments in the previous quarter shut down and all establishments in the current quarter started up. The true underlying labor market is, of course, somewhere in between these two extreme cases; the second scenario illustrates one possible intermediate case.

Net employment growth is nothing more than a comparison of cross-sectional employment at two points in time: how many more jobs exist at the latter period compared with the earlier one. Thinking about how this net employment growth might have occurred indicates that, in all likelihood, some establishments have expanded, some have contracted, some have opened, and some have closed. *Job creation* is defined as the employment growth contributed by establishments that expand or start up, and *job destruction* is defined as the em-

ployment decline resulting from establishments that contract or shut down. The sum of job creation and job destruction is the net change in employment. It is obvious that longitudinal microdata at the establishment level are required to decompose net employment change into its components of job creation and job destruction. The desire to achieve this decomposition is one of the motivations for the longitudinal establishment database being developed by the Bureau.

It is informative to present job creation and job destruction statistics as rates as well as a count of the number of jobs. Let  $E_t$  denote aggregate employment in quarter  $t$ , let  $e$  index establishments, define  $S^+$  as the sector of expanding and opening establishments, and define  $S^-$  as the sector of contracting and closing establishments. Then net employment growth over the quarter is  $E_t - E_{t-1}$ , and the quarterly net employment growth rate is written as

$$\left[ \frac{E_t - E_{t-1}}{\{E_t + E_{t-1}\}/2} \right].$$

In accordance with the previous definition of job creation, the quarterly job creation rate is defined as

$$\left[ \sum_{e \in S^+} \left( \frac{E_t^e - E_{t-1}^e}{\{E_t + E_{t-1}\}/2} \right) \right].$$

Similarly, following the previous definition of job destruction, the average quarterly job destruction rate is defined as

$$\left[ \sum_{e \in S^-} \left( \frac{|E_t^e - E_{t-1}^e|}{\{E_t + E_{t-1}\}/2} \right) \right].$$

As is evident in the preceding equations, the mean of employment in the current and the previous quarter is the measure of employment in the denominator when one converts employment levels into rates. The reason for this is that the Bureau will be publishing job creation and destruction rates by employment size class, an approach that introduces certain statistical issues. As noted by Davis, Haltiwanger, and Schuh, defining “size according to base-year employment leads to a regression fallacy, which in turn paints an overly favorable picture of the relative job growth performance of small employers.”<sup>7</sup>

The difficulties faced in using the base year in the denominator of a growth rate can, again, be illustrated. Suppose that an establishment grows from one employee to two and then reverts to one employee. Using employment in the previous quarter in the denominator, one finds that the growth rate in the first quarter is 100 percent (2 minus 1, divided by 1) and the growth rate in the second quarter is -50 percent (1 minus 2, divided by 2). By contrast, if we use average employment across two quarters in the denominator, the growth rate in the first quarter is 67 percent (2 minus 1, divided by 1.5), and the growth rate in the second quarter is -67 percent (1 minus 2, divided by 1.5). This simple example illustrates how using

the average of the current and previous quarters' employment in the denominator portrays expansion and contraction symmetrically.

## The longitudinal microdata

*Data sources and definitions.* The source of the establishment microdata used for constructing the new BLS longitudinal database (often referred to as the LDB) is the quarterly unemployment insurance microdata. All employers subject to State unemployment insurance laws are required to submit quarterly reports detailing their monthly employment and quarterly wages to the State Employment Security Agencies. After the microdata are edited and, if necessary, corrected by the State labor market information staff, the States submit these data and other business identification information to the Bureau of Labor Statistics as part of the Covered Employment and Wages program (ES-202), which is a cooperative endeavor of the Bureau and the States. The data gathered in the ES-202 program are a comprehensive and accurate source of employment and wages and provide a virtual census (covering 98 percent) of employees on nonfarm payrolls. According to *Employment and Wages*, an annual publication of the Bureau, in 1999 employers in private industry provided State Employment Security Agencies with quarterly unemployment insurance tax reports for an average of 107.6 million wage and salary workers in approximately 7.6 million business establishments.<sup>8</sup>

Several definitions deserve mention. An *establishment* is an economic unit, such as a factory or store, that produces goods or provides services. An establishment is usually a physical location and is engaged in one or predominantly one type of economic activity to which a Standard Industrial Classification (SIC) code is applicable. The code assigned to an establishment is based on its primary activity, which is determined by the primary product or groups of products the establishment produces or distributes (or the services the establishment renders). Employers report employment and wages on an individual establishment basis. Multiple Worksite Reports are used to collect separate employment and wage data for each establishment owned by employers with multiple locations within a State.

*Employment* for a given month is the number of covered workers (whose wages are subject to unemployment insurance taxes) who earned wages during the pay period that includes the 12th of the month. The quarterly unemployment insurance microdata contain information on monthly employment. The publications from the longitudinal database will use employment in the 3rd month of the quarter as the measure of an establishment's quarterly employment. This decision was made because comparisons between specific points in time are easier to interpret than are comparisons of quar-

terly averages. The averaging of monthly employment within a quarter distorts the timing of when changes in employment actually occurred, especially when an establishment shuts down. Furthermore, monthly employment flows constructed from data reported quarterly might be affected by unknown problems such as quarterly seam effects and other forms of recall bias—this is, accordingly, an area for further research.

*Construction of longitudinal microdata.* The Bureau of Labor Statistics uses two sets of information to match establishments across quarters. The first is the State Employment Security Agencies' identification number (SESA-ID), which is the unemployment insurance account number in combination with the establishment's reporting unit number. The SESA-ID is the establishment's unique identifier that the State Employment Security Agencies transmit to the Bureau. Although the reporting unit number is not used in the administration of the Unemployment Insurance system, it is still assigned by the State (through information collected in Multiple Worksite Reports) to satisfy the BLS purpose of identifying establishments within a multiestablishment employer in each State.

Two other pieces of information in the unemployment insurance microdata that are used for longitudinal linking are the predecessor and successor numbers. The predecessor number is the SESA-ID of the establishment that previously owned the given establishment, in the event of either a change in ownership or a change in reporting configuration (that is, a breakout of units). The successor number is the SESA-ID of the establishment that will take over the given establishment in the event of either a change in ownership or a change in reporting configuration (that is, a consolidation of units). The term *breakout* refers to a transition from a single-establishment employer to a multiestablishment employer, and the term *consolidation* refers to a transition from a multiestablishment employer to a single-establishment employer. Breakouts and consolidations may be actual economic events representing business expansions and contractions or merely administrative reporting changes stemming from whether or not the business completes the Multiple Worksite Report.

In addition to matching on SESA-ID and matching on predecessor and successor numbers both within and across quarters, another step undertaken to link establishment-level microdata across quarters is a probability-based statistical match that attempts to identify two establishments with different SESA-IDs as continuous. This match is based upon comparing births in the current quarter with deaths in the previous quarter and looking for occurrences such as the same name, the same address, the same phone number, and so forth. Almost all of the establishments identified as continuous from quarter to quarter are matched by SESA-ID (between 95 and 97 percent each quarter). Although the predecessor-successor match and the probability-based match link only a relatively

small number of establishments, both matches have a significant effect on the number of births and deaths.<sup>9</sup>

*Establishment classifications.* The following definitions are used to identify the status of establishments in the LDB tables: A *business expansion* is defined as a transition of a previously operating establishment—one that had positive employment (greater than zero) in the 3rd month of the preceding quarter—to a higher level of positive employment in the current quarter. A *business opening* is defined as either a transition of an establishment from an employment level of zero to an employment level greater than zero or an establishment appearing for the first time with positive employment. Openings are counted only in the unit totals for the quarter in which an establishment first appears with positive employment. A *business contraction* is defined as a transition of a previously operating establishment wherein the establishment decreases its 3rd-month employment between two periods of time and the employment in the latter quarter is greater than zero. A *business closing* is defined as either a transition of an establishment from an employment level greater than zero to zero or an establishment with positive employment disappearing from the file with no link to the subsequent quarter. Closings are not counted in the unit totals for the quarter in which the establishment reports zero employees, but are counted for the quarterly comparison.

It is not possible for the LDB system to define business deaths on a contemporaneous basis. Businesses in the Unemployment Insurance system are allowed to, and often do, report zero employment for several quarters after they have effectively closed. This undoubtedly occurs when a business owner temporarily shuts down, but anticipates starting up the business again when economic conditions improve. By reporting zero employment and zero wages on the quarterly contributions form, the business owner can keep his or her unemployment insurance account active. This practice results in many observed business closings, but which establishments will start up again and which will remain closed is not observed for several more quarters.

Although deaths cannot be defined contemporaneously, we can define births and deaths in the historical data. A *business birth* is defined as an establishment for which no predecessor in any previous period is identified that achieves nonzero employment for the first time. Births are a subset of openings. Likewise, a *business death* is defined as an establishment that, over some period of time, either ceases reporting with no successor identified or decreases employment from positive to zero and does not resume operations (report positive employment) during the subsequent four quarters. Deaths are a subset of closings.

Note that the employment numbers tabulated from the LDB will be slightly below the summary statistics released by the

ES-202 program. As a result of the record linkage process, two types of records are deleted: (1) imputed current-quarter single records whose prior-quarter mates find better matches to other records in the current quarter and (2) the predecessor halves of intraquarter matches after merging with their successors. The differences caused by these deletions have not been quantified yet, but they should be small. Furthermore, certain establishments are excluded from forthcoming BLS publications of job creation and destruction statistics and hence also are excluded from the tables presented in the next section. These establishments either fall under SIC 8811 (private household workers), are not in the private sector (that is, they are Federal, State, local, or foreign government establishments), or are located in Puerto Rico or the Virgin Islands.

## First results

*Basic results.* The following tabulation presents employment levels for September 1999 and December 1999, as well as the quarterly flows in between these 2 months:

	<i>Level</i>	<i>Percent change</i>
Employment:		
September 1999 .....	108,171,968	...
December 1999 .....	109,185,909	...
Change .....	1,013,941	0.9
Job creation:		
Total .....	9,018,416	8.3
Expanding establishments .....	7,194,722	6.6
Opening establishments .....	1,823,694	1.7
Job destruction:		
Total .....	8,004,475	7.4
Contracting establishments .....	6,296,869	5.8
Closing establishments .....	1,707,606	1.6

The first column of the tabulation, of course, presents employment counts; the second column presents rates, with the denominator an average computed from the two quarters. For the U.S. private-sector economy, there were 108,171,968 jobs in September 1999 and 109,185,909 jobs in December of that year. Thus, employment grew by 1,013,941 jobs between the third and the fourth quarters. Converted to percentage terms, net employment growth between September and December 1999 was 0.9 percent.

Employment in expanding establishments grew by 7,194,722 jobs, and employment in opening establishments grew by 1,823,694 jobs. Employment in contracting establishments declined by 6,296,869 jobs, and closing establishments accounted for the loss of 1,707,606 jobs. The vector sum of these four counts is the net employment growth of 1,013,941 jobs.

It is sometimes more useful to express these job flows as percentages rather than levels. Accordingly, as the second column of the tabulation shows, the job creation rate in the U.S. private-sector economy between September and December 1999 was 8.3 percent and the job destruction rate was 7.4 percent. These statistics imply that the jobs created by opening establishments and expanding establishments are 8.3 percent of the total number of jobs and the jobs destroyed by closing establishments and contracting establishments are 7.4 percent of the total number of jobs. The 0.9-percent difference between the job creation and job destruction rates is the net employment growth rate between the third and fourth quarters of 1999.

Job creation is the employment gain from expanding establishments and opening establishments. Expanding establishments account for 79.8 percent of quarterly job creation, whereas opening establishments account for 20.2 percent of quarterly job creation. Similarly, contracting establishments account for 78.7 percent of quarterly job destruction, whereas closing establishments account for 21.3 percent of quarterly job destruction. These statistics are similar to the birth and death statistics presented by James R. Spletzer, who used historical data from West Virginia to show that births and deaths account for slightly less than 20 percent of job creation and job destruction on a quarterly basis.<sup>10</sup>

The establishment counts underlying the preceding job creation and job destruction statistics are given in the following tabulation:

	<i>Level</i>	<i>Percent change</i>
<b>Establishments:</b>		
September 1999 .....	6,158,342	...
December 1999 .....	6,228,999	...
Change .....	70,657	1.1
<b>Job-creating establishments:</b>		
Total .....	1,919,122	31.0
Expanding establishments .....	1,541,283	24.9
Opening establishments .....	377,839	6.1
<b>Job-destroying establishments:</b>		
Total .....	1,720,373	27.8
Contracting establishments .....	1,413,191	22.8
Closing establishments .....	307,182	5.0

There were 6,158,342 establishments with positive employment in September 1999 and 6,228,999 in December 1999, an increase of 70,657 establishments, or a 1.1-percent growth rate. There were 1,541,283 establishments (24.9 percent of all establishments) expanding during the quarter and 1,413,191 (22.8 percent) contracting during the quarter. During the same quarter, 377,839 establishments (6.1 percent) opened and 307,182 establishments (5.0 percent) closed. The 2.9 million estab-

ments that did not change their employment between September and December are not included in the tabulation.

Combining the statistics from the two tabulations to compute the ratios of means reveals that the average expanding establishment is adding 4.7 jobs per quarter and the average contracting establishment is losing 4.5 jobs per quarter. Also, the average opening establishment starts with 4.8 employees in its first quarter of positive employment, and the average closing establishment is responsible for the loss of 5.6 employees in its final quarter with employees.

How do these longitudinal statistics expand on current BLS labor market statistics? The September and December 1999 data for employment and establishments are similar to the cross-sectional or "snapshot" statistics that are currently available from the Bureau. These data tell us that employment grew at a rate of 0.9 percent over the quarter and the number of establishments grew at a rate of 1.1 percent between September and December. The net employment growth of 1,013,941 jobs is the result of employment growth from a set of 1,919,122 establishments that added 9,018,416 new jobs, combined with employment losses from a set of 1,720,373 establishments that lost 8,004,475 jobs. Similarly, the net growth of 70,657 establishments between September and December is the result of 377,839 new establishments opening and 307,182 existing establishments closing. These large gross flows that underlie the substantially smaller net flows are not captured in the cross-sectional statistics.

So what do the data presented in the tabulations tell us about the economy? The main thing they reveal is the tremendous amount of heterogeneity underlying the net growth rates. The sum of job creation and job destruction, which is 15.7 percent of all jobs, tells us that more than 1 in 7 jobs were either created or destroyed during the period from September 1999 to December 1999. In particular, 8.3 percent of jobs that existed in December did not exist in September, and 7.4 percent of jobs that existed in September did not exist in December. In addition, 31 percent of establishments added jobs during the 3-month period, and 27.8 percent of establishments decreased their employment during the period. These job creation and job destruction statistics demonstrate that a sizable number of jobs and businesses appear and disappear in the short time frame of 3 months.

*Results by industry:* The quarterly job creation and job destruction statistics for each of the major industries are presented in tables 1 and 2, and the quarterly establishment flows by industry are given in tables 3 and 4. Ignoring unclassified establishments, one immediately sees that the job creation and job destruction rates in agriculture and construction are the highest of all industries. This result has also been found by others.<sup>11</sup> One immediate explanation is the substantial seasonality of employment in those industries.

**Table 1. Quarterly employment levels and flows, by industry, September 1999 to December 1999**

Industry	Employment			Job creation		Job destruction	
	September 1999	December 1999	Change	Expanding establishments	Opening establishments	Contracting establishments	Closing establishments
Total .....	108,171,968	109,185,909	1,013,941	7,194,722	1,823,694	6,296,869	1,707,606
Agriculture, forestry, and fishing .....	2,037,815	1,722,840	-314,975	202,361	64,762	479,383	102,715
Mining .....	530,982	528,569	-2,413	26,991	6,747	30,130	6,021
Construction .....	6,613,828	6,428,999	-184,829	561,133	151,194	729,576	167,580
Manufacturing .....	18,510,755	18,441,768	-68,987	690,224	106,716	732,317	133,610
Transportation and public utilities .....	6,641,545	6,740,689	99,144	393,520	77,054	289,362	82,068
Wholesale trade .....	6,928,158	6,993,858	65,700	386,250	98,356	326,489	92,417
Retail trade .....	22,914,513	23,866,027	951,514	2,130,887	450,467	1,214,466	415,374
Finance, insurance, and real estate .....	7,401,138	7,441,430	40,292	350,074	103,746	311,046	102,482
Services .....	36,352,934	36,621,305	268,371	2,426,794	570,673	2,156,547	572,549
Unclassifiable establishments .....	240,300	400,424	160,124	26,488	193,979	27,553	32,790

**Table 2. Quarterly employment flows, by industry, September 1999 to December 1999**

Industry	Net change	Job creation			Job destruction		
		Total	Expanding establishments	Opening establishments	Total	Contractions	Closings
Total .....	.9	8.3	6.6	1.7	7.4	5.8	1.6
Agriculture, forestry, and fishing .....	-16.8	14.2	10.8	3.4	31.0	25.5	5.5
Mining .....	-5	6.4	5.1	1.3	6.8	5.7	1.1
Construction .....	-2.8	10.9	8.6	2.3	13.8	11.2	2.6
Manufacturing .....	-4	4.3	3.7	.6	4.7	4.0	.7
Transportation and public utilities .....	1.5	7.0	5.9	1.2	5.6	4.3	1.2
Wholesale trade .....	.9	7.0	5.5	1.4	6.0	4.7	1.3
Retail trade .....	4.1	11.0	9.1	1.9	7.0	5.2	1.8
Finance, insurance, and real estate .....	.5	6.1	4.7	1.4	5.6	4.2	1.4
Services .....	.7	8.2	6.7	1.6	7.5	5.9	1.6
Unclassifiable establishments .....	50.0	68.8	8.3	60.5	18.8	8.6	10.2

**Table 3. Quarterly establishment levels and flows, by industry, September 1999 to December 1999**

Industry	Establishments			Job-creating establishments		Job-destroying establishments	
	September 1999	December 1999	Change	Expanding establishments	Opening establishments	Contracting establishments	Closing establishments
Total .....	6,158,342	6,228,999	70,657	1,541,283	377,839	1,413,191	307,182
Agriculture, forestry, and fishing .....	171,516	163,379	-8,137	33,737	9,396	57,815	17,533
Mining .....	23,728	23,943	215	5,510	1,132	5,888	917
Construction .....	611,178	608,947	-2,231	147,973	43,430	167,156	45,661
Manufacturing .....	371,239	371,179	-60	116,895	12,066	109,386	12,126
Transportation and public utilities .....	274,655	274,558	-97	68,055	13,829	63,412	13,926
Wholesale trade .....	578,553	582,667	4,114	122,195	27,333	108,032	23,219
Retail trade .....	1,329,964	1,324,659	-5,305	422,682	52,435	346,254	57,740
Finance, insurance, and real estate .....	581,631	590,102	8,471	108,700	33,001	100,510	24,530
Services .....	2,148,571	2,177,947	29,376	504,988	130,821	446,579	101,445
Unclassifiable establishments .....	67,307	111,618	44,311	10,548	54,396	8,159	10,085

**Table 4. Quarterly establishment flows, by industry, September 1999 to December 1999**

Industry	Net change	Job-creating establishments			Job-destroying establishments		
		Total	Expanding establishments	Opening establishments	Total	Contracting establishments	Closing establishments
Total .....	1.1	31.0	24.9	6.1	27.8	22.8	5.0
Agriculture, forestry, and fishing .....	-4.9	25.8	20.1	5.6	45.0	34.5	10.5
Mining .....	.9	27.9	23.1	4.7	28.5	24.7	3.8
Construction .....	-4	31.4	24.3	7.1	34.9	27.4	7.5
Manufacturing .....	.0	34.7	31.5	3.3	32.7	29.5	3.3
Transportation and public utilities .....	.0	29.8	24.8	5.0	28.2	23.1	5.1
Wholesale trade .....	.7	25.8	21.0	4.7	22.6	18.6	4.0
Retail trade .....	-4	35.8	31.8	4.0	30.4	26.1	4.4
Finance, insurance, and real estate .....	1.4	24.2	18.6	5.6	21.3	17.2	4.2
Services .....	1.4	29.4	23.3	6.0	25.3	20.6	4.7
Unclassifiable establishments .....	49.5	72.6	11.8	60.8	20.4	9.1	11.3

The effects of seasonal employment patterns can also be seen in the large number of jobs added in the retail trade industry. Employment in the industry grew by 4.1 percent during the fourth quarter of 1999. As shown in table 2, this net employment growth rate is the result of an 11.0-percent job creation rate and a 7.0-percent job destruction rate. Furthermore, the statistics in table 4 illustrate that 35.8 percent of retail trade establishments expanded or opened during the quarter and 30.4 percent contracted or closed. This heterogeneity is also evident in the construction industry: the quarterly net employment growth rate of -2.8 percent in the industry was the result of a 10.9-percent job creation rate and a 13.8-percent job destruction rate. (See table 2.) Moreover, 31.4 percent of establishments in the industry expanded or opened during the quarter, and 34.9 percent contracted or closed. (See table 4.) Thus, in both growing and declining industries, a sizable number of establishments expanded and a sizable number contracted. The gross job and establishment flows are large relative to the net flows in both growing and declining industries.

The manufacturing industry stands out in all of the tables. The lowest job creation and job destruction statistics are in manufacturing: 4.3 percent and 4.7 percent, respectively. (See table 2.) As table 4 shows, manufacturing has the lowest rate of opening and closing establishments (3.3 percent each). The statistics in table 1 illustrate the fact that the job creation attributable to openings and the job destruction attributable to closings exhibit relatively large variations across industries. Ignoring unclassified establishments again, one sees that the job creation attributable to openings ranges from a low of 13.4 percent [ $106,716/(106,716 + 690,224)$ ] in manufacturing to a high of 24.2 percent [ $64,762/(64,762 + 202,361)$ ] in agriculture and the job destruction attributable to closings ranges from a low of 15.4 percent [ $133,610/(133,610 + 732,317)$ ] in manufacturing to a high of 25.5 percent [ $415,374/(415,374 + 1,214,466)$ ] in retail trade. One explanation undoubtedly underlying these statistics is the average establishment size, which is highest in manufacturing (approximately 50 employees); it is easy to theorize that it is more difficult for large establishments to open and close than it is for smaller establishments.

## Future directions

The Bureau of Labor Statistics has constructed a longitudinal database that contains quarterly employment and wage data for virtually all business establishments in the United States. The LDB is the Bureau's sampling frame for establishments and contains the most current data available, as well as the entire history of quarterly microdata from 1990 through the first and second quarters of calendar-year 2000. The LDB enables us to track changes in employment and wages not only at the macrolevel, but also at the microlevel of the establishment. The database can be used to generate high-quality,

high-frequency, timely, and historically consistent information regarding not only job creation and job destruction, but also the life cycle of establishments. The Bureau plans to publish quarterly and annual tables of job creation and job destruction statistics on the entire U.S. economy, by industry, by State, and by size and age of firm. These tables will be put through a nondisclosure review to ensure that the identity of the establishments is protected. No timetable has been established for the first official release of the new statistics or for the frequency of their publication.

Job creation and job destruction statistics have the potential to increase our understanding of labor markets. For example, labor market outcomes reflect the interactions of supply and demand, and because of the ready availability of appropriate microdata, almost all that is known about worker mobility reflects supply-side considerations such as individual preferences and human-capital acquisition. By contrast, the data on job flows suggest that job opportunities at a specific employer appear and disappear, which suggests a major role for demand-side considerations. Another example is that underlying the gross job flows are gross worker flows, and an analysis of the relationship between these two types of flows would further economists' understanding of the matching process that occurs between employees and employers. Such worker-firm matching is undoubtedly related to important areas of research, including wage determination, capital-labor complementarities, and long-term employment relationships.

The data on job flows will also increase economists' understanding of industrial organization. Topics such as firm growth and survival are interrelated with job flows, as firms seek the set of workers that maximizes profitability, given their product markets and choices of technology. Haltiwanger, Julia I. Lane, and Spletzer have found that long-lived employers choose very different types of workforces and that these choices are quite persistent over time.<sup>12</sup> This finding leads to speculation about the role of entry and exit and about the dynamics of how businesses initially choose and evolve toward a particular mix of workers. Job flows have also been found to be a key component in the study of aggregate productivity growth: L. Foster, Haltiwanger, and C. J. Krizan have shown that the reallocation of jobs from less efficient to more efficient plants plays a significant role in such growth.<sup>13</sup>

Data on job flows also have interesting implications for the study of macroeconomics. One of the key findings by Davis, Haltiwanger, and Schuh is that job destruction rates in U.S. manufacturing exhibit greater cyclical variation than do job creation rates.<sup>14</sup> In particular, recessions are characterized by a sharp increase in job destruction in manufacturing, accompanied by a relatively mild slowdown in job creation. This finding has led to several theories of business cycle dynamics that emphasize the "cleansing" effects of recessions, dur-

ing which costly reallocation activities can be concentrated when the value of foregone production is low. A natural question is whether this cyclical asymmetry extends to nonmanufacturing industries. The evidence presented by Foote suggests that the manufacturing and nonmanufacturing sectors exhibit

systematically different job flow dynamics.<sup>15</sup> The job flows data in the LDB, which are computed from essentially the full universe of establishments, should help economists, policymakers, and the business community develop a more complete understanding of business cycles. □

## Notes

ACKNOWLEDGMENT: We wish to acknowledge all those within the BLS Office of Employment and Unemployment Statistics and Division of Business Establishment Systems who contributed to the creation of the LDB. We thank especially the LDB Systems staff for their assistance in creating the tables presented in this article.

<sup>1</sup> S. J. Davis, J. C. Haltiwanger, and S. Schuh, *Job Creation and Destruction* (Cambridge, MA, MIT Press, 1996).

<sup>2</sup> See S. J. Davis and J. C. Haltiwanger, "Gross Job Creation and Destruction: Microeconomic Evidence and Macroeconomic Implications," *NBER Macroeconomics Annual* (Cambridge, MA, MIT Press, 1990), pp. 123–68; S. J. Davis and J. C. Haltiwanger, "Gross Job Creation, Gross Job Destruction, and Employment Reallocation," *Quarterly Journal of Economics*, August 1992, pp. 819–63; and T. Dunne, M. J. Roberts, and L. Samuelson, "Plant Turnover and Gross Employment Flows in the U.S. Manufacturing Sector," *Journal of Labor Economics*, January 1989, pp. 48–71.

<sup>3</sup> See P. M. Anderson and B. D. Meyer, "The Extent and Consequences of Job Turnover," *Brookings Papers on Economic Activity* (Washington, DC, Brookings Institute, 1994), pp. 177–236; J. Lane, D. Stevens, and S. Burgess, "Worker and Job Flows," *Economics Letters*, April 1996, pp. 109–14; C. L. Foote, "Trend Employment Growth and the Bunching of Job Creation and Destruction," *Quarterly Journal of Economics*, August 1998, pp. 809–34; and J. R. Spletzer, "The Contribution of Establishment Births and Deaths to Employment Growth," *Journal of Business and Economic Statistics*, January 2000, pp. 113–26.

<sup>4</sup> Davis and Haltiwanger, "Gross Job Creation and Destruction"; and "Gross Job Creation, Destruction, and Reallocation."

<sup>5</sup> Dunne, Roberts, and Samuelson, "Plant Turnover."

<sup>6</sup> Anderson and Meyer, "Job Turnover."

<sup>7</sup> See S. J. Davis, J. C. Haltiwanger, and S. Schuh, *Small Business and Job Creation: Dissecting the Myth and Reassessing the Facts*, NBER

Working Paper no. 4492, 1993; and *Job Creation and Destruction*.

<sup>8</sup> For more information on the ES–202 program, see *BLS Handbook of Methods*, Bulletin 2490 (Bureau of Labor Statistics, 1997); and T. E. Farmer and M. A. Searson, "Use of Administrative Records in the Bureau of Labor Statistics' Covered Employment and Wages (ES–202) Program," in *Proceedings of the Bureau of the Census 1995 Annual Research Conference* (Bureau of the Census, 1995), pp. 198–235.

<sup>9</sup> For a more detailed description of the matching algorithm used for the LDB, see K. Robertson, L. Huff, G. Mikkelsen, T. Pivetz, and A. Winkler, "Improvements in Record Linkage Processes for the Bureau of Labor Statistics' Business Establishment List," *Proceedings for the 1997 Record Linkage Workshop and Exposition* (Office of Management and Budget, 1997); and T. Pivetz and H. Chang, "Linking Unemployment Insurance Wage Records to ES–202 Establishment Microdata to Improve the Accuracy of the BLS' Longitudinal Business Establishment Database," paper presented at the 1998 International Symposium on Linked Employer-Employee Data, Washington, DC, 1998.

<sup>10</sup> Spletzer, "Establishment Births and Deaths."

<sup>11</sup> Anderson and Meyer, "Job Turnover," table 12; see also Foote, "Trend Employment Growth," and Spletzer, "Establishment Births and Deaths."

<sup>12</sup> J. C. Haltiwanger, J. I. Lane, and J. R. Spletzer, "Productivity Differences across Employers: The Roles of Employer Size, Age, and Human Capital," *American Economic Review Papers and Proceedings*, May 1999, pp. 94–98; and *Wages, Productivity, and the Dynamic Interaction of Businesses and Workers*, NBER Working Paper no. 7994, 2000.

<sup>13</sup> L. Foster, J. Haltiwanger, and C. J. Krizan, *Aggregate Productivity Growth: Lessons from Microeconomic Evidence*, NBER Working Paper no. 6803, 1999.

<sup>14</sup> Davis, Haltiwanger, and Schuh, *Job Creation and Destruction*.

<sup>15</sup> Foote, "Trend Employment Growth."