The Evolution of Regional Manufacturing Employment: Gross Job Flows within and between Firms and Industries

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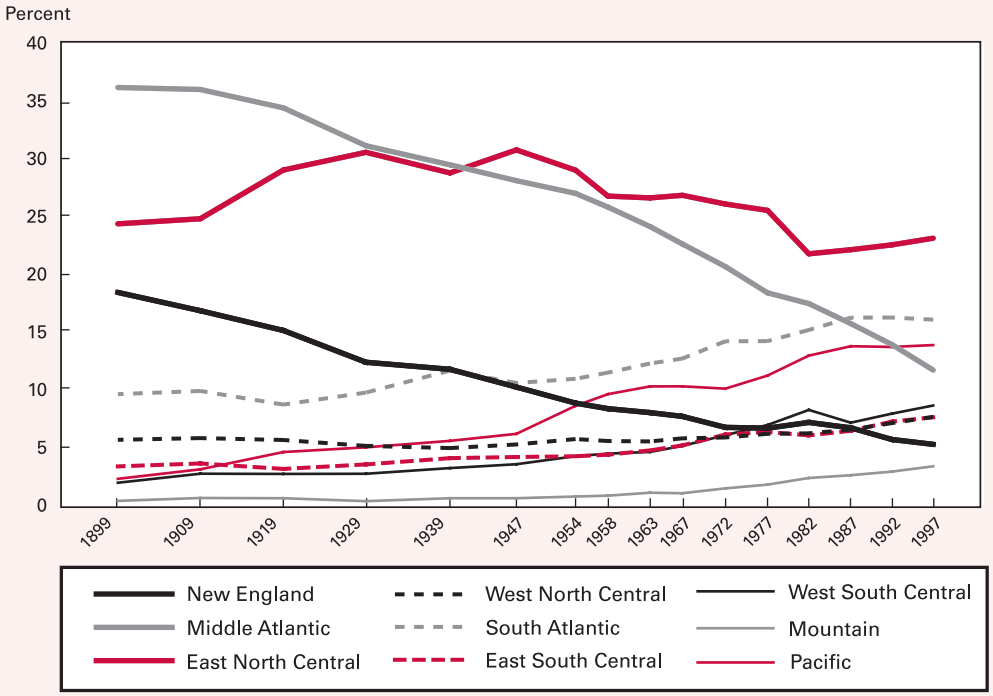
The distribution of manufacturing employment across regions of the United States has changed tremendously over time. Shares of manufacturing employment in older, northern regions of the country have declined markedly relative to shares in the Sunbelt regions.[1] But the shifting of manufacturing employment shares goes beyond the well-known migration of population to the South and West. Manufacturing employment relative to population has also fallen in northern regions, and even the absolute number of manufacturing jobs has declined in these areas as well.

Anecdotal evidence suggests that some of the shift in the distribution of manufacturing employment is due to the movement of particular firms and industries to the Sunbelt in search of lower costs of production and increased proximity to customers. However, other forces driving the shift between regions are also often cited. The fast-growing Sunbelt regions may have benefited from specialization in newer, faster-growing manufacturing industries than those clustered in the North. And the Sunbelt may also have been the preferred location for entrepreneurial manufacturing startups.

This study focuses on two particular questions. First, what is the importance of job shifts within a firm but across regions in explaining regional differences in manufacturing employment growth? Second, to what degree are the varying fortunes of regions due to employment reallocation within industries?

Figure 1

Manufacturing Employment by Census Region, as Share of U.S. Manufacturing Employment



Source: Decennial Census, 1900-1940, and Census of Manufactures General Summary, 1947-1992. Data for 1997 aggregated from preliminary Census of Manufactures Geographic Area Series.

Our investigation measures and examines *gross* job flows (job creation and job destruction). Most studies of the evolution of regional manufacturing employment, like most studies of population migration, focus on the *net* changes in employment between regions. Much less is known, however, about the distribution of gross job flows across geographic regions and how that distribution changes over time. The primary evidence on regional gross job flows comes from Eberts and Montgomery (1994, 1995). Using regionally aggregated data, these studies argue that cross-region variation in employment is more closely associated with job creation than job destruction.[2]

In this article, we reexamine the process of job creation and destruction at the regional level to gain a better understanding of regional employment dynamics. In particular, we use plant-level data from the Longitudinal Research Database (LRD) at the Census Bureau to construct quinquennial gross job flows for the period 1963 to 1992. This sample is notably longer than those in previous studies and yields a clearer view of the secular changes that dominate regional flows. Furthermore, the richness of the plant-level LRD provides the opportunity to disaggregate the data and construct measures that are not available from more aggregated data. Of particular relevance to this study, the LRD allows us to calculate gross job flows that occur across regional boundaries but within the same firm or industry.[3]

Our central finding is that although intrafirm and intra-industry job reallocation between regions makes up relatively small shares of total gross employment flows, these flows account for a substantial portion of the differences in manufacturing employment growth rates across regions. Reflecting the constant churn of plant births, expansions, contractions, and closures, regional gross job flow rates are much larger than are regional rates of net employment growth. So, job real-

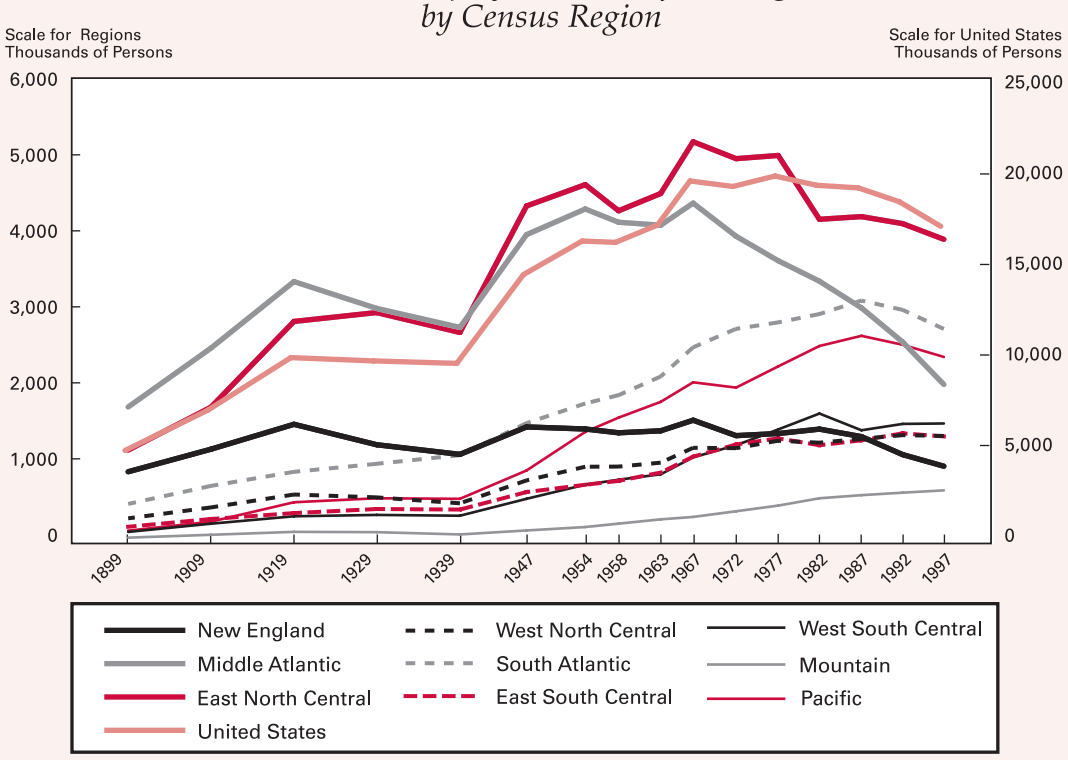
[1] By Sunbelt, we mean the South Atlantic, East South Central, West South Central, Mountain, and Pacific regions.

[2] Davis, Haltiwanger, and Schuh (1996) contains some evidence consistent with this notion as well.

[3] This study follows up on our earlier work (Schuh and Triest 1999, 2000) on intrafirm gross job flows.

Figure 2

Number Employed in Manufacturing, by Census Region



Source: Decennial Census, 1900-1940, and Census of Manufactures General Summary, 1947-1992. Data for 1997 aggregated from preliminary Census of Manufactures Geographic Area Series.

location between regions can be both small relative to total gross flows and large relative to net employment growth. Our results are consistent with anecdotal evidence of firms shifting jobs from older, northern facilities to newer plants in the Sunbelt states. And our results refute the hypothesis that manufacturing employment in the Sunbelt areas has grown faster than in the North because of the Sunbelt's specialization in fast-growing industries.

The paper is organized as follows. First, we provide a historical context for our analysis of regional manufacturing reallocation, with a brief review of trends in regional manufacturing growth over the twentieth century. Section II follows with an exposition of the job-flow concepts that we use in our subsequent analysis, along with a discussion of data and measurement issues. Section III presents our evidence on regional plant-level and firm-level job flows, followed, in Section IV, by our analysis of intrafirm and intra-industry job flows between regions. Section V concludes.

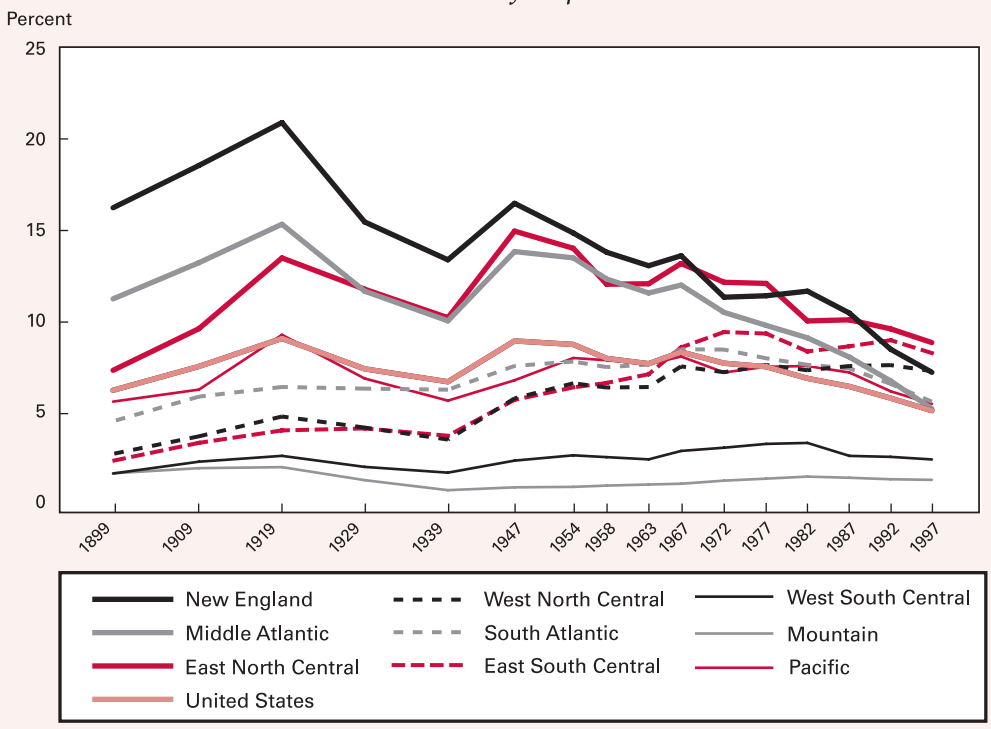
I. Regional Manufacturing Trends in Historical Perspective

Although manufacturing was concentrated in the northeastern part of the United States at the start of the twentieth century, as the century progressed, the distribution of manufacturing activity tended to move south and west. Trends in the distribution of manufacturing across regions of the United States are shown in Figures 1 through 4.[4] Figure 1 shows that throughout the twentieth century there was a steady drop in the share of manufacturing jobs located in New England and in the Middle Atlantic states, while the share of jobs in the southern and western regions of the country grew steadily. In 1899, New England accounted for 19 percent of manufacturing employment, and the

[4] Data for 1899 to 1939 are from the U.S. decennial Census; data for subsequent years are from the Census of Manufactures. The regional definitions we use are the groupings of states into nine Census divisions; these groupings are shown in the box on page 51.

Figure 3

Manufacturing Employment by Census Region, as Share of Population



Source: Decennial Census, 1900-1940, and Census of Manufactures General Summary, 1947-1992.
Data for 1997 aggregated from preliminary Census of Manufactures Geographic Area Series. U.S. Census Bureau.

Middle Atlantic, 36 percent; by 1992, these shares had declined to 6 percent and 12 percent, respectively.

In 1899, New England accounted for 19 percent of manufacturing; by 1992, its share had declined to 6 percent.

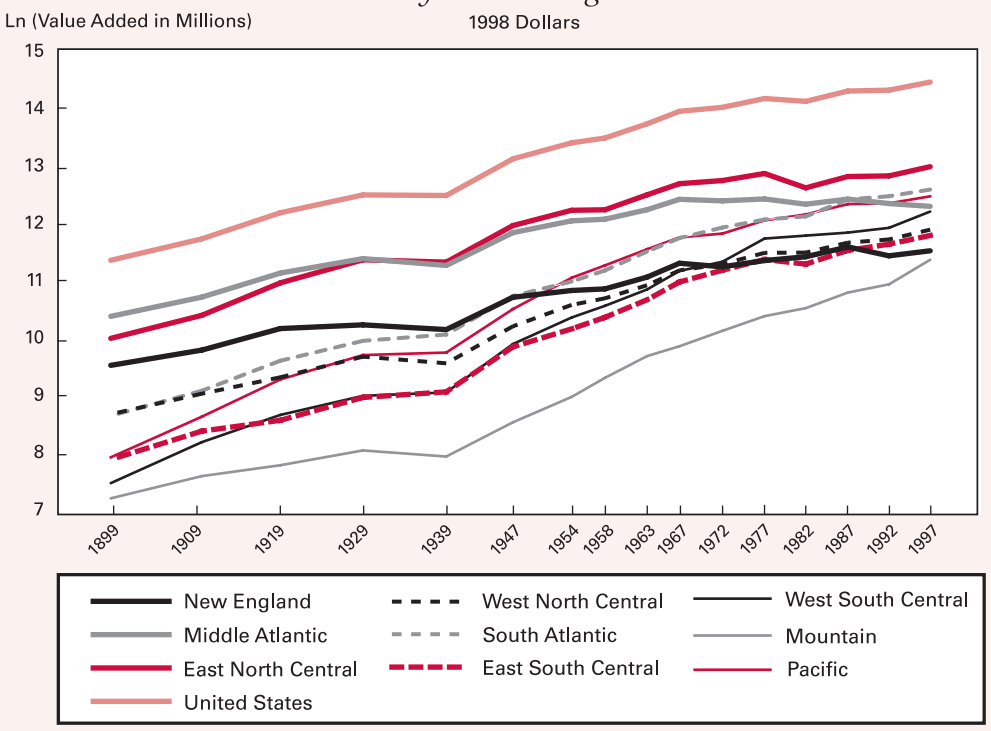
Although this shift in the regional distribution of manufacturing employment partly reflects changes in the distribution of population, changes in the distribution of manufacturing employment occurred at a faster rate than changes in population distribution.

This point is illustrated in Figure 2, which shows that there has been a marked convergence across regions in the number of persons employed in manufacturing. Although national manufacturing employment increased rapidly over much of this century, it has stagnated since the late 1960s. However, the stagnation has not been uniform over regions of the country. Manufacturing employment fell sharply in the Middle Atlantic states, and also decreased in the East North Central and New England regions during the 1967–97 period. In other regions, manufacturing employment increased. New England again stands out for its early decline—its 1967 manufacturing employment just barely eclipsed the previous 1919 peak (and employment of production workers never again reached the level recorded for that year).

At the same time that the population distribution shifted toward the Sunbelt regions, those regions were becoming increasingly industrialized. This point is shown in Figure 3. In New England, in contrast, deindustrialization started relatively early in the century. At the time of the 1920 Census, a much higher share of New England's population was employed in manufac-

Figure 4

Value Added in Manufacturing, by Census Region



Source: Decennial Census, 1900-1940, and Census of Manufactures General Summary, 1947-1992.
Data for 1997 aggregated from preliminary Census of Manufactures Geographic Area Series. GDP deflator:
1899-1929, *Historical Statistics of the United States*, U.S. Census Bureau; 1929-1992, U.S. Bureau of Economic Analysis.

turing than was the case in other regions in the country. But that share decreased rapidly thereafter, and by 1997, it was just barely above the national average.

When one examines trends in value added in manufacturing, shown in Figure 4, the situation is somewhat different. As a result of productivity growth, value added has been stable or has shown only a relatively small drop in regions where manufacturing employment has fallen since 1967. Measured productivity gains were much greater in manufacturing than in services during the slow productivity-growth era starting in the 1970s. So, manufacturing output did not necessarily decline in the regions where employment decreased. However, regions with faster manufacturing employment growth enjoyed greater increases in value added.

The shift of manufacturing activity to the Sunbelt is familiar and well documented. Less well documented, and more controversial, is the question of what factors facilitated this shift. Anecdotes from the early twentieth century indicate that New England textile-mill owners shifted jobs to southern states in order to reduce labor costs, but there has been little research quantifying the importance of this type of phenomenon in the general geographic redistribution of manufacturing activity. In the remainder of this article, we examine the mechanisms underlying the regional shift of manufacturing employment toward the Sunbelt. In particular, we examine the roles of job creation and job destruction, and the extent to which the shifts in employment occurred mainly within firms and within industries.

II. Methodological Issues

Our measurement of gross job flows follows the work of Davis, Haltiwanger, and Schuh (1996), with elements also incorporated from Schuh and Triest (1999). This section gives a heuristic sketch of the measures used and discusses their extension to the analysis of regional flows used in this article; algebra-

ic definitions of the measures are provided in the appendix.

Basic Concepts

Our basic building block for constructing the measures used in this article is the change in employment at individual manufacturing plants over five-year intervals (between economic Censuses). Our measure of gross job creation within a sector is computed by summing all positive values of employment change over plants in the sector. Similarly, our measure of gross job destruction within a sector is computed by summing the absolute value of all negative values of employment change over plants in the sector. We convert these to growth rates by dividing by the average of the beginning and end-of-period values of employment in the sector. For "sectors" we use geographic regions, industries, and companies (although, in principle, a sector could be any characteristic used to assign plants into groups, such as employment size or age).

Three simple functions of the rates of job creation and job destruction are of interest: (1) The *rate of job reallocation* is defined as the sum of the rates of job creation and job destruction, and is a measure of the overall amount of job churning. (2) The *rate of net employment change* is the difference between the rate of job creation and the rate of job destruction. Note that any particular net employment growth can be achieved by a wide variety of magnitudes of gross job creation, destruction, and reallocation. (3) The *rate of excess reallocation* is defined as the rate of job reallocation minus the absolute value of the rate of net employment change. This measures how much job creation and job destruction have occurred above the minimal amount necessary to accomplish the net change in employment.

Data and Measurement

As stated earlier, we use the Longitudinal Research Database (LRD) from the U.S. Census Bureau to construct gross job flows. The LRD includes information from the Census of Manufactures, which is conducted every five years in years ending in "2" or "7" (except for 1963) and covers the universe of all plants and firms. The basic sampling unit is a plant, but information is included that accurately identifies both plants and their parent firms in each year. (Data from the Annual Survey of Manufactures, an annual probability sample of plants, are also included in the LRD, but we do not use these data in this study.)

We construct quinquennial gross job flows for two main reasons.[5] First, regional movements typically are driven primarily by long-run factors, and quinquennial flows are more appropriate than annual or quarterly job flows for long-run analysis. Second, we investigate the role of firm-level factors on regional flows and thus must have firm-level measures of gross job flows. Such measures can be constructed only on a quinquennial basis because complete information on all of the manufacturing plants owned by a given firm is generally available only in the Census of Manufactures, conducted every five years. The primary drawback to analyzing quinquennial flows, instead of annual or quarterly flows, is that the lower frequency measures are less suitable for studying issues related to changes in labor markets over the business cycle.

Regional Gross Job Flow Issues

To what degree is the redistribution of manufacturing employment across regions due to cross-region job reallocation within firms or industries? To find out, we extend the existing measures of job flows. We define a region's *complementary gross job creation* within a sector as job creation within the sector summed over all other regions (the complement of the region in question). *Complementary gross job destruction* is defined analogously.

When a firm is designated as the sector, a region's complementary creation is the gross job creation occurring at all plants owned by the firm in other regions. Thus, it represents the maximum amount of job destruction that potentially could have been avoided in the region if the firm had maintained employment in its plants in the region rather than expanding employment in other regions. Our estimate of the gross job destruction in a region that is attributable to job flows within firms is computed by summing, over all firms operating in the region, the lesser of each firm's job destruction and the firm's complementary job creation. Similarly, we estimate the gross job creation in a region that is attributable to job flows within firms by summing, over all firms operating in the region, the lesser of each firm's job creation in the region and the firm's complementary job destruction.

Table 1 illustrates how the job-flow measures would be constructed for a hypothetical firm that operates five plants in three regions (the New England, Mountain, and Pacific regions). Between

[5] Dunne, Roberts, and Samuelson (1989) also construct and analyze quinquennial gross job flows.

Table 1
Gross Job-Flow Calculations for a Hypothetical Firm

Region		Employment			Gross Job Flows		Complementary Gross Job Flows		Within-Firm Job Flows between Regions	
		1967	1972	Net Change	Creation	Destruction	Creation	Destruction	Creation	Destruction
New England										
	Plant 1	700	0	–700	0	700				
	Plant 2	100	200	+100	100	0				
	Total within Region	800	200	–600	100	700	300	50	50	300
Mountain										
	Plant 3	0	200	+200	200	0				
	Plant 4	400	350	–50	0	50				
	Total within Region	400	550	+150	200	50	200	700	200	100
Pacific										
	Plant 5	400	500	+100	100	0				
	Total within Region	400	500	+100	100	0	300	750	100	0
Total		1600	1200	–400	400	800			400	400

Source: Authors' calculations.

1967 and 1972, the firm closed a plant in New England (plant 1), opened a new plant in the Mountain region (plant 3), increased employment at existing plants in New England (plant 2) and the Pacific region (plant 5), and reduced employment at an existing plant in the Mountain region (plant 4). Each plant that increased employment generated job creation, but not destruction. Conversely, each plant that decreased employment generated job destruction, but not creation. Taking New England as an example, its value of complementary gross job creation (300) is found by summing the values of gross job creation for the other two regions (100 + 200). New England's job destruction potentially attributable to job reallocation within the firm but across regions (300) is the lesser of its gross job destruction (700) and its complementary job creation (300). Similarly, New England's complementary gross job destruction (50) is equal to the sum of gross job destruction in the other two regions (50 + 0). New England's job creation potentially attributable to job reallocation between regions (50) is the lesser of its gross job creation (100) and its complementary gross job destruction (50).

Measures for regional job flows within 3-digit SIC industries are constructed analogously. We use 3-digit industries because 4-digit industries are too detailed to generate sufficient within-industry gross flows and because plants' primary operations are likely to shift frequently among such highly detailed industrial classes.

It is important to note that these within-sector estimates of regional gross job flows are clearly upper bounds. Some of the complementary gross job creation and destruction could be attributable to gross job destruction or creation, respectively, in regions other than the one in question.[6] Nevertheless, these measures provide a sensible starting point for quantifying the effects of corporate restructuring and industry shifts on regional job flows.

III. Evidence on Regional Gross Job Flows

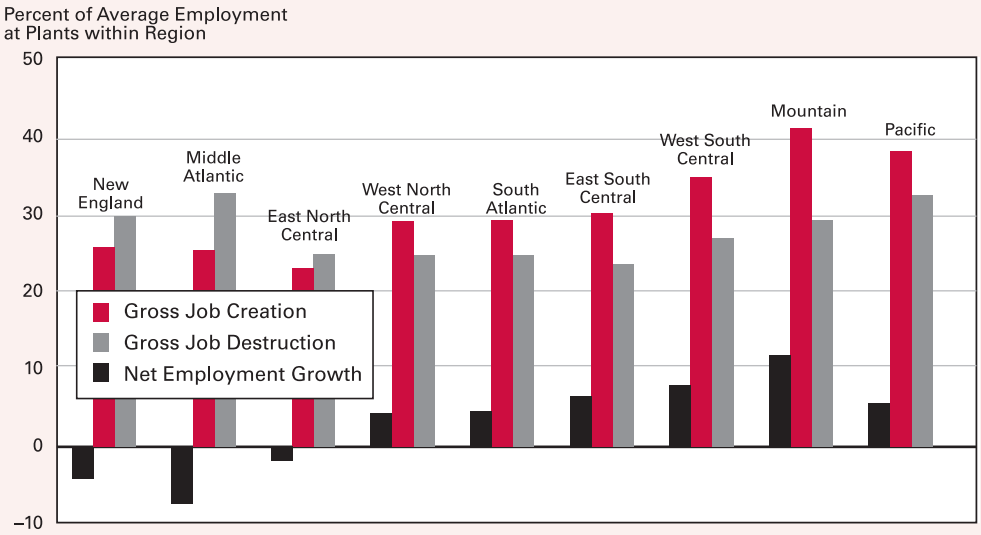
Quinquennial rates of job creation, job destruction, and net employment growth averaged over the 1963–92 period are shown by Census region in Figure 5; the top panel of Table 2 provides the numbers underlying this figure.[7] The regional pattern of net employment flows reflects the well-known southward and westward migration of jobs (and population) in the United States over this time.

[6] Lower-bound estimates of regional job flows attributable to within-firm or within-industry flows could be obtained from similar measures using complementary *net* job flows, rather than *gross* job flows, in all other regions. Given that gross job flows are much larger than net flows, we suspect the upper-bound estimate is likely to be more accurate.

Figure 5

Gross Job Flows and Net Employment Growth, by Census Region, 1963 to 1992

Five-Year Average Growth Rates



Note: The base for computing these growth rates is the average of beginning and end-of-period values for total employment at plants within each region. See text.
Source: Authors' calculations using the Longitudinal Research Database.

Indeed, manufacturing employment declined in the three easternmost regions while increasing in other regions, with notably large increases in the westernmost regions.

The magnitudes of the net employment growth rates are swamped by remarkably large gross job flows. Each region's job-reallocation rate is at least five and often ten times larger than its net employment growth rate. In New England, for example, manufacturing employment declined by an average of 4 percent in every five-year period. But this masks the fact that on average every five years 29 percent of jobs in New England manufacturing plants were destroyed, and 25 percent of jobs were newly created. The same net employment change could have been accomplished with a 4 percent job-destruction rate and no job creation. The high rate of job creation is somewhat contrary to the popular perception of a stagnant or slowly declining manufacturing base. Although, on net, New England did lose manufacturing jobs, most of the jobs lost as a result of plants closing or scaling back were offset by jobs created at new or expanding plants.

New England and the Middle Atlantic region had higher-than-average job-destruction rates and declining manufacturing employment, but perhaps the most striking difference across all regions was in the rates of job creation. The three northeastern regions had the lowest rates of job creation, while the fast-growing western regions experienced extraordinarily high rates of job creation. The Pacific region, for example, had an average quinquennial job-creation rate of 38 percent. The fact that the variation across regions is much larger for job creation than for job destruction has previously been emphasized by Eberts and Montgomery (1994, 1995) and also documented by Davis, Haltiwanger, and Schuh (1996). Table 2 shows that job

[7] The top panel of this table is analogous to Table 3.3 in Davis, Haltiwanger, and Schuh (1996) except that it covers a longer sample period and the rates are quinquennial rather than annual. The quinquennial rates are much less than five times the annual rates for the same reason that the annual rates are much less than four times the quarterly rates. That is, much of the higher frequency gross job flows are ultimately transitory and do not appear at lower frequencies. Whereas the quarterly data contain significant transitory seasonal flows, the annual data contain significant transitory flows attributable to business cycles and other medium-term fluctuations.

Table 2

Net Employment Growth and Gross Job Flows by Census Region, 1963 to 1992

	Average Net Employment Growth Rate	Average Gross Job Flow Rates				Share of Gross Job Flows due to Between-Firm Flows[a]			
		Job Creation	Job Destruction	Job Reallocation	Excess Job Reallocation	Job Creation	Job Destruction	Job Reallocation	Excess Job Reallocation
All Plants									
New England	–4.0	25.4	29.4	54.8	46.0	82	84	83	91
Middle Atlantic	–7.3	25.0	32.3	57.3	47.2	82	86	85	87
East North Central	–1.8	22.7	24.5	47.2	39.7	76	78	77	87
West North Central	4.3	28.7	24.4	53.1	47.1	84	81	82	84
South Atlantic	4.5	28.9	24.4	53.3	47.0	80	77	78	80
East South Central	6.5	29.7	23.2	52.9	43.7	84	79	82	84
West South Central	7.8	34.4	26.6	61.0	48.2	86	82	84	91
Mountain	11.7	40.6	28.9	69.6	57.8	89	85	88	85
Pacific	5.5	37.7	32.1	69.8	61.4	84	81	82	85
Standard Deviation	*6.1*	*6.0*	*3.5*	*7.8*	*6.8*				
Single-Unit Plants *(firm has only one plant)*									
New England	3.0	36.9	33.9	70.7	62.6	100	100	100	108
Middle Atlantic	–3.5	36.6	40.1	76.7	72.6	100	100	100	101
East North Central	9.3	38.8	29.5	68.4	57.7	100	100	100	102
West North Central	12.5	43.5	31.0	74.5	62.1	100	100	100	100
South Atlantic	10.1	44.7	34.6	79.3	69.2	100	100	100	100
East South Central	13.7	46.8	33.2	80.0	66.3	100	100	100	100
West South Central	14.4	52.0	37.7	89.7	72.2	100	100	100	104
Mountain	20.6	59.0	38.5	97.5	76.9	100	100	100	100
Pacific	16.7	55.2	38.5	93.7	77.0	100	100	100	100
Standard Deviation	*7.3*	*8.1*	*3.7*	*10.2*	*6.8*				
Multi-Unit Plants *(firm has more than one plant)*									
New England	–7.0	20.5	27.5	48.0	36.9	68	76	73	75
Middle Atlantic	–9.3	18.9	28.3	47.2	34.1	65	76	72	72
East North Central	–4.9	18.2	23.1	41.3	31.1	62	70	66	72
West North Central	1.8	24.2	22.4	46.6	40.8	75	73	74	80
South Atlantic	2.8	24.3	21.4	45.7	39.5	69	65	68	71
East South Central	4.6	25.2	20.6	45.8	36.8	76	70	73	79
West South Central	5.7	28.7	23.0	51.7	40.4	78	73	76	83
Mountain	8.2	33.3	25.1	58.4	48.1	82	76	79	79
Pacific	.4	29.5	29.2	58.7	50.2	70	69	69	80
Standard Deviation	*6.0*	*5.1*	*3.1*	*5.9*	*6.2*				

[a]Includes within-firm flows to another region.

Note: Net employment growth rates and gross job flow rates are quinquennial. All numbers are in percent.

Source: Authors' calculations using the Longitudinal Research Database.

creation varies 71 percent more than job destruction across regions, measured by standard deviations.[8] One should note, however, that the high cross-sectional variance of creation is largely due to the fast-growing western regions (West South Central, Mountain, and Pacific). Outside of these regions, creation and destruction rates have similar cross-sectional variances; the regions with declining manufacturing

[8] This number is up from 50 percent in Table 3.3 of Davis, Haltiwanger, and Schuh (1996), possibly because manufacturing employment grew 13 percent from 1963 to 1967. Table 3 also shows greater variation across regions in job flow rates than found by Davis, Haltiwanger, and Schuh (1996). This is likely a result of the longer sample period and the use of quinquennial rather than annual job flow rates.

employment experienced relatively low creation rates and high destruction rates, and the regions with positive employment growth experienced the opposite pattern. Note that even in the two most rapidly declining regions, New England and the Middle Atlantic, plants *created* jobs at a rate of about 25 percent over five-year intervals. Furthermore, note that in the fastest growing region, Mountain, plants *destroyed* jobs at about the same rate (29 percent) as in New England.

Even in the two most rapidly declining regions, plants created jobs at a rate of about 25 percent over five-year intervals.

Figure 6 shows the pattern over time of job creation, job destruction, and net employment growth for each region. Corroborating a finding of Eberts and Montgomery (1995), the figure shows that although variation across regions in job-creation rates exceeds the variation across regions in rates of job destruction, regional job-destruction rates vary more over time than do rates of job creation. For example, New England's long-term loss of manufacturing employment is due mainly to a lower-than-average long-term rate of job creation rather than to a higher-than-average long-term rate of job destruction, but the timing of its net job losses coincides with increases in its job-destruction rate, with job creation relatively steady. This pattern is hard to interpret, and theoretical models have not yet been developed to explain it. It is broadly consistent with the view that the location of new investment and job creation is determined by relatively long-run profitability criteria, while the timing of when to shut down a plant and destroy jobs may be heavily influenced by cyclical factors.

Single-Unit and Multi-Unit Plants

Roughly 70 percent of manufacturing employment is in plants owned by firms operating multiple plants, and nearly half of manufacturing employment is in firms that operate more than 10 plants. Given the importance of multi-plant firms, their role in the changing regional patterns of manufacturing employment warrants attention. We first compare job flow rates between single-plant firms and multi-plant firms for each region; we then evaluate the proportion of job flows for each region that are due to firms reallocating jobs between plants they own in the same region. Our main finding here is that no more than one-third of the job flows are the result of firms reallocating jobs within regions, implying that gross job flows between regions and between firms have a significant impact on local labor markets.

Striking differences in the behavior of net and gross job flows between single-unit plants (plants that are the only plant owned by a firm) and multi-unit plants (plants owned by firms that own more than one plant) are revealed in Table 2. Net employment growth rates were considerably higher for single-plant firms than for multi-plant firms in all nine Census divisions. In fact, two of the regions in which overall manufacturing employment declined, New England and East North Central, experienced positive employment growth in single-plant firms. Overall, there appears to be a pronounced shift toward employment in single-plant firms in all areas of the country.

Gross job flows are much larger among single-unit plants than among multi-unit plants in all regions. Plants owned by single-plant firms tend to be smaller and younger than those owned by multi-plant firms, and both of these factors are associated with substantially higher rates of job creation and job destruction.[9] Excess reallocation rates in single-unit plants are typically at least 50 percent larger than those in multi-unit plants. In particular, the cross-region variability of job creation relative to job destruction is much greater among single-unit plants. Thus while job creation appears to be the relatively more important margin on which all plants make regional net employment adjustments, this margin is particularly important for single-plant firms. However, the overall cross-regional patterns of gross job flows are broadly similar for single-unit and multi-unit plants. And because multi-unit plants account for roughly 70 percent of manufacturing employment, the magnitudes and cross-regional patterns of net employment growth in multi-unit plants are quite similar to those of all plants.

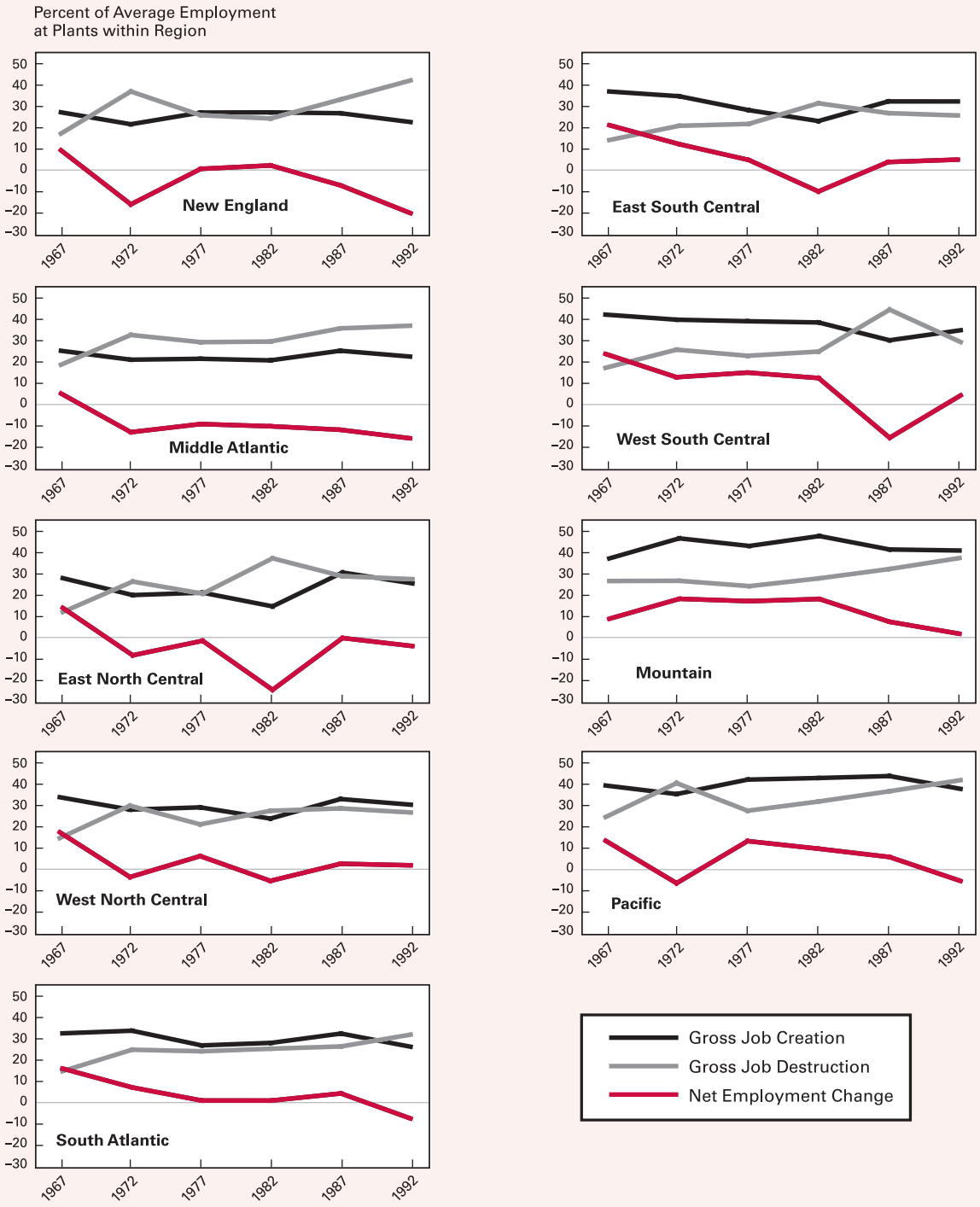
Table 2 also reveals information about the shares of total gross job flows accounted for by flows between firms. For a typical region, more than four-fifths of total gross job flows occur between firms, and this share does not vary much across regions. Of course, part of the reason this share is so large is that 100 per-

[9] See Davis, Haltiwanger, and Schuh (1996) for an analysis of the relationship between plant employment size, plant age, and job flow rates. Schuh and Triest (2000) provide an exposition of the characteristics of plants owned by single-plant and multi-plant firms.

Figure 6

Gross Job Flows and Net Employment Change, by Census Region

Five-Year Periods, 1963 to 1992



Note: Years are for the end of each five-year period. The base for computing these growth rates is the average of beginning and end-of-period values for total employment at plants within the region.
Source: Authors' calculations using the Longitudinal Research Database.

Table 3
Interregional Job Flows Occurring within Multi-Plant Firms, 1963 to 1992
Within-firm portion of interregional job flows of multi-plant firms

Region	Job Creation	Job Destruction	Job Reallocation	Excess Job Reallocation
New England	18	24	22	20
Middle Atlantic	12	20	17	13
East North Central	11	17	14	12
West North Central	22	22	22	24
South Atlantic	21	12	17	14
East South Central	31	21	26	23
West South Central	28	17	23	20
Mountain	30	25	28	26
Pacific	15	16	16	18
Average	21	20	20	19
Standard Deviation	7	4	5	5

Source: Authors' calculations using the Longitudinal Research Database.

cent of the flows between single-unit plants are, by definition, flows between firms.[10] However, even among multi-unit plants, two-thirds or more of all gross job flows occur between firms. Thus, at most, one-third of all job flows may occur as a result of firms reallocating jobs between plants they operate in the same region.

The regional between-firm job-flow shares in Table 2 are well above the national between-firm shares reported in earlier work (Schuh and Triest 1999, 2000) using the same data and time period. For example, the earlier work found that the national between-firm share of job reallocation by plants owned by multi-plant firms is 58 percent.[11] The corresponding within-region shares, which range from 66 percent (East North Central) to 79 percent (Mountain), are higher because they treat reallocation that occurs between a firm's plants located in different regions as a between-firm reallocation.

The fact that only a relatively small percentage of job flows are between plants owned by the same firm within a region has important bearing on our understanding of the driving forces behind employment changes and their impact on local labor markets. Even if workers are relatively mobile within Census regions—a strong assumption given the size of some regions—gross job flows have a significant impact on local labor markets. It is *not* the case that extraordinarily high rates of plant-level gross job flows are simply the result of firms shifting workers across plants within the firm (and region). Instead, most workers must change firms, as well as plants, when plants reallocate jobs. If there is significant plant-specific and firm-specific human capital associated with worker/job matches, these gross job flows entail significant disinvestment in human capital that is likely to be associated with significant declines in real wages for affected workers.

The discussion in this section of within-firm job flows pertains to job flows within, rather than between, geographic regions. Of greater interest in understanding the changing geographic distribution of manufacturing employment is the magnitude of interregional job flows within firms. We turn to analysis of this phenomenon in the next section.

IV. Interregional Job Flows within Firms and Industries

Job Flows within Firms

Table 3 shows the proportions of interregional job flows of multi-plant firms that are within-firm flows; the contribution of within-firm flows to net employment change is shown in Figure 7. In this exercise, we restrict our analysis to plants owned by multi-plant firms, because these are the only plants that have the potential of generating within-firm job flows. On average, gross job flows within firms account for about one-fifth of all multi-plant job flows in a region, but the percentage varies widely across regions. The cross-region variation is greater for job creation than job destruction. Only 11 percent of multi-plant job creation in the East North Central is due to firms shifting jobs into the region, whereas nearly one-third of multi-plant job creation in the East South Central and Mountain regions is due to firms shifting jobs into the region.[12] The percentage of multi-plant job destruction

[10] A few of the excess reallocation shares do not round to 100 percent for technical reasons. Excess reallocation is a nonlinear function of reallocation and net, and aggregation of these nonlinear functions can violate the share boundaries.

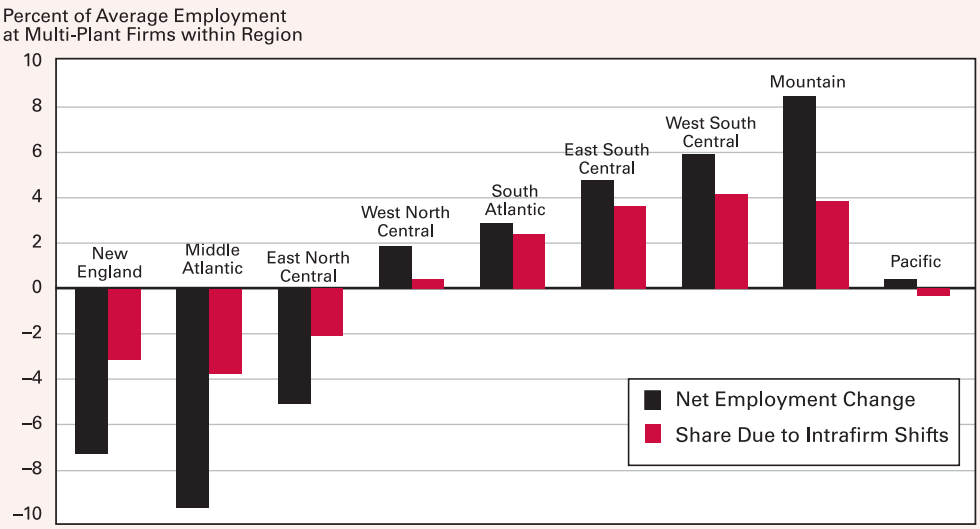
[11] Schuh and Triest (2000), p. 39, Table 3.

[12] By intrafirm job shifts, we mean job reallocation within the firm. It is not necessarily the case that particular jobs are shifted from one of the firm's plants to another. It might instead be the case that the firm destroys a job at one location, and creates a different type of job at another location.

Figure 7

Net Employment Change of Multi-Plant Firms, by Census Region, 1963 to 1992

Five-Year Average Growth Rates



Note: The base for computing these growth rates is the average of beginning and end-of-period values for total employment at multi-plant firms within each region. See text.
Source: Authors' calculations using the Longitudinal Research Database.

caused by intrafirm shifts also varies significantly, from 12 percent in the South Atlantic to 25 percent in the Mountain region. For excess reallocation, the intrafirm share of total multi-plant job flows varies from 12 percent to 26 percent.

Although the share of total job flows attributable to reallocation within firms and between regions is relatively small, it accounts for a large fraction of total net employment growth at multi-plant firms. In most regions, the intrafirm component accounts for one-third to one-half or more of the net growth. Furthermore, the pattern of net growth across regions is broadly similar to that of the intrafirm component.

Much of the job destruction by multi-plant firms in the Rustbelt is associated with firms destroying jobs in the Northeast and creating new jobs in the Sunbelt states.[13] (Much of the job creation by multi-plant firms in the Sunbelt is associated with firms destroying jobs in the Rustbelt and increasing employment in the Sunbelt states). It is important to note that we are able to measure only domestic job reallocation within firms. A firm that shifts jobs from a U.S. plant to a foreign facility would appear in our data as destroying jobs without offsetting job creation in another region. Similarly, the outsourcing of some of a firm's production to a facility located in another region would also not be identified by us as an intrafirm reallocation across regions. Overall, our analysis strongly supports the conclusion that the decline of manufacturing in the Northeast was not due solely to firms based in the Northeast dying or stagnating. A substantial part of the decline was the result of firms operating in the Northeast shifting the location of their production.

Job Flows within Industries

Results of a similar analysis of the role of between-region job flows within 3-digit SIC industries are shown in Table 4 and Figure 8. (Note that in this case the growth rates are for all plants rather than just

[13] By Rustbelt, we mean New England, the Middle Atlantic, and the East North Central regions.

plants owned by multi-plant firms.)[14] The shares of between-region gross job flows accounted for by job reallocation within detailed industries range from 9 percent to 14 percent, on average. These percentages are smaller than those for interregional flows within firms. Interestingly, however, the cross-region variation in these shares is actually greater and more systematic than the cross-region variation in the within-firm shares. Interregional job flows within industries accounted for a much higher share of job creation in western regions (nearly one-fourth) but a much higher share of job destruction in eastern regions.

Table 4
Interregional Job Flows Occurring within 3-Digit Industries, 1963 to 1992
Within-industry portion of interregional job flows of 3-digit industries

Region	Job Creation	Job Destruction	Job Reallocation	Excess Job Reallocation
New England	8	22	15	9
Middle Atlantic	2	17	11	2
East North Central	5	13	9	6
West North Central	15	12	14	13
South Atlantic	14	7	11	7
East South Central	22	11	17	12
West South Central	23	9	17	10
Mountain	26	11	20	11
Pacific	12	7	10	7
Average	14	12	14	9
Standard Deviation	8	5	4	3

Source: Authors' calculations using the Longitudinal Research Database.

As with job flows within firms, job flows within detailed industries account for a significant fraction of the net employment growth in a region. In fact, they typically account for even more than do flows within firms. Part of the reason for this result is that some multi-plant firms operate in only one region, reducing the flow of jobs between regions within firms, while every 3-digit industry operates in all regions.

One common conclusion to draw from Tables 4 and 5 and Figures 7 and 8 is that job flows within firms and within industries are more important for explaining net employment change than for explaining gross job flows. For both firms and industries, the within-sector contribution of regional job flows composes a relatively small portion of gross job flows but accounts for a relatively large fraction of net employment growth. In some cases, the within-sector flows account for essentially all net employment growth. Put another way, net employment growth in a region is primarily determined by the movement of jobs by firms and industries across regions.

Job flows within firms and within industries are more important for explaining net employment change than for explaining gross job flows.

Job Flows Simulated with National Industry Growth Rates

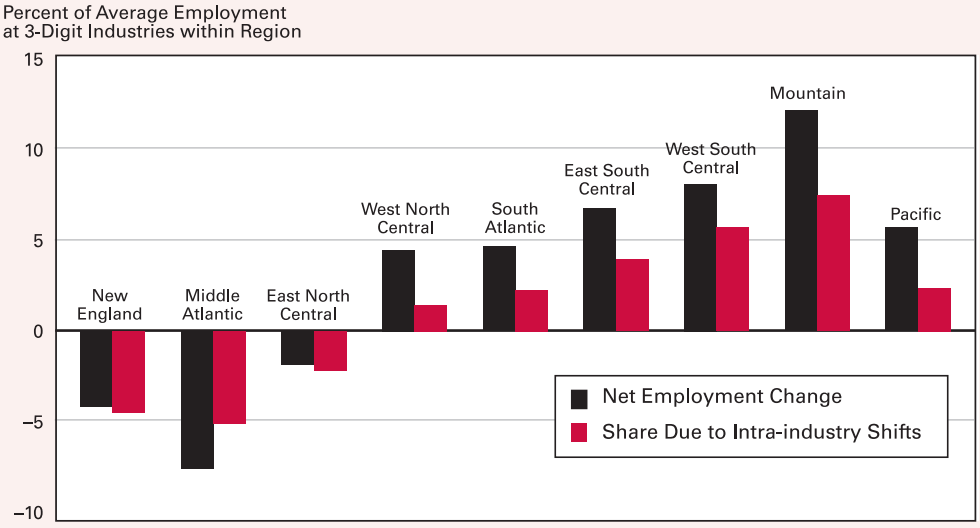
An alternative method of quantifying the effects of industry shifts on regional job flows is to compare the average quinquennial manufacturing employment growth rates of each region with what the rates would have been if each 3-digit industry within each region had experienced job creation and destruction at the national rates for the industry. This exercise answers the question of whether differences in industrial composition across regions can account for the observed patterns of net and gross job flows. To do this, using the methodology of shift-share analysis, we simulated total gross job flows in each region by setting the net and gross job flow rates of each plant in a region equal to the U.S. net and gross job flow rates of its 3-digit industry. This restriction isolates the effect of industrial mix on regions' gross job flows and net employment change. For example, if the popular (and simplistic) notion of massive employment shifts out of heavy industry in the Rustbelt into newer manufacturing industry in the Sunbelt is true, then the exercise should reveal that simulated net job flows explain the cross-section pattern of actual net flows.

[14] Because the plants owned by a firm may be classified in different 3-digit SIC industries, within-firm reallocation is not necessarily also within-industry reallocation.

Figure 8

Net Employment Change of 3-Digit Industries, by Census Region, 1963 to 1992

Five-Year Average Growth Rates



Note: The base for computing these growth rates is the average of beginning and end-of-period values for total employment at 3-digit industries within each region. See text.
Source: Authors' calculations using the Longitudinal Research Database.

Table 5 shows the size of regions' simulated gross job flows relative to the actual flows, and Figure 9 compares the simulated net employment growth for each region with the growth that actually occurred. The striking result is that the simulated net employment growth rates are quite similar across regions and hardly explain the observed cross-region variation in actual net employment growth. Relative to the actual gross job flows, the simulated job flows are often quite different. For example, Table 5 shows that job creation would have been 19 percent higher in the East North Central region and 26 percent lower in the Mountain region, with similar differences arising among regional job-destruction rates. Figure 9 shows that manufacturing employment in New England and the Middle Atlantic and East North Central regions would have grown, rather than decreased, if each industry's employment had grown at the national

Table 5

Simulated Interregional Job Flows Occurring within Industries, 1963 to 1992

Simulated flows as a percent of actual flows

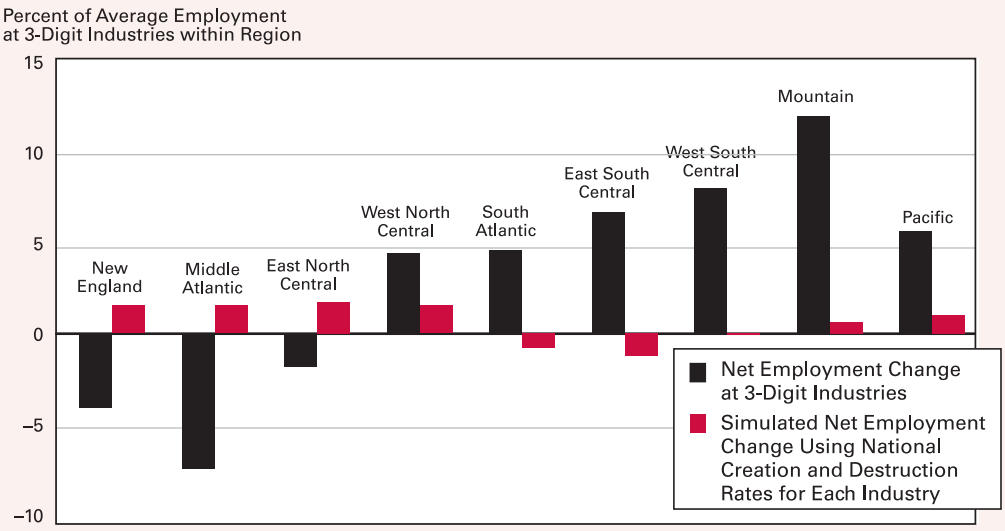
Region	Job Creation	Job Destruction	Job Reallocation	Excess Job Reallocation
New England	114	93	103	108
Middle Atlantic	116	85	98	110
East North Central	119	103	111	112
West North Central	101	112	106	112
South Atlantic	94	114	103	111
East South Central	93	124	106	119
West South Central	81	106	92	105
Mountain	74	102	86	102
Pacific	80	91	85	91

Note: Simulation assumes each 3-digit industry within each region experiences job creation and job destruction at the national rates for the industry.
Source: Authors' calculations using the Longitudinal Research Database.

Figure 9

Actual Versus Simulated Net Employment Change of 3-Digit Industries, by Census Region, 1963 to 1992

Five-Year Average Growth Rates



Note: The base for computing these growth rates is the average of beginning and end-of-period values for total employment at 3-digit industries within each region. See text.
Source: Authors' calculations using the Longitudinal Research Database.

rate.[15] In contrast, the South Atlantic and East South Central regions would have experienced employment declines rather than the healthy rates of net employment growth that they actually enjoyed.

The conclusion to draw from this exercise is that interregional differences in industry mix are not particularly important in explaining net employment growth across regions, although they do involve significant differences in gross job flows. The implication of this conclusion is that there are significant region-specific effects within 3-digit industries that generate most of the net employment changes across regions. One possible explanation for this finding is that the composition of 3-digit industries (say, at the 4-digit industry level) varies widely across regions. An additional possible explanation is that economic conditions vary widely across regions and have significant differential impacts on manufacturing activity. An extensive literature has developed on firm location and state competitiveness, although research in this area has concentrated on net employment change rather than gross job flows.[16]

V. Conclusion

This paper documents two important facts regarding job flows between regions. First, job flows within companies between regions are an important contributor to the shifting geographic distribution of manufacturing employment at multi-plant firms. Firms that operate plants in more than one region have tended to destroy jobs in regions with declining manufacturing employment and create jobs in regions with expanding manufacturing employment. Second, differences between regions in the industry mix of their manufacturing employment (measuring industries at the 3-digit SIC level) explain little of the differences between regions in net growth rates in manufacturing employment. Most of the differences in employment

[15] This finding is not uncommon in shift-share analysis. For example, Browne (1977) finds that New England's industry mix accounted for little of the difference between its rate of employment growth and the national employment growth rate between 1950 and 1976.

[16] See, for example, the symposium on "The Effects of State and Local Public Policies on Economic Development," *New England Economic Review*, March/April 1997.

growth between regions appear to be due to employment shifts within industries.

Further research is needed to understand more fully why firms and industries shifted jobs from the older, northern industrial areas to the Sunbelt, and whether there is a role for policy in attenuating the adjustment costs incurred by workers as this shift occurs. Research is also needed to further investigate the magnitude of the adjustment costs associated with intrafirm job shifts across regions. The adjustment costs would be much lower if workers were transferred to the new locations than they would be if workers at plants with declining employment were laid off and new workers hired at new or expanding plants.

The direction of causality is not clear in analyzing the relationship between movements in population and manufacturing employment. Transportation costs are reduced by locating plants closer to the consumers of the goods being produced, and one would expect that manufacturing jobs would follow the movement of the population to the Sunbelt. In addition, much of the Sunbelt historically has had lower labor, land, and electricity costs relative to northern areas. Transportation-cost and labor-availability arguments suggest that interregional shifts in population and labor supply lead to shifts in manufacturing employment. In contrast, land-cost and electricity-cost arguments point to shifts in labor demand leading to population movements.

One interesting area for further research would be to investigate the factors associated with interregional mobility for firms. Do firms with relatively high propensities to reallocate jobs between regions exhibit advantages, such as faster growth or greater productivity, relative to firms with lower propensities to reallocate jobs across regions? Again, the direction of causality is not clear *a priori.* Interregional mobility may improve firm performance, or might instead just be a characteristic exhibited by high-performing firms.

Because we have measured job flows over five-year periods, we can say relatively little about the cyclical properties of job reallocation across regions. Such reallocation is potentially very relevant for policy, however. Imbalances between the patterns of labor supply and demand over regions make job matching more costly, and may slow employment growth during economic recoveries. Further research is needed to understand the role of interregional reallocation in business cycles.

Census Regions

New England	Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont
Middle Atlantic	New Jersey, New York, Pennsylvania
East North Central	Illinois, Indiana, Michigan, Ohio, Wisconsin
West North Central	Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota
South Atlantic	District of Columbia, Delaware, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, West Virginia
East South Central	Alabama, Kentucky, Mississippi, Tennessee
West South Central	Arkansas, Louisiana, Oklahoma, Texas
Mountain	Arizona, Colorado, Indiana, Montana, New Mexico, Utah, Wyoming
Pacific	Alaska, California, Hawaii, Nevada, Oregon, Washington

Appendix

Measures of Job Flows

Measurement begins at the level of the sampling unit, which in this study is a plant. Plant-level net employment growth rates are

$$g_{est} = \frac{\Delta X_{est}}{Z_{est}} = \frac{X_{est} - X_{est,t-1}}{0.5(X_{est} + X_{es,t-1})},$$

where X_{est} denotes employment in plant e located in sector s at time t, and Z_{est} is average employment size. Gross job creation and destruction are the (weighted) sums of all employment gains and losses, respectively, across plants in a sector:

$$c_{st} = \sum_{e \in s} \left(\frac{Z_{est}}{Z_{st}} \right) \max(0, g_{est})$$

$$d_{st} = \sum_{e \in s} \left(\frac{Z_{est}}{Z_{st}} \right) \max(0, -g_{est}).$$

Analogous job flows also exist for the entire economy summed over all plants in all sectors (no subscript s). At the sectoral and aggregate levels, we are interested in three functions of gross job creation and destruction. First, the standard measure of labor market conditions is net employment change,

$$n_{st} = c_{st} - d_{st},$$

which is the difference between gross job creation and destruction. Second, gross job reallocation,

$$r_{st} = c_{st} - d_{st},$$

is a measure of the overall amount of job churning that occurs. Finally, we also are interested in excess reallocation,

$$x_{st} = r_{st} - |n_{st}|,$$

because it abstracts from the job reallocation necessary to accommodate net employment changes.

Measures of gross job flows between sectors (superscript b) are direct analogues of the measures between plants,

$$c_t^b(s) = \sum_s \left(\frac{Z_{st}}{Z_t} \right) \max(0, g_{st})$$

$$d_t^b(s) = \sum_s \left(\frac{Z_{st}}{Z_t} \right) \max(0, -g_{st}),$$

where the only difference is that measurement occurs at the sector rather than the plant. One informative statistic is the share of total gross job flows attributable to job flows between sectors; for example:

$$\sigma_t^c(s) = \left(c_t^b(s) \Big/ c_t \right).$$

We define complementary gross job creation in a firm in a region as

$$\tilde{c}_{fr} = \sum_{i \in \tilde{r}} \left(\frac{Z_{fi}}{Z_f} \right) c_{fi},$$

where the subscript f denotes firm, the subscript r denotes geographic region, and the tilde notation denotes all other regions except region r (that is, the complement of region r). Analogous measures exist for the other job-flow concepts. Measures of gross job creation and destruction in a region that are attributable to job flows within (superscript w) firms are defined as:

$$c_{rt}^w(f) = \sum_{f \in r} \left(\frac{Z_{frt}}{Z_{rt}} \right) \min(c_{frt}, \tilde{d}_{frt})$$

$$d_{rt}^w(f) = \sum_{f \in r} \left(\frac{Z_{frt}}{Z_{rt}} \right) \min(d_{frt}, \tilde{c}_{frt}).$$

The effect of job flows within firms between regions on net employment growth is then

$$n_{rt}^w = c_{rt}^w - d_{rt}^w.$$

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References

Browne, Lynn E. 1977. "The Impact of Industry Mix on New England's Economic Growth Since 1950." *New England Economic Indicators* (April): 3–33.

Davis, Steven J., John C. Haltiwanger, and Scott Schuh. 1996. *Job Creation and Destruction*. Cambridge, MA: MIT Press.

Dunne, Timothy, Mark J. Roberts, and Larry Samuelson. 1989. "Plant Turnover and Gross Employment Flows in the U.S. Manufacturing Sector." *Journal of Labor Economics* 7 (1): 48–71.

Eberts, Randall W. and Edward B. Montgomery. 1994. "Employment Creation and Destruction: An Analytical Review." Federal Reserve Bank of Cleveland, *Economic Review* 30 (3):14–26.

_____. 1995. "Cyclical versus Secular Movements in Employment Creation and Destruction." NBER Working Paper No. 5162.

Haltiwanger, John and Scott Schuh. 1999. "Gross Job Flows between Plants and Industries." *New England Economic Review* (March/April): 41–64.

Schuh, Scott and Robert K. Triest. 1999. "Gross Job Flows and Firms." 1999 *Proceedings of the American Statistical Association*, Government Statistics Section, pp. 13–22.

_____. 2000. "The Role of Firms in Job Creation and Destruction in U.S. Manufacturing." *New England Economic Review* (March/April): 29–44.