Chicago's economy: Twenty years of structural change

There are more service jobs than manufacturing jobs in today's Chicago; despite this reversal, new manufacturing jobs retain a much stronger ripple effect in creating other new jobs in the economy

Philip Israilevich and Ramamohan Mahidhara

The Chicago economy experienced a dramatic structural change during the last decade, making the 1980s very different from the 1970s. The most extreme changes took place in the Chicago labor market. In the post-World War II period, up to the last decade, manufacturing had been Chicago's major employer. However, in 1980, employment in services[1] matched and subsequently surpassed employment in manufacturing.[2] Between 1970 and 1987, the Chicago economy lost close to a quarter of a million manufacturing jobs, a striking loss by any standards.

A historical analysis of the Chicago economy provides useful insights into the nature of Chicago's structural change. Historical data analysis is, however, often inadequate in assessing the complete impact of any given change. We supplement our historical analysis here with simulation results for the years 1979 to 1987 obtained from the Chicago Regional Econometric Input-Output Model (CREIM).[3] In particular, these simulations are used to obtain estimates of potential losses and to answer some "what-if" questions.

Chicago's transition from a manufacturing-dominated employment base to a service-dominated employment base raises a number of questions. Did Chicago lose its share of national manufacturing employment? How did this transition affect employment, income, and output in other sectors? Did the decline in manufacturing employment imply a decline in output? More importantly, does the shrinking share of manufacturing employment mean that the region should be less interested in the fate of manufacturing jobs?

To answer these and other questions, we analyze the Chicago economy as a highly interdependent system where changes in any one sector affect other sectors of the economy. Quantitative measures of such spillover effects cannot be obtained from analysis of historical trends. We obtain such estimates from simulation results using CREIM. Along with changes in employment, we also look at changes in productivity, output, and income.

Chicago and the nation

Economic regions, such as Chicago, compete with each other in order to maintain or enhance their share of national output of goods and services. Regions that outperform others expand their market, while regions that lag behind lose market share. Any evaluation of a region's economic performance requires a comparison of that region with the nation as a whole.

Nationally, service employment surpassed manufacturing employment in 1982. In Chicago, this watershed was reached in 1980. In both the nation and Chicago, service employ-

Philip Israilevich is an economist at the Federal Reserve Bank of Chicago. Ramamohan Mahidhara is a research associate with the Institute of Government and Public Affairs at the University of Illinois. Israilevich is associate research director and Mahidhara is a research associate in the Regional Economic Applications Laboratory.

ment approximately doubled between 1970 and 1987.[4] Over the same period, manufacturing employment, while somewhat constant in the nation, declined in Chicago.[5] The fall in Chicago's manufacturing employment was steady in the 1970s and sharper in the 1980s (see Figures 1 and 2).

In the last two decades, Chicago's manufacturing employment experienced a gradual decline relative to manufacturing employment in the nation. Chicago's share of national manufacturing employment decreased from 4.9 percent in 1970 to 3.4 percent in 1987. Over the entire period, this constitutes a 31 percent decline in Chicago's manufacturing employment base relative to the nation (see Figure 3).

Prior to the 1970s, growth in Chicago's manufacturing sector was aided by a number of factors. The availability of natural resources, easy access to waterways and railroads, and close proximity to major consumers located in the Midwest and East made Chicago an attractive place to site manufacturing activity. As these advantages declined over time, so did Chicago's ability to draw manufacturing. In addition, relatively expensive labor and electricity further eroded the manufacturing base.

Other structural factors, such as a higher than average proportion of mature industries, played a prominent role in the restructuring of Chicago. Such mature industries as steel and automobiles which were highly energy intensive were also inefficient users of energy. This drawback hardly mattered, given the abundant availability of cheap oil in the 1950s and the 1960s. But, the oil price increases of 1973 and 1979 rendered part of the capital stock in such industries obsolescent. Meanwhile, the stricter environmental regulations of the early 1970s raised costs by requiring considerable capital investment in pollution control devices. The net effect on the Chicago region was to raise manufacturing costs and lower productivity in the short run.

Chicago's service industry, on the other hand, showed substantial growth in employment from 1970 to 1987. However, employment growth in Chicago's service industry was slightly lower than that of the nation between 1970 and 1979. As a result, Chicago's share of national service employment declined from 5.3 percent in 1970 to 4.8 percent by 1979. From 1979 onwards, Chicago's service employment growth has kept pace with national service employment growth, and remained at a constant 4.8 percent of national service employment (see Figure 4).

The steady growth in Chicago's service employment in the face of declining manufacturing employment runs counter to conventional wisdom, which considers manufacturing the prime mover behind all employment growth. A decline in manufacturing employment should be accompanied by a decline in service and other nonmanufacturing employment. This line of thinking can be wrong, at least in Chicago, where the service sector grew even as manufacturing employment declined.

FIGURE 1

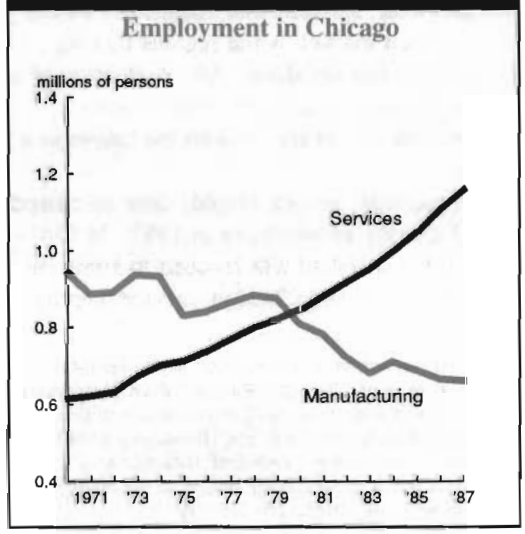


FIGURE 2

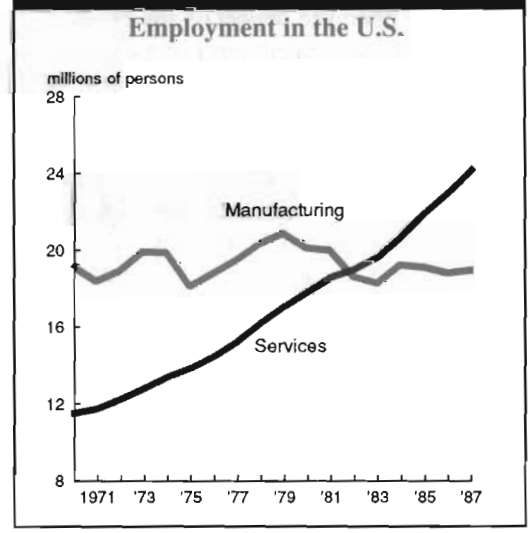
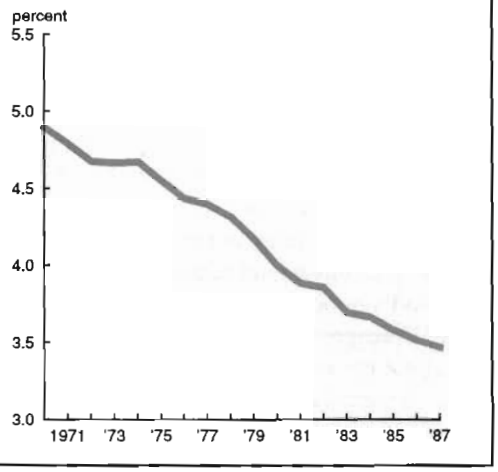


FIGURE 3

Chicago's share of U.S. manufacturing jobs



But such counterintuitive growth does not necessarily diminish the importance of the manufacturing sector. Indeed, manufacturing-service linkages grew stronger in Chicago in the post-1979 period.

To study the structural relationship between Chicago and the nation, we use location quotients. Location quotients measure the importance of a sector in the local economy relative to the importance of the same sector in the national economy.[6] A location quotient value less than one implies that the given sector has a smaller role to play in the local economy than in the nation as a whole. Similarly, a location quotient greater than one implies that (in terms of the variable being measured), the given sector has a larger role to play locally than in the nation as a whole.

Manufacturing and service sectors location quotients are graphed in Figure 5. The service sector employment location quotient was greater than one over the last two decades, rising from 1.02 in 1970 to 1.09 by 1987. Thus a larger proportion of Chicago's overall employment came from the service industry than was the case with the nation. Manufacturing location quotients were, however, lower than those for the service sector, and differed both in levels as well as trends. The location quotient for manufacturing fell from 0.93 in 1971, to 0.79 in 1987. These numbers clearly indicate that, over the last two decades, manufacturing employment has had an increasingly smaller role in Chicago's overall employment, not only in absolute terms but also relative to manufacturing at the national level.

General changes in the Chicago economy

Between 1970 and 1987, employment in manufacturing fell from 947, 290 to 659, 700. Much of this decline occurred between 1978 and 1987, when the Chicago economy lost manufacturing jobs in every year but one. Overall employment, however, rose during that period, from 3.7 million to nearly 4.5 million. Thus, as manufacturing jobs were disappearing from Chicago, other (nonmanufacturing) sectors were posting employment gains that more than made up for manufactur-

FIGURE 4

Chicago's share of U.S. service jobs

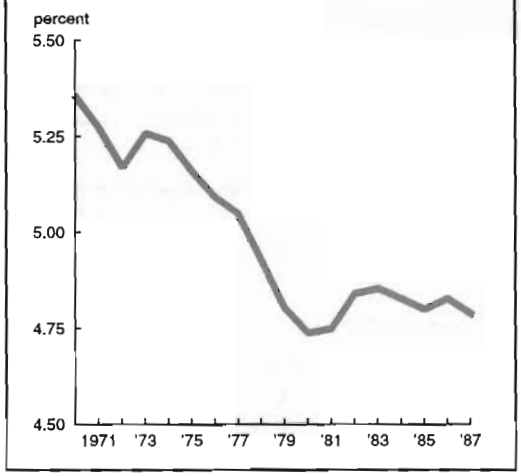
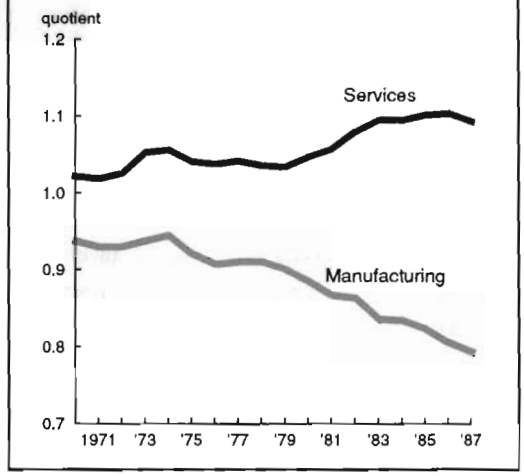


FIGURE 5

Chicago's location quotients



ing job losses. Within the nonmanufacturing sector, services generated the most jobs. While industries such as trade and finance, insurance, and real estate (FIRE) displayed substantial gains in employment, service industry gains were so much larger that we focus here only on manufacturing and services—the key job loser and gainer.

The continued, long-term ability of a region to retain and raise employment is of great importance to public policymakers. Policymakers in the Chicago region might see little cause at first to be worried about Chicago's employment-generating capability because of the gain in overall employment over the last decade. But, there are important concerns. Replacement of manufacturing jobs by service jobs implies replacing high-wage jobs with low-wage ones. This is likely to have a significant impact on income distribution in the region.

Table 1 presents total personal income figures for the two sectors. Personal income in manufacturing dropped between 1970 and 1987 along with the drop in employment. Employment losses in manufacturing over this period were about a quarter of a million jobs, while corresponding income losses amounted to about five billion dollars. At the same time, employment in services grew by about half a million, while personal income in services grew by about ten billion dollars. While both these variables might suggest that manufacturing is becoming less important to the Chicago economy, it is necessary to look at output figures before arriving at any such conclusion.

TABLE 1

Total personal income, Chicago
(billions of 1982 dollars)

	Manufacturing	Services
1970	$21.39	$11.24
1971	20.59	11.48
1972	21.32	11.94
1973	22.41	12.62
1974	22.00	12.63
1975	19.87	12.69
1976	20.82	13.41
1977	21.78	14.07
1978	22.35	14.76
1979	22.10	15.02
1980	20.35	15.28
1981	19.24	15.71
1982	17.71	16.19
1983	16.96	17.29
1984	17.86	18.52
1985	17.58	19.71
1986	17.38	21.64
1987	17.01	22.57

Despite substantial reductions in employment and a noticeable drop in personal income, Chicago's manufacturing output in 1987 was about the same as it was in 1970. Output in the service sector doubled between 1970 and 1987, along with the doubling of service income and employment. Thus, output *per worker* in services remained virtually constant over nearly two decades. In manufacturing, however, output per worker rose from $75, 865 in 1970 to $108, 829 in 1987. Thus, while the manufacturing sector was losing jobs heavily, the workforce that remained was producing more output per worker—43 percent more in 1987 than in 1970. On the other hand, output per worker in services was about one tenth of one percent higher in 1987 than in 1970.

These changes in productivity growth rates and differences in productivity levels were also reflected in annual earnings per worker for the two sectors. Annual earnings per worker in services rose from $18, 200 in 1970 to $19, 490 in 1987, a simple growth rate of 7.4 percent over the entire period. In contrast, annual earnings per worker in manufacturing rose from $22, 600 to $25, 800 between 1970 and 1987, averaging a simple rate of 14.2 percent—nearly twice as fast as in services.

Table 2 shows the annual rates of change in labor productivity in manufacturing and services. Over the 18-year period, manufacturing labor productivity fell only for two consecutive years after each oil price hike. In contrast, service productivity fell in ten out of 18 years. Between 1980 and 1987, service productivity fell in six of seven years.

Lessons in CREIM

Until now, our discussion has centered around the analysis of historical changes in labor requirements along with changes in income and output. This so-called *direct* analy-

TABLE 2

Annual rates of change in Chicago's labor productivity
(percent)

	Manufacturing	Services
1970	N.A.	N.A.
1971	6.54	-0.92
1972	4.15	2.23
1973	2.13	2.45
1974	-1.96	-3.01
1975	-1.36	-0.91
1976	6.44	-0.03
1977	4.17	0.25
1978	0.07	1.78
1979	-0.03	1.99
1980	-3.08	-2.07
1981	1.28	-0.30
1982	0.35	-2.21
1983	8.79	1.30
1984	3.14	-1.41
1985	2.15	1.66
1986	3.05	-0.64
1987	1.45	-0.62

sis, where each sector of the economy is analyzed independent of the performance of the other sectors, is both useful and interesting. However, it ignores numerous linkages that exist between sectors. For example, steel production requires coke as an input. Coke production, in turn, requires machinery, and the production of machinery, in turn, requires steel. Thus, in order to produce 1 ton of steel as a final product, the economy has to supply 1 plus x tons of steel where "x" is the indirect consumption of steel used to make the machinery that produces coke, which then acts as an input for steel. In the direct analysis, all interindustry linkages are ignored and only first-order, i.e., direct, demands are considered.

Direct analyses provide snapshot pictures of the economy. However, if one were interested in a more comprehensive dynamic analysis, one would have to take into account all indirect effects as well. These would include interindustry effects based upon the technological structure of production processes, as well as final demand effects that arise from these interlinkages. CREIM allows us to measure both direct and indirect impacts. We use CREIM to determine employment, output, and income losses in the Chicago economy arising from employment or output loss in a given sector (see box for details on CREIM).

We have noted that employment in Chicago's manufacturing sector has declined both in absolute terms and as a proportion of national manufacturing employment. This decline was not unique to Chicago. There was a general decline in the manufacturing sector throughout much of the Midwest (see, for example, Bluestone and Harrison 1982, Schnorbus and Israilevich 1987). As one may recall, there was considerable debate in the late 1970s and early 1980s about regional restructuring in the United States (Hulten and Schwab 1984, Sawers and Tabb 1984). The central theme of this debate was the decline of the Midwest and the rise of the South and the West. One particularly prominent concern was that employment, income, and output in the Midwest were growing slower, or in some cases, declining faster, than in the nation as a whole.

While Chicago's declining employment share of national manufacturing is cause for concern, the full import of this decline is not apparent at first. A declining sector has a twofold impact on an economy—direct and indirect. Over time these effects produce a cumulative effect. Using CREIM, we compute the direct and indirect effects of change in a sector on all other sectors of the economy for a given year. We further calculate cumulative effects across years.

We ran two sets of simulations, one each for the durable and nondurable sectors. Output in Chicago's durable manufacturing sector peaked in 1978. Our simulation assumed that Chicago's durable manufacturing output grew at the same rate as that of the nation from 1979 to 1987. Similarly, output in Chicago's nondurable manufacturing sector peaked in 1979. We assumed that output in this sector grew at the same rate as its national counterpart from 1980 to 1987. In each case, we computed a separate base-line simulation, in which we used the model to "forecast" all variables for the years under question (1979–1987 for

How CREIM pays off

The **C**hicago **R**egional **E**conometric **I**nput-Output **M**odel, or **CREIM**, is based upon the Washington Projection and Simulation Model (WPSM). CREIM combines detailed interindustry information (obtained from the input-output component) with time series data (obtained from the econometric model). Input-output models provide a physical analog of purchases and sales in an economy. However, these models can not adequately describe intertemporal changes. On the other hand econometric models are not rich enough in data to be able to describe detailed interindustry relationships. The combination of these two models results in a rich and elaborate model for the Chicago economy, capable of predicting structural changes, along with other variables typical of regional econometric and input-output models. Since the following discussion (which draws heavily on Conway 1990) is presented exclusively in terms of CREIM, it must be noted that features that appear unique to CREIM have their origins in WPSM.

CREIM covers the Chicago SMSA, consisting of Cook, Du Page, Kane, Lake, McHenry, and Will counties. Currently formulated on a one-digit SIC basis, CREIM has eight private industrial sectors and three government sectors. The model has 50 behavioral equations, 9 identities, 59 endogenous variables, and 30 exogenous variables. It is set up for annual long-term projections.

The Chicago economy faces two sets of demands in CREIM: (1) Exports from outside the region constituting external demands, and (2) demands from the various economic sectors within the Chicago economy which constitute internal demands.

In the first stage, exports are predicted using national GNP figures. Exports for individual industries in Chicago are linked to the same industries at the national level. Projections for all exogenous variables (including GNP and US industrial output) are obtained from Data Resources Incorporated (DRI). In the second stage, production of local exports generates a set of internal demands, that is, regional interindustry demands. The individual output equations capture these internal demands with input-output relationships. Unlike many other models which use national input-output coefficients, CREIM uses coefficients from a Chicago-specific input-output model (constructed at REAL*). Interindustry coefficients are adjusted for temporal changes, allowing for new interindustrial relationships every year.

Forecasts of output (obtained using national data and exports) are combined with forecasts of labor productivity and wage rates to predict employment and earnings by industry. These projections are further combined with projections of the labor force participation rate and the unemployment rate to obtain population forecasts. Meanwhile total earnings are obtained by predictions of property income, transfer payments, residence adjustments, and personal contributions to social insurance. Total earnings are then combined with population forecasts to obtain estimates of personal income. This completes the first set of demands the external demands.

Personal income and population now explain internal demands, that is, the final demand sector, which consists of consumption, investment, and government. Very briefly, four types of consumption expenditures and three types of investment expenditures are considered, along with one type of state and local government expenditure.

Until now, the entire stimulus to the Chicago economy in the model has come from external demand, that is, exports. For example, an increase

durables and 1980–1987 for nondurables). The difference between results obtained from these base line simulations and the preceding growth scenarios then give us a quantitative measure of the losses that arose due to the relative decline of Chicago's manufacturing economy when compared to the U.S. average.[7]

In the first scenario, we assumed that output in Chicago's durable manufacturing sector grew at the same rate as its national counterpart. On an average, this means that Chicago's durable manufacturing output would have been about 2.7 percent higher in each year between 1979 and 1987 than observed historical data. While this persistent slow growth is likely to generate some concerns among Chicago's public policymakers, there is no reason for immediate alarm. However, they do have a cumulative effect that is very significant.

In employment terms, these figures mean that durable manufacturing employment in

in the nation's GNP would lead to an increase in exports from the Chicago region. As explained in the preceding steps, this increase in exports would feed into the input-output model, which would then give rise to a set of interindustry demands. The increase in output would trigger an increase in employment, and thus earnings. Given labor force participation rates, the rise in employment would give rise to an increase in population. The rise in population, and earnings produces a rise in personal income, which is reflected in rising personal consumption, investment, and state and local government expenditures. This increase in personal income now gives rise to the second set of demands driving the model, namely, the internal demands.

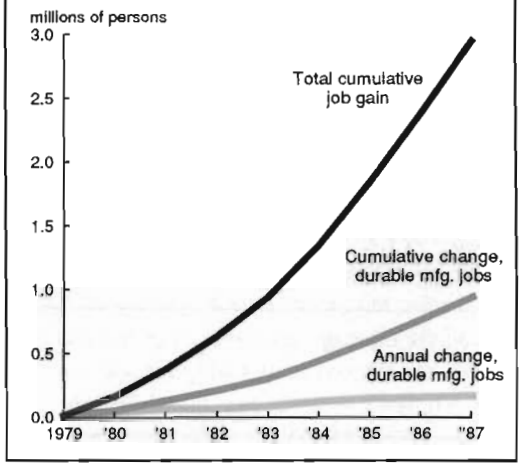
The model is closed as the final demands feed into the output sector. The increase in final demand (consumption + investment + government) further raises output. This time, though, the output increase comes about not in response to exports *but in response to increased internal demand for goods and services, both private and public.* This increased internal demand works its way through the input-output model in exactly the same way as exports did, resulting in another chain of increases in output, earnings, employment, population, income, and ultimately, final demand. What we see here is a multiplier effect at work. This process continues, and at each stage, the multiplier effect grows smaller and smaller. After several iterations, the model converges, and we obtain figures on the employment, output, and income impact of increased exports.

*The Regional Economics Applications Laboratory (REAL), is a cooperative venture between the University of Illinois and the Federal Reserve Bank of Chicago, focusing on the development and use of analytical models for urban and regional economic development.

Chicago would have been about 2.5 percent higher than actual observed data. While the "shortfall" in any given year was rather small, the cumulative effect of this modest yet persistent shortfall was very large. By 1987, the cumulative loss in potential output is estimated at $187 billion, approximately 86 percent of Chicago's 1987 total output. The cumulative loss of potential jobs[8] between 1979 and 1987 was about 2.9 million jobs, nearly two-thirds of Chicago's 1987 total employment. Figure 6

FIGURE 6

Hypothetical gains if Chicago grew at U.S. rate



shows that the relatively small annual changes in a given sector (in this case durable manufacturing) led to large cumulative changes in total employment.[9]

Results of the second set of simulations were similar in effect though smaller in magnitude. Had output in Chicago's nondurable manufacturing sector grown at the same rate as the nation, the average annual increase in nondurable manufacturing output would have been about 0.7 percent, while the average annual increase in nondurable employment would have been about 0.5 percent. This "shortfall" leads to cumulative losses of potential. By 1987, cumulative losses in potential total output for Chicago amounted to about $95 billion, or nearly 43 percent of total output in Chicago by 1987. Similarly, the cumulative losses in potential employment were 1.3 million jobs, approximately 29 percent of Chicago's 1987 total employment.

These small annual changes resulting in such large cumulative effects naturally leads us to the issue of multipliers. In general, what is the effect of an additional job in a given sector on the rest of the economy? Does this impact vary over time? Given the radical restructuring in Chicago's economy, does one additional manufacturing job now mean more total jobs than before, or has manufacturing become less important in generating jobs?

In order to answer some of these questions, we ran additional simulations using CREIM. The sectors chosen were once again

durable and nondurable manufacturing. Within each sector, simulations were run across two time periods. In the first set of simulations, we investigated the impact of $1 billion annual increase in output for durable manufacturing between 1972 and 1979. In the second set, we repeated the exercise, but for the years 1980–1987. Two identical exercises were also run for the nondurable manufacturing sector. The employment multiplier for durable manufacturing in the first period (1972–79) was 2.84. In other words, one new durable manufacturing job created 1.84 additional jobs, leading to a total increase of 2.84 jobs in the Chicago economy. For the second period, the employment multiplier rose to 3.12, implying that one additional durable manufacturing job led to a total increase of 3.12 jobs in the Chicago economy. Thus, durable manufacturing in Chicago appears to have become more important in the 1980s. Nondurable manufacturing figures were similar—3.45 for the first period and 3.83 for the second.

Conclusion

We have used three perspectives to analyze the structural change that has affected the Chicago economy: Regional and national comparisons; Chicago's output, employment, and income; and simulations obtained from the Chicago Regional Econometric Input-Output Model.

The structural change was due, in part, to the rapid growth of productivity in manufacturing, and to the lack of productivity growth in services. We found: 1) that most of the labor force growth came from the service sector and not manufacturing; 2) that average earnings per worker declined in the 1980s as a result of this employment restructuring; and 3) that linkages between employment in manufacturing sector and the rest of the economy became greater.

While Chicago's structural readjustment was similar to that of the nation, the timing was different. More specifically, structural readjustment in Chicago preceded that in the nation by about two years. Furthermore, actual readjustment in Chicago was more pronounced than in the nation as a whole. Chicago's service industry grew at the national rate during the 1980s, while Chicago's manufacturing sector grew more slowly than the national average. As a result, the gap between manufacturing and service employment grew over the 1980s in Chicago.

If trends observed in the 1980s continue, employment in services is likely to increase its share of total employment in Chicago. Does this mean that manufacturing will no longer be important? It does not. Manufacturing jobs will retain their importance because, to a much greater degree than service jobs, they generate increases in per capita income and additional employment in all other sectors.

FOOTNOTES

[1]In our paper, services refer to SIC codes 7 and 8. Included among these are hotels, personal services, business services, auto repair, amusement, health, and legal services.

[2]By manufacturing, we refer to SIC codes 2 and 3. Included among these are food and beverages, printing and publishing, chemicals, heavy metals, machinery, and miscellaneous manufacturing.

[3]A brief description of CREIM is presented in the box. Our geographical definition of Chicago is the six county metropolitan area consisting of Cook, Du Page, Kane, Lake, McHenry, and Will counties. Data on the Chicago economy were obtained from a detailed database built for CREIM.

[4]In 1970, service employment in Chicago and the nation was 0.62 million and 11.55 million respectively. By 1987, Chicago's service employment stood at about 1.12 million, while national service employment rose to 24.2 million.

[5]In 1970, manufacturing employment in Chicago and the nation stood at 0.95 million and 19.4 million respectively. In 1987, corresponding values were 0.66 million for Chicago and 19.0 million for the nation.

[6]Specifically, location quotients are ratios of ratios and are of the form (A/B)/(C/D). For example, *A* would be Chicago employment in manufacturing, while *B* would be total Chicago employment. Thus A/B tells us what proportion of Chicago's total employment is accounted for by the manufacturing sector. *C* would then be national manufacturing employment, while *D* would be total national employment. Thus C/D would tell us what proportion of the nation's total employment is accounted for by the manufacturing sector. The ratio of these two ratios would then enable us to gauge whether a particular industry is more important to Chicago than it is to the nation. Furthermore, one is not restricted to using employment values alone. One can also obtain income and output location quotients.