Job Creation and Destruction in Massachusetts: Gross Flows Among Industries

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The Massachusetts economy has experienced wide swings in employment in the 1990s, losing over 10 percent of existing jobs in the 1990–91 recession (which began locally in 1989) and not surpassing its pre-recession job peak until early 1998. Within individual sectors of the economy, the losses and gains have been even greater, with many manufacturing industries losing jobs almost nonstop while some non-manufacturing industries have expanded markedly. This article examines these employment swings and attempts to better understand their dynamic underpinnings by disaggregating them into the simultaneous job creation and job destruction that underlie any net change.

Specifically this article decomposes net employment changes in Massachusetts into two components, job additions attributable to expanding industries and job cutbacks occurring in contracting industries. Over the decade-plus from January 1988 through June 1999, the Massachusetts economy added about 118,000 jobs, on net. The gross yearly flows were much bigger, however, amounting to 736,000 jobs created and 618,000 jobs destroyed.[1]

A given rate of net employment change may be associated with a variety of rates of job creation and destruction. For example, in September 1993, total nonagricultural employment in Massachusetts was up 2.0 percent from a year earlier; this job growth reflected a 3.0 percent job creation rate offset by a 1.0 percent job destruction rate. In June 1998, the same 2.0 percent rate of job growth was associated with job creation and destruction rates of 2.4 and 0.4 percent, respectively. Expanding industries were adding jobs more slowly, on average, while contracting industries were at the same time cutting jobs more gradually. To the degree that changes in numbers of jobs by industry are associated with individual worker flows, lower rates of job creation and destruction (given the pace of net change) may imply greater job security for existing workers but somewhat more difficulty for job-seekers in finding new positions.

The current analysis uses industry data that encompass all sectors of the Massachusetts economy, whereas most research on U.S. job creation and destruction at the plant level has been limited to manufacturing. Nonmanufacturing industries account for six of every seven jobs in the Massachusetts economy, and for an even higher share of newly created jobs (14 out of 15). Tracking and learning more about the performance of these industries is one important aspect of understanding the factors determining overall economic growth and decline and, therefore, the environment in which most new labor market entrants and reentrants, as well as job-losers, will find themselves seeking employment in coming months and years.

> *Lower rates of job creation and destruction (given the pace of net change) may imply greater job security for existing workers but somewhat more difficulty for job-seekers in finding new positions.*

The article proceeds as follows: The next section describes the data and outlines the methods used to calculate measures of job creation and destruction. Part II summarizes the magnitude of job flows in Massachusetts over the 1988–99 period and documents the substantial shift out of manufacturing that occurred even after the total count of jobs had regained its pre-recession peak. Because of the different trends in manufacturing and nonmanufacturing industries, Part III compares job flows in the two sectors, examining the magnitude of flows through the very deep recession and subsequent recovery. Part IV measures the persistence of job creation and destruction, as long-lasting flows may have different implications than transitory ones. Part V recaps the major findings.

I. Methodology

Monthly employment data are available for 65 detailed industries in Massachusetts.[2] (Appendix Table 1 lists the individual industries along with their

Standard Industrial Classification (SIC) codes and 1998 employment totals.) The 65 industries sum to total nonagricultural employment in the Commonwealth, that is, they are mutually exclusive and exhaustive. The estimates of employment in each industry are based on reports filed by a sample of establishments in Massachusetts. As is the case for other measures of employment and job flows, a job is counted only if it is filled; that is, an individual holding the job is on the establishment's payroll.

Using these employment data, industries are categorized each month as to whether they have added jobs or shed jobs since a year earlier (zero is categorized as adding).[3] Following the approach used by Davis, Haltiwanger, and Schuh (DHS 1996) in their study of employment changes at manufacturing plants, this article sums the positive job additions across all expanding industries and labels the sum "gross job creation." Similarly, the sum of job losses across all contracting industries is labeled "gross job destruction." Each is then expressed as a rate by dividing the gross job change by the beginning-of-period tally of total jobs.[4] The rate of gross job creation minus the rate of gross job destruction equals net employment change, and the sum of the two gross rates is the rate of job reallocation.

While the gross creation and destruction measures provide more information than the typical indicator of net employment change from year-earlier, they capture only a small fraction of the overall flow of jobs and workers in the economy. Within expanding or contracting industries, some individual firms are

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[1] These figures refer to changes measured over 12-month intervals. On a month-to-month basis, 1,328,700 jobs were created in Massachusetts over the 11½ years and 1,210,300 destroyed.

[2] The data originate with the Massachusetts Department of Employment and Training as part of the BLS 790 program. The New England Economic Project, a private, nonprofit organization that analyzes the New England economy, seasonally adjusts the monthly figures.

[3] The appendix displays job flow data based on employment changes measured from three months earlier and from one month earlier.

[4] DHS use an average of beginning-of-period and end-of-period as their denominator in calculating rates of gross job creation, destruction, and so on. The beginning-of-period denominator is used here because it corresponds to the usual method for computing rates of job growth (that is, net employment change here is identical to what analysts typically use to discuss the employment growth rate). DHS use the average because it bounds their measures between zero and 2, while using the beginning-of-period denominator would yield an infinite rate of gross job creation for a start-up plant. Because the data here refer to industries, not plants, there is no risk of extremely high rates of job creation or destruction; the two denominators produce measures that are very close for the moderate rates of creation and destruction observed here for industries.

cutting back while others are adding, but only net additions or subtractions for the industry as a whole are counted here. Thus, some of the jobs that are counted as being in a given industry throughout a time period have actually been destroyed at one firm and created at another during the period.[5] Haltiwanger and Schuh's study of U.S. manufacturing over the 1972–93 period (1999) finds that between-industry job flows account for only about one-third of the gross job flows among plants. Ritter (1993) finds a similar gap. If those figures applied to all Massachusetts industries, at least two-thirds of gross job flows among plants would not be counted in the measures used here, which tally only between-industry changes.

Gross job creation and destruction capture only a small fraction of the overall flow of jobs and workers in the economy, since only net additions or subtractions for the industry as a whole are counted.

Two other differences also affect the degree to which total gross flows among plants would be picked up in these data. First, the 65 Massachusetts industries are considerably less detailed than the 450 4-digit industries for which Haltiwanger and Schuh calculated between-industry flows, suggesting that the Massachusetts measures would capture even less than one-third of the job flows among plants. Furthermore, the Massachusetts industries for which data are available vary significantly in size.[6] Offsetting this to an

unknown degree is the fact that Massachusetts industries make up only a small fraction of U.S. industry employment. Thus, if a software firm moved some operations from the Silicon Valley to Massachusetts, the data used here would recognize the change as job creation (as would U.S. plant-level data) while U.S. industry data would not.

While it is impossible to know how much the Massachusetts between-industry flows understate the magnitude of total gross flows among plants, Haltiwanger and Schuh note that plant-level and industry-level measures are very highly correlated.[7] Thus, between-industry measures are still useful as indicators of movement in the economy.

II. The Magnitude of Gross Job Change in Massachusetts in the 1990s

Figure 1 plots job flows in Massachusetts from 12 months earlier. (The rate of gross job destruction, although calculated as a positive number, is plotted as negative in the chart to make it easier to see the relationships among the measures.) The most striking feature of the chart is that both creation and destruction occur simultaneously throughout the 1988–99 period. For example, during the recession of the late 1980s and early 1990s, which was very severe in Massachusetts, some industries continued to add jobs even as employment tumbled, on net.[8] And during the quite good times of the mid to late 1990s, some industries have been cutting back; this is a more familiar fact, because of the publicity surrounding layoff announcements.[9]

Figure 2 summarizes the size of the flows in three four-year periods and illustrates the fact of simultaneous job creation and destruction. The full length of each bar indicates the magnitude of the dominant gross flow in that period—destruction for the bar below the zero line and creation for bars in the positive range. The red portion of the bar measures the size of the offsetting gross flow, while the black portion of the bar shows the net change in number of

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[5] Even plant-level measures do not pick up all the worker flows or job changes in the economy, since within both expanding and contracting firms, some jobs or occupations are being added and other types of work reduced. As a result, the individual jobs in a plant may be different at the end of the period than they were at the beginning even when the total count of filled jobs in the plant is unchanged. And even when job counts by occupation are unchanged, the individuals holding specific jobs may change with retirements and other separations offset by promotions, other internal moves, and new hiring.

[6] The largest of the "detailed" Massachusetts industries, business services, included 235,000 employees in 1998 while the smallest (mining) had only 1,300. The average industry accounted for just under 50,000 jobs of the 3.2 million in the Massachusetts economy.

[7] They report a correlation of 0.95 between total (among plants) annual gross job creation and between-industry annual gross job creation for 4-digit manufacturing industries in the United States over the 1972–93 period; the corresponding correlation for gross job destruction is 0.97.
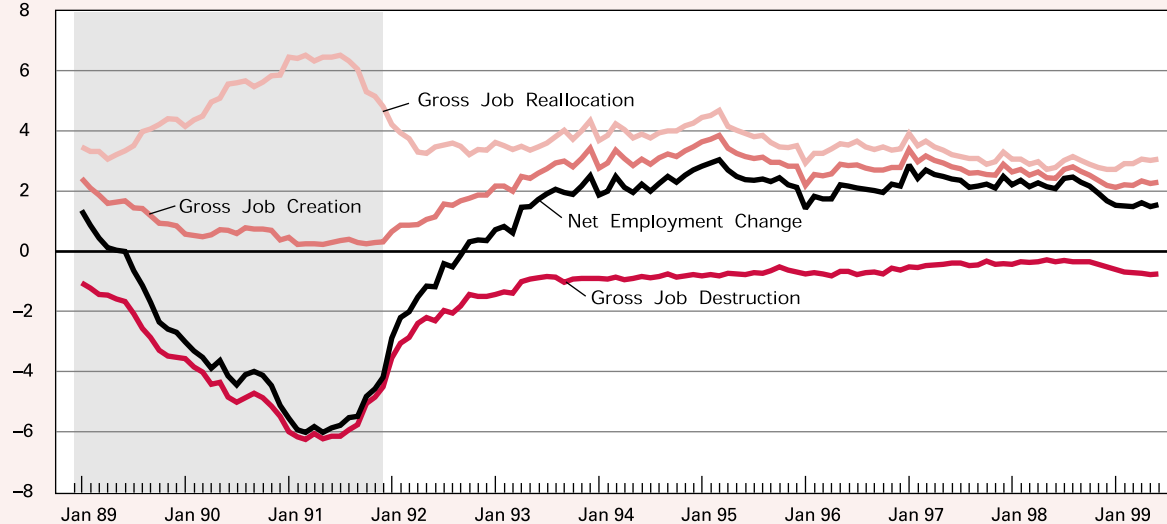
[8] The low point of job creation occurred in the spring of 1991; both April and May showed only three industries adding jobs from 12 months earlier, and the rate of gross job creation was 0.2 percent.

[9] The available data show a 0.3 percent low point in mid 1998 for the rate of gross job destruction from year earlier.

Figure 1

Job Creation and Destruction in Massachusetts
From 12 Months Earlier, Seasonally Adjusted
All Industries

Changes as Percent of Employment 12 Months Earlier

Note: Shaded area indicates peak to trough in Massachusetts total nonagricultural employment.

jobs. For example, in the 1992–95 period, 330,000 jobs were created (full bar) and 110,000 were destroyed (red portion), so the net increase in employment was 220,000 (black portion).
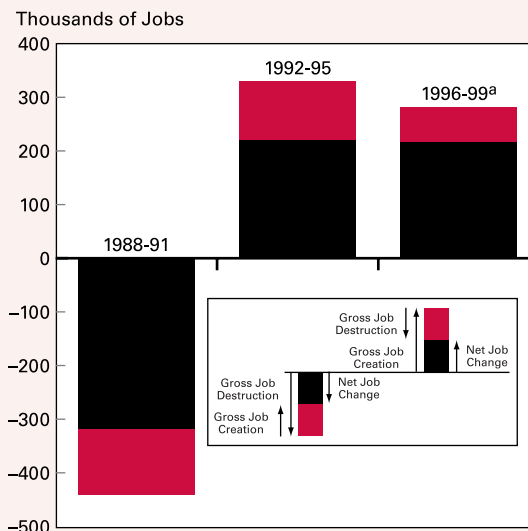
Table 1 reports March observations of the data shown in Figure 1: rates of gross job creation and destruction, net employment change, and gross job reallocation from 12 months earlier, along with counts of expanding and contracting industries.[10] The rate of gross job creation ranges from 0.2 percent to 3.9 percent and gross job destruction from 0.4 percent to 6.3 percent.

Gross job reallocation, the sum of creation and destruction, summarizes the extent of interindustry job changes. Over the entire period, gross job reallocation averaged about 4 percent. Thus, roughly one out of every 25 jobs in the Massachusetts economy was either added to an industry or cut from an industry in an average 12-month period. If Halti-

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[10] The charts show from-year-earlier flows for every month; the use of March data in the tables is arbitrary, but choice of a month early in the year seemed best for tabular summary since the from-year-earlier data begin in January 1989 and continue through June 1999.

Figure 2

Gross and Net Job Flows
in Massachusetts, by Period

Thousands of Jobs

aThrough June 1999

Table 1

Massachusetts Job Changes, All Industries
Changes from previous March to March of year shown
Percent, except where indicated

	Number of Expanding Industries	Number of Contracting Industries	Rate of Gross Job Creation	Rate of Gross Job Destruction	Net Employment Change	Rate of Gross Job Reallocation
1989	31	34	1.9	1.4	.4	3.3
1990	8	57	.5	4.0	−3.5	4.5
1991	4	61	.2	6.3	−6.0	6.5
1992	16	49	.9	2.9	−2.0	3.7
1993	29	36	2.0	1.4	.6	3.4
1994	44	21	3.4	.9	2.5	4.2
1995	43	22	3.9	.8	3.0	4.7
1996	30	35	2.5	.8	1.7	3.3
1997	43	22	3.2	.5	2.7	3.7
1998	50	15	2.5	.4	2.1	2.9
1999	34	31	2.2	.7	1.5	2.9
Average	30	35	2.1	1.8	.2	3.9

wanger and Schuh's proportions apply to these Massachusetts data, almost 12 percent of jobs in Massachusetts were created or destroyed at the plant level each year.

In addition to showing the magnitude of flows, Figure 1 shows wide swings in destruction and creation in the recession and recovery. The increase in job creation and decline in destruction in the recovery suggest that the jobs lost during the recession were later regained. However, while Massachusetts did eventually reattain its pre-recession total job count, the jobs were not the same. The industries in which the most jobs were destroyed in the recession were not the industries in which the bulk of jobs were created in the ensuing recovery.

Figure 3 plots the number of jobs destroyed in the recession and the number created in the recovery, by industry sector; Table 2 reports the numbers (as well as flows over the entire 1988–99 period). The first set of bars in Figure 3 measures industry flows during the recession from December 1988 to the employment trough in December 1991; the second refers to the recovery period, from December 1991 until the job total exceeded the pre-recession peak in February 1998. For example, during the recession, the finance, insurance, and real estate sector suffered gross destruction of 25,000 jobs (full bar), gross job creation of 4,000 (red portion), for a net loss of 21,000 jobs (black portion). In the recovery, industries within the sector created 34,000 jobs and destroyed 18,000 for a net gain

of 16,000. By contrast, construction and mining industries also created 34,000 jobs in the recovery, but destroyed less than 1,000, so net employment growth was more than twice as great as in the financial sector (thus, the two bars are similar in height, but the construction and mining bar is almost entirely black).

Industry by industry, the recovery pluses do not balance the recession minuses. The services industry accounted for a small fraction of recession job losses but was responsible for about half of j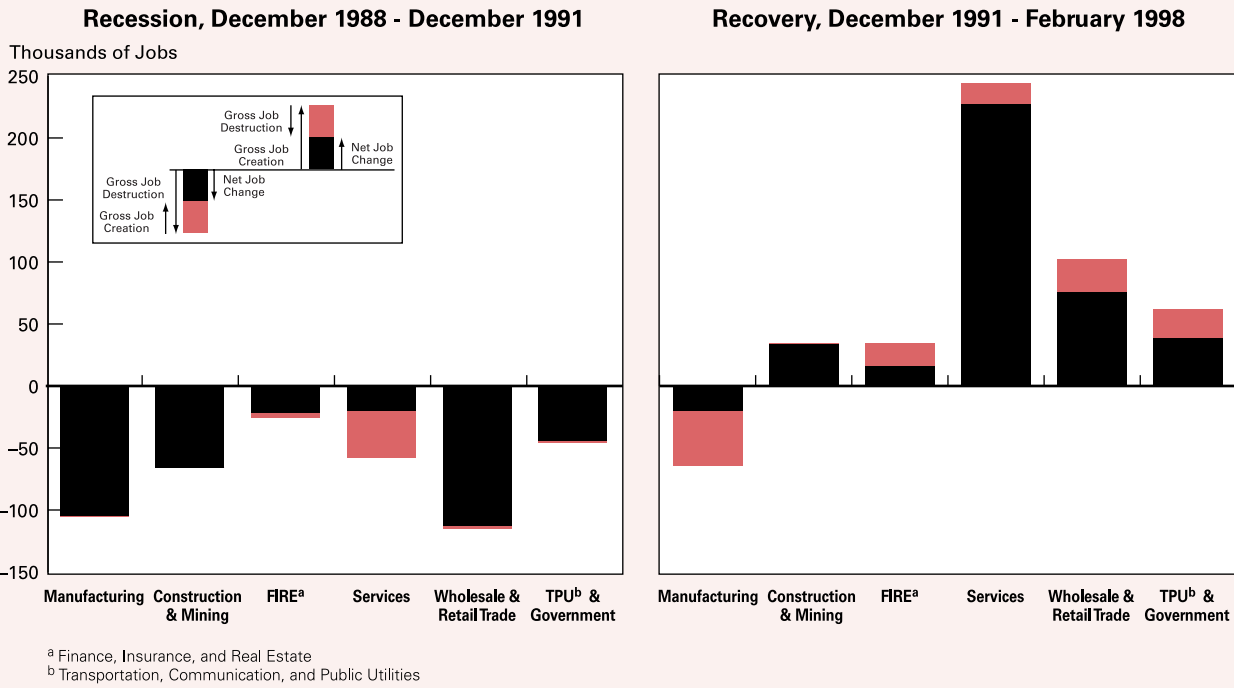ob creation in the recovery and three-fifths of the recovery's net job additions, adding almost 230,000 jobs over the six years. At the other extreme, having lost over 100,000 jobs in the recession, Massachusetts manufacturing lost an additional 20,000 jobs, on net, in the recovery (consisting of 64,000 jobs destroyed and 44,000 created). The services industry regained its pre-recession peak employment level in 1993, nonmanufacturing as a whole in 1996. But manufacturing remained more than 20 percent below its pre-recession level. Because manufacturing and nonmanufacturing experienced such different trends in Massachusetts during the 1990s, and because most research on job creation and destruction has been limited (by data availability) to manufacturing industries, the next section of the article examines job flows for manufacturing and nonmanufacturing separately.

III. Job Creation and Destruction in Massachusetts Manufacturing and Nonmanufacturing Industries, 1988 to 1999

Figure 4 displays counts of expanding and contracting industries separately for 27 manufacturing industries and 38 nonmanufacturing industries. Figure 5 plots measures of job change from 12 months earlier in manufacturing (top panel), with the gains and losses expressed as a percentage of manufacturing employment in Massachusetts at the beginning of the period. The bottom panel shows nonmanufac-

Figure 3

Gross and Net Job Flows in Massachusetts, by Industry

Recession, December 1988 - December 1991

Thousands of Jobs

Recovery, December 1991 - February 1998

ᵃ Finance, Insurance, and Real Estate
ᵇ Transportation, Communication, and Public Utilities

turing. (Table 3 reports March observations of the data.)

Because of a historical focus on manufacturing, both by those who developed and periodically revised

SIC codes and by the state employment agencies that decide on the level of industry aggregation to publish, the nonmanufacturing industries for which data are available are markedly bigger, on average, than the

Table 2
Job Creation and Destruction by Industry
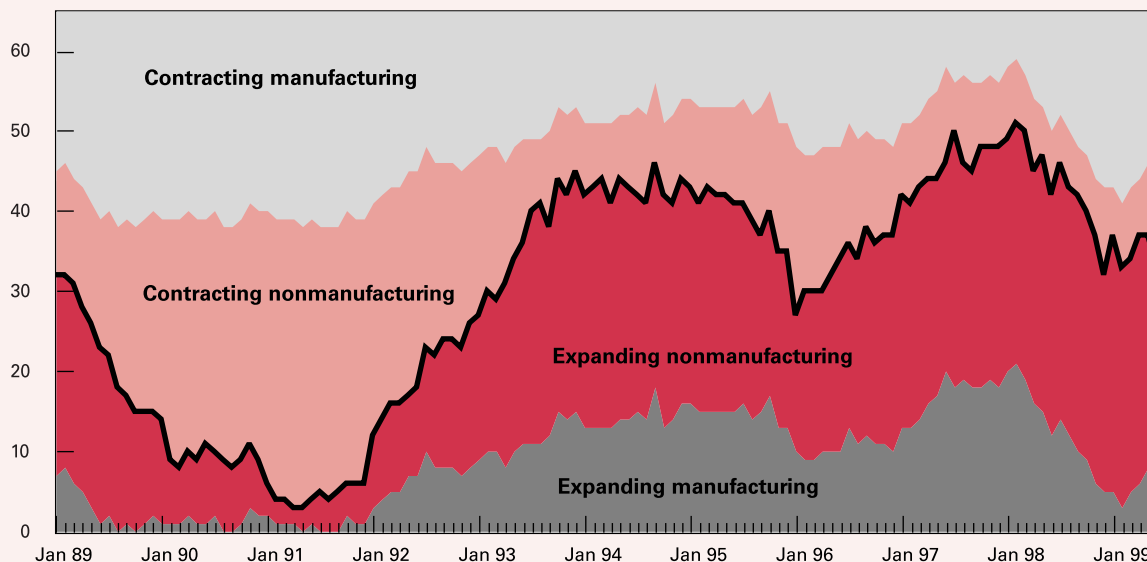Thousands of jobs; flows measured from December to December[a]

	Full Period 1/88–6/99		Recession 12/88–12/91		Recovery 12/91–2/98		Total Employment (annual average)		Memo: Number of
	Creation	Destruction	Creation	Destruction	Creation	Destruction	1988	1998	Industries
Manufacturing	48.9	204.3	.7	104.0	44.6	64.2	584.6	448.3	27
Construction & Mining	44.8	71.2	.0	65.2	34.3	.8	143.7	109.0	4
Finance, Insurance, & Real Estate	46.7	47.6	3.8	24.7	34.2	18.2	221.5	216.8	7
Services	361.0	74.1	37.7	57.2	243.9	16.9	896.3	1133.5	7
Wholesale & Retail Trade	145.5	143.9	2.4	114.3	102.1	26.4	739.3	720.8	10
Transportation, Public Utilities, & Government	89.3	76.7	2.1	45.1	61.7	23.0	545.0	547.6	10
Total	736.2	617.8	46.7	410.5	520.8	149.5	3,130.4	3,176.0	65

[a]Flows measured over shorter intervals fill in when period does not begin or end in December.

Expanding and Contracting Industries in Massachusetts

Number of Industries Adding (Cutting) Jobs from 12 Months Earlier

Note: Of the 65 industries, 27 are in manufacturing and 38 in nonmanufacturing.

manufacturing industries.[11] As a result, the industry-based flow measures reported here may understate the magnitude of total flows in nonmanufacturing relative to manufacturing.

Ebb and Flow in the Massachusetts Economy in the 1990s

The dominant feature of Figures 4 and 5, like Figure 1, is the recession at the beginning of the decade. Also evident, however, are two growth slow-downs in Massachusetts, one in 1995 and another that began in 1998 and was still in progress in mid 1999. Each phase of the decade's business cycle has displayed different patterns of job creation and destruction across sectors.

The Recession. What makes the recession stand out in the charts is the steep rise in gross job destruction.[12]

In addition, gross job creation declined over the 1989–91 period. This pattern is generally consistent with past research on manufacturing, which finds that recessions are characterized by sharp jumps in job destruction rates but smaller (and more variable) changes in job creation rates.

Job destruction in manufacturing was pervasive during the deep recession, with very few expanding industries (Figure 4) and hence virtually no job creation (top panel of Figure 5). The three years from December 1988 to December 1991 saw 104,000 manufacturing jobs destroyed, with one industry—computers and office equipment—accounting for 15 percent of that loss.[13] In fact, manufacturers began cutting jobs in Massachusetts in late 1984, but the recession steepened the decline.

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[11] The significant job losses occurring in Massachusetts manufacturing industries have reinforced the initial size differences between the two sectors. Nonmanufacturing industries in Massachusetts averaged employment of 71,800 in 1998, while manufacturing industries averaged 16,600.

[12] The start date of the data makes it impossible to know when the rise began. The monthly employment data begin in January

1988; hence the 12-month-change data begin in January 1989. Total employment in Massachusetts peaked in December 1988, but the flows undoubtedly began shifting before then.
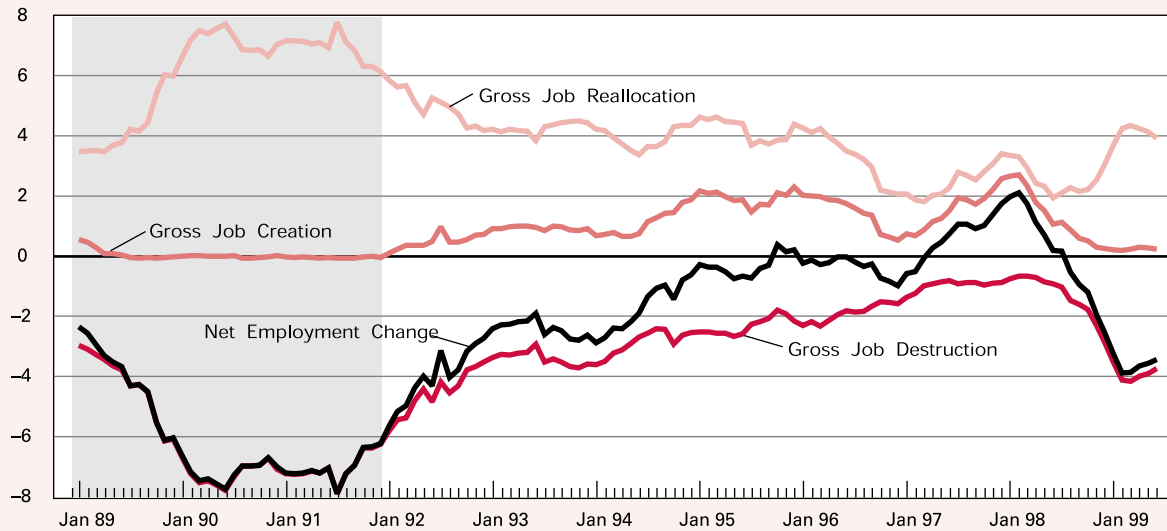
[13] Computers accounted for 9 percent of manufacturing employment in 1988. Six industries comprising two-fifths of manufacturing jobs accounted for over half the gross job destruction in manufacturing during the recession: computers and office equipment, printing and publishing, electronic components and accessories, other fabricated metal products, transportation equipment, and other electrical equipment.

Figure 5

Job Creation and Destruction in Massachusetts, by Sector
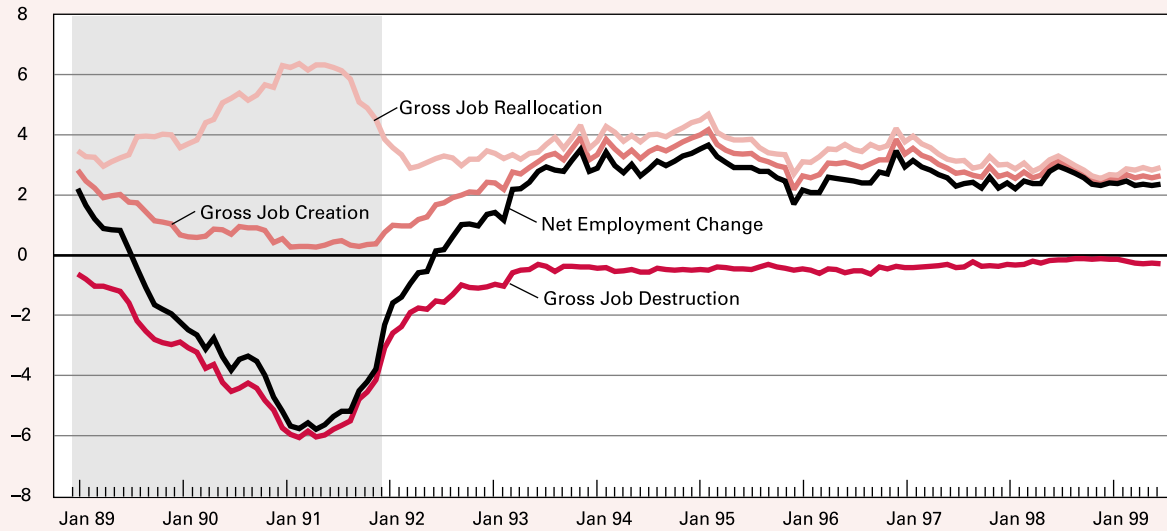### From 12 Months Earlier, Seasonally Adjusted

Manufacturing

Changes as Percent of Employment 12 Months Earlier

Gross Job Reallocation

Gross Job Creation

Net Employment Change

Gross Job Destruction

Nonmanufacturing

Changes as Percent of Employment 12 Months Earlier

Gross Job Reallocation

Gross Job Creation

Net Employment Change

Gross Job Destruction

Note: Shaded area indicates peak to trough in Massachusetts total nonagricultural employment.

The general rise and fall of job creation and destruction in nonmanufacturing is similar to that in manufacturing, except that the central tendency is considerably more positive for nonmanufacturing (lower panel of Figure 5). While nonmanufacturing also displayed a very sharp rise in destruction, several nonmanufacturing industries added jobs even during the worst of the recession, most notably hos-

Table 3
Massachusetts Job Changes by Sector
Changes from previous March to March of year shown
Percent, except where indicated

	Number of Expanding Industries	Number of Contracting Industries	Rate of Gross Job Creation	Rate of Gross Job Destruction	Net Employment Change	Rate of Gross Job Reallocation
Manufacturing Industries:						
1989	6	21	.4	3.2	−2.9	3.6
1990	1	26	.1	7.5	−7.4	7.6
1991	1	26	.0	7.2	−7.2	7.2
1992	5	22	.4	5.3	−4.9	5.7
1993	10	17	1.0	3.2	−2.2	4.3
1994	13	14	.8	3.2	−2.3	4.0
1995	15	12	2.2	2.5	−.3	4.7
1996	9	18	2.0	2.3	−.2	4.3
1997	14	13	.9	.9	.0	1.9
1998	19	8	2.4	.6	1.8	3.0
1999	5	22	.3	4.1	−3.8	4.4
Average	9	18	.9	3.5	−2.6	4.4
Nonmanufacturing Industries:						
1989	25	13	2.2	1.0	1.2	3.3
1990	7	31	.6	3.2	−2.7	3.8
1991	3	35	.3	6.1	−5.8	6.4
1992	11	27	1.0	2.4	−1.4	3.3
1993	19	19	2.2	1.0	1.2	3.2
1994	31	7	3.9	.4	3.4	4.3
1995	28	10	4.2	.5	3.7	4.7
1996	21	17	2.6	.5	2.1	3.1
1997	29	9	3.6	.4	3.2	4.0
1998	31	7	2.5	.3	2.2	2.9
1999	29	9	2.5	.1	2.4	2.7
Average	21	17	2.3	1.5	.8	3.8

pitals and other health services. State government employment in education (state colleges and universities) and the private education industry (private K-12 schools and colleges and universities) also grew intermittently.

Initial Recovery. After the recession, the state's net job losses in manufacturing gradually abated, as the rate of job creation rose and the rate of job destruction declined. By mid decade, about half the state's manufacturing industries were adding jobs and the rate of job creation had risen to 2 percent. Nonetheless, the computer (hardware) industry and manufacturers of communications equipment, instruments other than measuring and control devices, apparel, rubber, and leather were still making sizable job cuts.

In nonmanufacturing, the rate of gross job destruction began to diminish in 1991. By mid 1993,

job destruction in nonmanufacturing had fallen to 0.5 percent, where it remained. Changes in the rate of growth of nonmanufacturing employment since 1993 have reflected changes in the rate of gross job creation.

Growth Slows in 1995 and Comes Back in 1996. In 1995, the Commonwealth's rate of employment growth decreased, peaking at 3.1 percent in February and falling to 1.4 percent by January 1996; U.S. employment growth followed a similar path from a peak of 3.5 percent. In both Massachusetts and the nation, the unemployment rate rose slightly in the first half of 1995, but then continued on a gradual downward path. The Massachusetts slowdown was concentrated almost entirely in nonmanufacturing and represented a decrease in gross job creation (which fell from 4.2 percent in early 1995 to 2.2 percent in early 1996), with very little change in gross job destruction. While a few key nonmanufacturing industries continued to create jobs in Massachusetts—notably business services and the money management industry—net employment growth virtually stalled in construction, wholesale trade, most retail trade industries including eating and drinking places, several financial industries (non-savings depository institutions and insurance), and a few services industries (including social services and engineering and management services).

Soon thereafter (in 1996), nonmanufacturing began picking up, but manufacturing job creation weakened, although job destruction continued to abate. In 1997, the reverse occurred—job creation in manufacturing strengthened noticeably and the Commonwealth began to gain manufacturing jobs solidly for the first time in over a dozen years; the number of expanding manufacturing industries rose to three-

quarters of the total, and the computer industry was finally adding jobs. Meanwhile, job creation in non-manufacturing slowed.

Growth Slows Again. The Asian crisis was brewing; in early 1998, its effects could be seen in Massachusetts manufacturing employment (and indeed in U.S. manufacturing, which also began to experience falling job totals). Exports to Asian markets fell off markedly and, as the top panel of Figure 5 indicates, job creation in manufacturing declined (falling from over 2.5 percent in early 1998 to under 0.5 percent in early 1999) and job destruction rose (from less than 1 percent in early 1998 to more than 4 percent in early 1999). The count of expanding manufacturing industries fell to a low of three in February 1999 (Figure 4). Nonmanufacturing job growth stabilized in 1998 as manufacturing declined.

Using Job Creation and Destruction Data to Understand the 1997–99 Slow Growth Period

The preceding discussion indicates that the genesis and pattern of the 1997–99 slowdown were quite different from those of 1995. Net employment growth in Massachusetts slowed from 2.9 percent in early 1997 to 1.5 percent in the first half of 1999, reflecting an increase in the rate of gross job destruction and a decrease in the rate of gross job creation. The job destruction was concentrated entirely in the manufacturing sector, while job creation slowed in both manufacturing and nonmanufacturing, although to a greater degree in manufacturing. The rate of U.S. job growth also slowed, but it slowed much less and remained more robust, widening the gap with Massachusetts. Unemployment in this slowdown remained on a steady downtrend, despite being very low to start with.

The steep increase in manufacturing's rate of gross job destruction reflects a sizable shift of individual industries from the expanding side of the ledger (where many of them enjoyed only a brief visit in 1997) to the contracting side, while the nonmanufacturing sector saw virtually no change in the numbers of expanding and contracting industries in the 1997–99 period. The nonmanufacturing industries that were expanding were doing so at a somewhat slower pace, however. Examples include several large industries: the business services industry, which was adding jobs at a 9 percent pace in early 1997 and "only" about 4 percent annually in early 1999; the money management industry (nonbank credit institutions and securities firms), down from 11 percent growth in

early 1997 to 7 percent in early 1999; retailers selling autos, furniture, or food and drink; engineering and management services; social services; general building and special trade contractors; and the communications industry.[14]

All told, Massachusetts manufacturing employment shifted from net employment growth of 2 percent in early 1998 to a net employment loss of close to 4 percent in early 1999, while nonmanufacturing showed fairly steady net employment growth of around 2.5 percent after mid-1997. Manufacturing's

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Manufacturing's recent woes are generally attributed to the Asian financial and economic crises and their ramifications for trade. Another factor—extremely tight labor markets—seems consistent with the "symptoms" in the nonmanufacturing sector.

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woes are generally attributed to the Asian financial and economic crises and their ramifications for trade. Another factor—extremely tight labor markets—seems consistent with the "symptoms" in the nonmanufacturing sector.

Examining job creation and destruction separately, rather than simply net employment change, suggests the dynamics that help explain how tight labor markets may have connected manufacturing

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[14] Notwithstanding its recent slowdown, the business services industry accounts for over one-sixth (104,500 jobs) of total nonmanufacturing job creation in the expansion from December 1991 through June 1999. This is attributable partly to its size (it accounts for over one-twelfth of all jobs in the nonmanufacturing sector) and partly to its stellar rate of job creation over most of the expansion. (Business services is an industry comprising diverse elements. It encompasses a number of high-technology industries, including computer programming, data processing, and software development, and also includes personnel supply services (the temporary help industry), advertising, telemarketing, services to buildings, mailing and reproduction services.) Other industries that have created large numbers of jobs in the Commonwealth during the expansion are non-hospital health services (which actually created quite a few jobs during the recession as well), other private services, eating and drinking places, and engineering and management services.

and nonmanufacturing in the 1997–99 period. Non-manufacturing employers in Massachusetts, seeing no slackening in demand (such as manufacturers saw in export markets), did not cut back (destroy jobs). Rather, facing very low unemployment, they may have found themselves unable to recruit all the workers they wanted to hire and therefore created jobs at a slower pace than previously.[15] The timing seems consistent with this tight-labor-market story: The Massachusetts unemployment rate came down to 4.0 percent in the second half of 1996, more than a full percentage point below the national jobless rate. With unemployment low, nonmanufacturing employers would have seen increased competition for new hires in 1997 as manufacturing employers began creating more jobs; hiring difficulties would only have intensified as the unemployment rate declined further at the end of 1997 and throughout 1998.

Magnitude of Flows by Sector: Full Period Summary

The data in Table 3 provide a summary of the differences between the key job flows in manufacturing and nonmanufacturing. For manufacturing, reallocation was dominated by job destruction, leading to net employment declines. The rate of gross job destruction in Massachusetts manufacturing averaged 3.5 percent.[16] For nonmanufacturing, the greatest reallocation also arose from job destruction during the recession, but substantial job creation occurred during the expansion. Furthermore, the nonmanufacturing sector tended to have low rates of destruction when creation was high. Comparing the manufacturing and nonmanufacturing data in Table 3 with the all-industries flows in Table 1 confirms in another way the industry shifts documented in Figure 3. Except in the recession, overall job reallocation primarily reflects creation in nonmanufacturing industries and destruction in manufacturing.

IV. Persistence

The story of Massachusetts' shift in industry composition from manufacturing to services also

Table 4

Persistence of Massachusetts Job Changes

Persistence of creation or destruction from previous March to March one or two years hence
Percent

	One-Year Persistence Rate		Two-Year Persistence Rate	
	Job Creation	Job Destruction	Job Creation	Job Destruction
All Industries:				
1989	62.9	96.1	35.3	96.1
1990	76.0	99.8	61.8	99.6
1991	95.9	92.7	95.9	81.9
1992	93.9	81.3	92.9	64.3
1993	90.7	47.2	87.2	42.5
1994	94.6	75.2	93.0	74.1
1995	94.0	84.9	92.4	77.5
1996	93.7	79.1	92.5	59.7
1997	97.4	62.8	95.7	58.9
1998	87.6	94.1	n.a.	n.a.
Average	87.8	81.3	82.7	72.8
Manufacturing Industries:				
1989	4.7	97.8	1.0	97.8
1990	.0	99.7	.0	99.3
1991	.0	95.2	.0	89.9
1992	75.5	92.0	75.5	88.9
1993	94.6	92.7	90.2	85.7
1994	89.6	85.6	71.9	83.6
1995	73.4	85.6	70.5	83.8
1996	85.2	87.4	75.5	61.0
1997	96.1	52.5	65.5	49.6
1998	19.4	96.2	n.a.	n.a.
Average	61.9	89.3	58.2	83.9
Nonmanufacturing Industries:				
1989	65.0	94.8	36.6	94.8
1990	78.1	99.8	63.6	99.8
1991	97.4	92.1	97.4	79.9
1992	95.5	76.3	94.4	52.8
1993	90.4	18.2	87.0	15.0
1994	94.8	60.1	93.9	60.1
1995	96.0	84.2	94.5	71.8
1996	94.9	72.5	94.9	58.7
1997	97.4	66.9	97.0	62.6
1998	98.4	93.5	n.a.	n.a.
Average	89.2	75.4	83.7	64.8

n.a. = not available.

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[15] Recall that these measurements do not count a job as created until it is filled.

[16] Rates of job destruction for manufacturing in Massachusetts in the 1990s are comparable to those reported by Haltiwanger and Schuh (1999) for U.S. manufacturing industries over the period from 1972 to 1993. See the box for additional comparisons with their results.

plays out in data on the persistence of job creation and destruction. Table 4 reports rates of persistence for job creation and job destruction in the 1990s. One-year or two-year persistence rates indicate the fraction of jobs created (or destroyed) over a 12-month

interval that still existed (or still had not reappeared) in their industries one year or two years later.[17]

The persistence rates for job creation and destruction are quite high, indicating that job additions in expanding industries and job cuts in contracting industries were not soon reversed. Even after two years, more than four out of five new jobs still existed in their

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[17] Two-year persistence refers to jobs that still existed (or had not reappeared) either one or two years later. Thus, for example, if an industry's job total rose by 1,000 between January 1995 and January 1996, the increase would be counted as job creation for January 1996. If the industry lost 200 jobs by January 1997, the one-year job creation persistence rate would be 80 percent. If the industry then lost another 100 jobs by January 1998, the two-year persistence rate would be 70 percent, but if the industry's job total in January 1998 exceeded the January 1997 total (or even the higher January 1996 total), the two-year persistence rate would be 80 percent.

consistency with the cyclical patterns documented by DHS or to secular trends in Massachusetts manufacturing in the 1990s (that differ from what was occurring in the nation's manufacturing sector in the 1970s and 1980s period studied by DHS).

In the context of discussing cyclicality, most earlier analyses of job creation and destruction have noted that job destruction is much more volatile than job creation.[b] These findings have been used to develop and inform macroeconomic models that incorporate sectoral shocks and sectoral shifts. Christopher Foote (1998), however, argues that these previous findings result from their exclusive focus on manufacturing; he reports on plant-level data for nonmanufacturing sectors in Michigan over the 1978–88 period, in which job creation varies more over time than job destruction. Foote explains the difference by noting that "empirically, it appears that sectors that are declining have high variances of job destruction, while growing sectors display high variances of job creation" (p. 810).

In the Massachusetts industry data over the last decade, destruction has been more variable over time than creation for nonmanufacturing as well as for manufacturing, although the difference is less pronounced for nonmanufacturing.[c] This inconsistency with Foote's findings may occur because the extremely severe downturn, when both manufacturing and nonmanufacturing were in steep decline, dominates the action of the entire period. Indeed, using data for the period after 1992 (when Massachusetts' violent swings, both down and up, were over), the variance of job creation is greater than the variance of job destruction in the non-

manufacturing sector, and the reverse remains the case (as Foote also finds) in manufacturing.[d]

Persistence

The persistence rates observed in the Massachusetts data (Table 4) are somewhat lower for job creation and somewhat higher for job destruction than those reported by Haltiwanger and Schuh in their plant-level and industry-level data. Their manufacturing data over the 1972–93 period yield a 68.2 percent between-industry persistence rate for job creation and 82.3 percent average persistence for job destruction. Like the differences in job creation and destruction magnitudes discussed above, these differences probably reflect the fact that Massachusetts lost manufacturing jobs at a faster pace during the 1988–99 period than did the nation over the Haltiwanger and Schuh period; with a steeper downtrend, other things equal, persistence of destruction is stronger and persistence of creation weaker.

While Haltiwanger and Schuh find similar rates of persistence in their plant-level and industry-level data, they note a cyclical difference. They report that between-industry persistence is much more variable over the cycle than total persistence (which is measured with plant-level flows). This presumably reflects a tendency for plants in an industry to be similarly affected by cyclical swings. The Massachusetts persistence data in Figure 6 show some of the cyclical patterns documented by Haltiwanger and Schuh, who report that destruction persistence rises going into recessions and falls shortly before recovery begins; creation persistence falls in recessions and rises sharply at the beginning of the recovery.

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[b]For example, Haltiwanger and Schuh (1999) note that "job destruction is two to three times more variable than job creation" (p. 54).
[c]The ratio of the standard deviation of gross job creation to the standard deviation of gross job destruction is 0.37 for manufacturing and 0.63 for nonmanufacturing.

[d]For the period from 1993 on, the ratio of the standard deviation of gross job creation to the standard deviation of gross job destruction is 0.65 for manufacturing and 2.54 for nonmanufacturing.

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industries, and almost three out of four destroyed jobs had not reappeared.

While recessions are typically thought of as temporary phenomena with their associated job cuts soon reversed, this was not the case for the early 1990s recession in Massachusetts. Indeed, job destruction was especially persistent in the recession. Because the recession lasted quite a while in Massachusetts and

the initial recovery was sluggish, virtually none (under 5 percent) of the jobs destroyed in the 1988–90 period were restored in their industries in the ensuing year or two. Job creation rose only gradually as the recovery began and, as documented earlier, when jobs were eventually created, they tended to be in different industries from those in which destruction was greatest.

When persistence rates are calculated separately for manufacturing and nonmanufacturing, they indicate that the flow that dominates in each sector also has greater persistence in that sector. The middle and lower panels of Table 4 show that the average persistence of job creation in nonmanufacturing is higher than in manufacturing and the reverse is true for persistence of job destruction. Persistence rates for each sector's "dominant" flow are almost identical, however. That is, in manufacturing, eight out of nine jobs that were destroyed did not reappear in their industries within a year, and the figure is the same for persistence of job creation in nonmanufacturing—89 percent of jobs created in nonmanufacturing were still in those industries one year later.[18]

Overall, high persistence rates indicate that changes in industry employment tend to be long-lived. Manufacturing industries typically contracted and nonmanufacturing, except in the worst of the recession, added jobs.

Figure 6 plots one- and two-year persistence rates for the dominant flows in each sector, and the job flows themselves—job destruction in manufacturing and job creation in nonmanufacturing.[19] The solid lines (measured with the left-hand axis) indicate the number of jobs destroyed (or created) in the preceding 12 months and the number of those jobs that had not reappeared (or still existed) in their industries one or two years later. The dotted lines express those job counts as rates (measured on the right-hand axis), with persisting jobs expressed as a percentage of the number of jobs destroyed (or created). The high level of both sets of lines for manufacturing job destruction in the recession shows graphically the story told

above, of large numbers of jobs destroyed in manufacturing, with almost none of them restored in a year or two. Similarly, the very high creation persistence figures for nonmanufacturing show that sector's dominant and steady role in job creation, once the recession was over.

Overall, these high persistence rates indicate that changes in industry employment tend to be long-lived. Aside from severe economywide swings (such as Massachusetts saw in the recession), these industries' fortunes do not fluctuate widely from year to year; each typically either grows or declines. Manufacturing industries typically contracted and nonmanufacturing, except in the worst of the recession, added jobs. Thus, of the 38 nonmanufacturing industries, 17 expanded in six or seven of the completed expansion years of the 1990s, and another 10 added jobs in five of the expansion years.[20]

While generally high persistence rates indicate that most job flows have been long lasting, existing jobs typically last even longer. By definition, existing jobs persist at a rate equal to one minus the rate of gross job destruction. Since gross job destruction in Massachusetts averages about 2 percent (shown in Table 1), the one-year persistence rate for existing jobs averages 98 percent for all industries combined, over 96 percent for manufacturing, and over 98 percent in nonmanufacturing (Table 3).

V. Conclusion

Gross job flows are quite large compared with net employment changes, even when measured among fairly aggregated industries in Massachusetts during the 1990s. An exclusive focus on net employment changes would ignore a substantial fraction of the gross job flows that occurred in Massachusetts between January 1988 and June 1999. Furthermore, knowing whether a slowdown or pickup in economic activity is primarily associated with changes in job creation or job destruction, and in which industries, helps us to understand the sources of the change and to anticipate its direction of spread or likelihood of reversal.

While sharply higher job destruction dominated the flows in the recession, most of the action in the expansion has been in job creation. Year-to-year changes in employment growth have largely reflected

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[18] The two-year persistence rates are also very similar: 83.9 percent for destruction in manufacturing and 83.7 percent for creation in nonmanufacturing.

[19] The persistence rates are rather volatile when the flows are very small; for example, during the recession, job creation was extremely low, so the denominator of the creation persistence rate was quite small—one industry's shift from expanding to contracting could reverse much of the creation that was occurring.

[20] Years ending in December, 1992 through 1998. Two manufacturing industries also expanded in six or seven of the years, and three expanded for five years.

Figure 6

Persistence of Job Flows

Manufacturing Job Destruction

Thousands of Jobs

Persistence Rate (percent)

Two-Year Persistence Rate
(right scale)

One-Year Persistence Rate
(right scale)

Jobs Destroyed

Destroyed Jobs Not
Restored One Year Later

Destroyed Jobs Not
Restored Two Years Later

Nonmanufacturing Job Creation

Thousands of Jobs

Persistence Rate (percent)

One-Year Persistence Rate
(right scale)

Two-Year Persistence Rate
(right scale)

Jobs Created

Jobs Created Persisting
One Year Later

Jobs Created Persisting
Two Years Later

Note: Shaded area indicates peak to trough in Massachusetts total nonagricultural employment.

shifting patterns of job creation, especially in non-manufacturing. Job creation is presumably responsive to supply-side factors (such as tight labor markets) as well as demand increases, while destruction is likely to reflect negative demand shocks (such as the falloff in export demand in 1998).

In addition to aiding our understanding of cyclical fluctuations, these data provide insight into secular

change in Massachusetts. One key fact emerging from the analysis is that manufacturing plays a relatively small, and shrinking, role in economic change in the state. While manufacturing now comprises about one-seventh of all jobs in the Commonwealth, it accounted for only one-fifteenth of job creation in the last 11 years. Even with respect to job destruction, manufacturing's role is smaller than one might expect: Although manufacturing destroyed more jobs than it created throughout the period and nonmanufacturing accounted for all the net job growth, manufacturing still accounted for only about one-third of all job destruction during the 11-year period.

The very high persistence rates measured for both job creation and job destruction further corroborate the secular changes. Most of the jobs that were created in Massachusetts nonmanufacturing industries lasted two or more years. Most of the job destruction that occurred in Massachusetts manufacturing industries also persisted for at least two years.

From a research perspective, it would be useful to expand this analysis to additional states and earlier time periods. Going beyond the previous literature's almost exclusive focus on manufacturing provides analysts a better window on the six of every seven jobs in the economy that are not in manufacturing industries, but this article provides that window for only one state (Massachusetts) and one economic cycle (the 1990s). In addition, future research could combine these job creation and destruction data with information on pay levels by industry to examine the relative quality of newly created and destroyed jobs. Such an analysis would help in assessing the implications of the sizable job flows documented here for the well-being of workers and families.

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Appendix Table 1
List of Massachusetts Industries and 1998 Average Employment
(SIC Codes in Parentheses)

	Employment (000s)	Percent of Total Employment
Total	3176.0	100.0
Mining	1.3	.0
General Building Contractors (15)	24.5	.8
Heavy Construction, Except Building (16)	12.6	.4
Special Trade Contractors (17)	70.6	2.2
Manufacturing Lumber and Wood Products (24, 25)	8.8	.3
Manufacturing Stone, Clay, and Glass Products (32)	8.8	.3
Manufacturing Primary Metal Industries (33)	10.2	.3
Manufacturing Cutlery, Handtools, and Hardware Products (342)	8.4	.3
Manufacturing Other Fabricated Metal Products (341, 343–349)	28.7	.9
Manufacting Metalworking Machinery (354)	8.2	.3
Manufacturing Special Industry Machinery (355)	8.0	.3
Manufacturing Computer and Office Equipment (357)	27.5	.9
Manufacturing Other Industrial Machinery and Equipment (351–353, 356, 358, 359)	21.2	.7
Manufacturing Communications Equipment (366)	14.9	.5
Manufacturing Electronic Components and Accessories (367)	28.1	.9
Manufacturing Other Electrical Equipment (361–365, 369)	19.0	.6
Manufacturing Transportation Equipment (37)	19.5	.6
Manufacturing Measuring and Controlling Devices (382)	23.4	.7
Manufacturing Other Instruments and Related (381, 384–387)	30.3	1.0
Manufacturing Jewelry, Silverware, and Plated Ware Products (391)	4.8	.1
Other Miscellaneous Manufacturing (393–399)	11.4	.4
Manufacturing Food and Kindred Products (20)	21.7	.7
Manufacturing Textile Mill Products (22)	14.1	.4
Manufacturing Apparel and Other Textile Products (23)	13.2	.4
Manufacturing Paper and Allied Products (26)	19.3	.6
Manufacturing Printing and Publishing (27)	49.1	1.5
Manufacturing Chemicals and Allied Products (28)	17.7	.6
Manufacturing Miscellaneous Plastics Products (308)	20.8	.7
Manufacturing Rubber Products (301–306)	6.4	.2
Manufacturing Leather and Leather Products (31)	3.2	.1
Manufacturing Miscellaneous Nondurable Goods (21, 29)	1.7	.1
Transportation (40–42, 44–47)	85.0	2.7
Communications (48)	31.5	1.0
Electric, Gas and Sanitary Services (49)	19.4	.6
Wholesaling Durable Goods (50)	105.5	3.3
Wholesaling Nondurable Goods (51)	69.6	2.2
Retailing Building Materials and Garden Supplies (52)	18.7	.6
Retailing General Merchandise Stores (53)	43.6	1.4
Retailing Food (54)	96.7	3.0
Retailing Automobiles and Related Services (55)	44.7	1.4
Retailing Apparel and Accessory Stores (56)	38.8	1.2
Retailing Furniture, Home Furnishings and Equipment (57)	22.1	.7
Eating & Drinking Places (58)	192.3	6.1
Miscellaneous Retail Establishments (59)	88.8	2.8
Commercial Banks (602)	34.9	1.1
Savings Banks (603)	17.5	.6
Credit Unions and Other Depository Institutions (601, 606–609)	7.4	.2
Nonbank Credit Institutions and Securities Firms (61, 62, 67)	60.5	1.9
Insurance Carriers (63)	46.4	1.5
Insurance Agents, Brokers, and Other Service (64)	20.4	.6
Real Estate (65)	29.8	.9
Business Services (73)	235.4	7.4
Hospitals (806)	131.7	4.1
Health Services Other Than Hospitals (801–805, 807–809)	197.2	6.2
Private Education (82)	133.2	4.2
Private Social Services (83)	82.9	2.6
Engineering and Management Services (87)	122.0	3.8
Other Private Services (70–72, 75–79, 81, 84–86, 88, 89)	231.2	7.3
US Postal Services (43)	26.2	.8
Other Federal Government	28.6	.9
State Hospitals	11.3	.4
State Education	24.1	.8
Other State Government (excluding hospitals and education)	67.4	2.1
Local Education	155.1	4.9
Other Local Government (excluding education)	99.0	3.1

Appendix Table 2

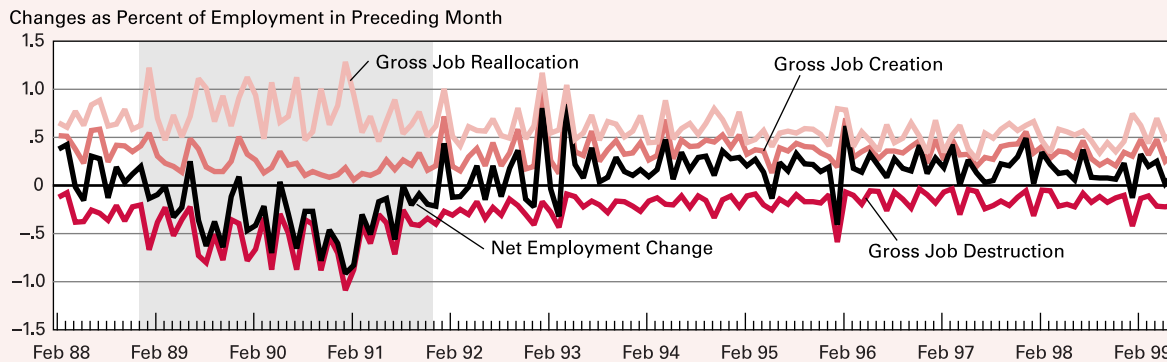## Massachusetts Job Changes from Three Months Earlier
Change from previous December to March of year shown
Percent, except where indicated

	Number of Expanding Industries	Number of Contracting Industries	Rate of Gross Job Creation	Rate of Gross Job Destruction	Net Employment Change	Rate of Gross Job Reallocation
All Industries:						
1989	29	36	.6	.8	−.3	1.4
1990	18	47	.3	1.4	−1.1	1.7
1991	4	61	.0	2.1	−2.1	2.2
1992	31	34	.6	.5	.2	1.1
1993	36	29	.8	.4	.4	1.2
1994	36	29	.7	.3	.4	1.1
1995	41	24	1.0	.3	.7	1.3
1996	32	33	.7	.3	.3	1.0
1997	47	18	1.0	.2	.9	1.2
1998	41	24	.7	.2	.5	.9
1999	31	34	.7	.3	.4	1.0
Average	31	34	.7	.6	.1	1.3
Manufacturing Industries:						
1989	9	18	.3	.8	−.5	1.1
1990	7	20	.1	1.8	−1.7	1.9
1991	1	26	.0	1.7	−1.7	1.7
1992	9	18	.2	.9	−.7	1.2
1993	12	15	.4	.9	−.5	1.4
1994	12	15	.5	.7	−.2	1.1
1995	17	10	.7	.8	.0	1.5
1996	13	14	.3	.8	−.5	1.2
1997	18	9	.7	.2	.4	.9
1998	17	10	.6	.2	.5	.8
1999	9	18	.3	1.1	−.8	1.3
Average	10	17	.4	.9	−.5	1.3
Nonmanufacturing Industries:						
1989	20	18	.6	.8	−.2	1.5
1990	11	27	.3	1.2	−.9	1.6
1991	3	35	.0	2.1	−2.0	2.1
1992	22	16	.7	.3	.4	1.0
1993	24	14	.9	.3	.6	1.1
1994	24	14	.8	.3	.5	1.0
1995	24	14	1.0	.2	.9	1.2
1996	19	19	.7	.2	.5	.9
1997	29	9	1.1	.1	.9	1.2
1998	24	14	.7	.2	.6	.9
1999	22	16	.8	.2	.6	.9
Average	21	17	.7	.5	.2	1.3

Job Creation and Destruction in Massachusetts
From Preceding Month, Seasonally Adjusted
All Industries

Changes as Percent of Employment in Preceding Month

Note: Shaded area indicates peak to trough in Massachusetts total nonagricultural employment.

Appendix: Measures of Change over One and Three Months Compared with Flows from 12 Months Earlier

Measures of job creation and destruction can be calculated on the basis of employment changes over shorter periods than the 12-month intervals on which this article focuses. The 12-month change data seem most relevant because they relate directly to the net employment change measure—percent change from year earlier—typically used in analyzing state economic fluctuations. For readers interested in shorter-term fluctuations, this appendix discusses some of the characteristics of higher frequency (monthly and quarterly) measures. Appendix Figures 1 and 2 display job flows measured from one month earlier and three months earlier, similar to text Figure 1's flows from 12 months earlier. Also included are quarterly versions of text Tables 1 and 3 and Figure 5: Appendix Table 2 reports March observations of job flow rates from three months earlier; the lower panels of Appendix Figure 2 plot rates of job creation and destruction measured from three months earlier separately by sector.

Appendix Figure 1 shows extreme volatility for the measures of changes over a single month. Some of this volatility may be attributable to measurement error in the monthly employment estimates or the seasonal adjustment factors applied to them; more important, many job changes at both plant and industry levels are reversed within a month or several months.[21] The rates shown in Appendix Figure 1 are so volatile that it is difficult to observe any trends other than the deep recession of the early 1990s. Even the rate of net employment change (the measure used most

frequently when these detailed industry data are not available) is volatile at a monthly frequency. Indeed, aside from noting whether total employment rose or fell, analysts typically do not examine month-to-month changes in employment for states or regions.
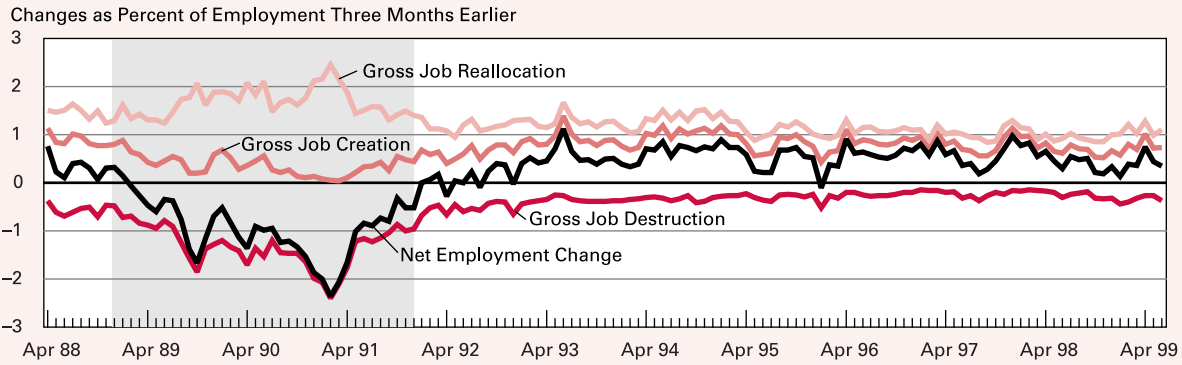
Throughout the period, the series measuring changes from three months earlier—shown in Appendix Figure 2—also move up and down more than those measuring changes from 12 months earlier. (The three-month-change series would be considerably more volatile—and show much higher job flows—if they were not based on seasonally adjusted data.[22]) The volatility of the three-month series compared with the 12-month series presumably reflects the fact that many industry job cutbacks or additions are reversed within a 12-month interval. In addition, however, because they measure changes over a shorter period, the three-month rates are more responsive to short-term fluctuations and reflect any change with less of a lag.

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[21] For example, data published by the U.S. Bureau of Labor Statistics indicate that in 1997 and 1998, only 30 to 45 percent of "mass layoffs" (layoffs of at least 50 persons from a single establishment) lasted more than 30 days. See U.S. BLS news release, "Mass Layoffs in March 1999," USDL 99-141.
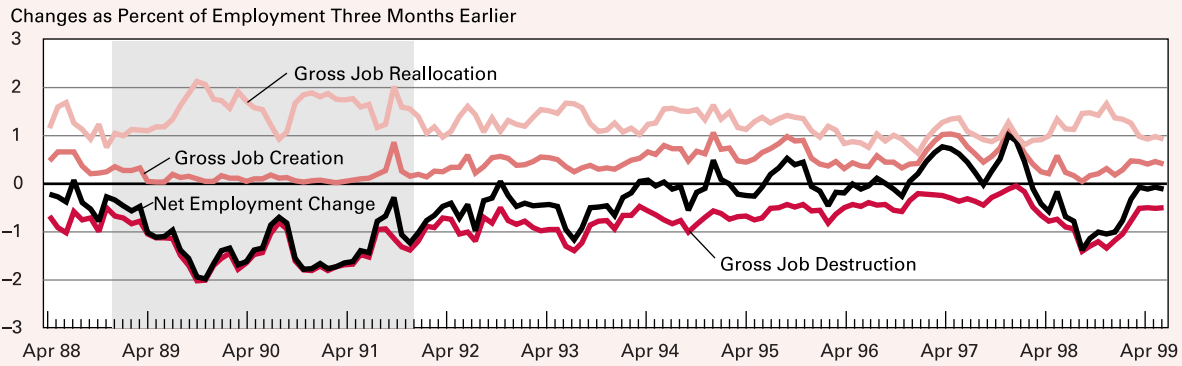
[22] Using unadjusted data, the job creation and destruction measures from three months earlier would include predictable seasonal job additions and cutbacks that are excluded here. For example, retailers typically augment their sales forces in November and December and construction firms reduce employment in the winter months.

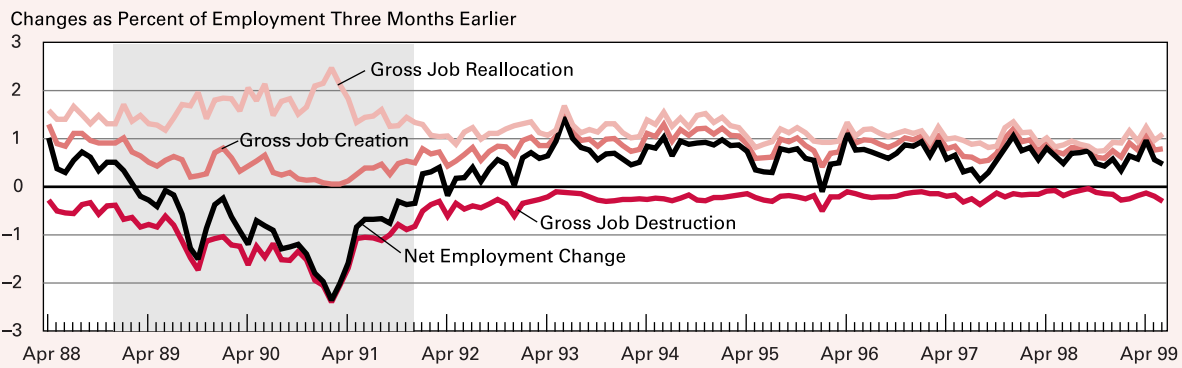## *Job Creation and Destruction in Massachusetts*
From Three Months Earlier, Seasonally Adjusted
All Industries

Changes as Percent of Employment Three Months Earlier

Manufacturing

Changes as Percent of Employment Three Months Earlier

Nonmanufacturing

Changes as Percent of Employment Three Months Earlier

Note: Shaded area indicates peak to trough in Massachusetts total nonagricultural employment.