Hog butchers no longer: 20 years of employment change in metropolitan Chicago

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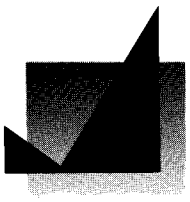

Over the last two decades, the Chicago metropolitan area has seen substantial changes in its manufacturing and service sector employment. Manufacturing employment declined by almost 300,000, while service employment rose by about 500,000 between 1970 and 1987.

Why did this happen? One possibility is that the productivity of workers in manufacturing firms increased and that of workers in service firms did not. Another possible explanation for the change in Chicago's employment patterns is that manufacturing firms may have contracted out many jobs that used to be done in-house, hence jobs which used to be classified as manufacturing are now classified as service. Finally, the decrease in manufacturing jobs and the increase in service jobs could have been caused by a change in consumer preferences. For example, an aging population may demand more health care and fewer skateboards, causing increased employment in the health care industry and decreased employment in the skateboard industry.

Effective policy decisions depend upon an accurate prediction of future employment trends. It makes sense to think that future employment trends could be predicted more accurately if the causes of employment change are understood. Hence, it is important for policy makers to understand the reasons for changes in employment.

In this article, we present the results of research into the causes of employment change in metropolitan Chicago over the last 20 years. Our results are obtained from a detailed economic model developed at the Regional Economics Applications Laboratory (REAL).[1] Using the model to identify the forces underlying employment changes in metropolitan Chicago over the last two decades, we found that changes in consumer preferences were the major cause of employment increases in the services industry.

We begin the second section of this article by discussing the importance of the service sector. We review the debate concerning the decline of manufacturing employment and the growth of service employment. In the third section, we present our methodology and the model itself. In the fourth section, we analyze the results obtained from our simulations. Conclusions are presented in the final section of the article.

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The importance of the service sector in analyzing changes in employment

Traditionally, economists viewed manufacturing firms as *basic* industries, which form the nucleus of the economy around which peripheral sectors revolve. According to the traditional view, peripheral sectors are inextricably linked to the manufacturing sector, growing when manufacturing grows and declining when manufacturing declines. However, the traditional view has been undermined by evidence that the service sector can grow when manufacturing either stagnates or declines.

The idea that manufacturing is the primary force in any economy is slowly changing in the public's perception, possibly due to the unprecedented growth in service employment. But the causes underlying rapid growth in services are not well established. Because the number of jobs in the service sector exceeded those in the manufacturing sector on the national level less than a decade ago, there has been relatively little research into the causes and implications of such growth.[2] Analysis of the cause of growth in the service sector at the regional level is hampered further by the lack of data.

It is often suggested that the employment growth in services and the employment decline in manufacturing is primarily a statistical illusion attributable to manufacturing firms closing down their auxiliary divisions and shifting the work to outside firms in the service industry. This shift in employment is called *unbundling* (Kutscher 1988). For example, a manufacturing firm could reduce the size of its accounting department and hire an accounting firm to do the same job. Consequently, the manufacturing sector loses some employees and the service sector gains some employees. However, according to the unbundling hypothesis, this reshuffling does not reflect either a real growth in services or a real decline in manufacturing. The unbundling hypothesis is important because it raises questions about the type of growth in the service sector, and more importantly, whether the service sector is growing at all.

In the last few years, researchers have looked more closely at the service sector through the analysis of occupational shifts.[3] The results indicate that unbundling plays a very small role in the expansion of the service sector. Researchers have shown that unbundling accounted for only about two percent of total employment growth in services. However, the unbundling argument is still popular in the media.

In an earlier study (Israilevich and Mahidhara 1990), we discussed the growth of the manufacturing and service sectors in the Chicago metropolitan area. According to our study, manufacturing and services appear to have followed two largely independent growth paths in Chicago between 1972 and 1987. While manufacturing output fluctuated substantially over the period of our study, manufacturing output in 1987 was about the same as in 1972, in real terms. Manufacturing employment and income, however, declined noticeably. Employment in 1987 was about two-thirds of its 1972 level, while income was about three-fourths of its 1972 value. For the service sector, however, output, employment and income grew steadily between 1972 and 1987. Service output, employment, and income all approximately doubled between 1972 and 1987. Thus, growth in Chicago's service industry was mostly independent of the manufacturing sector. In this article, we continue our investigation of employment in Chicago. We present results of recent research concerning employment changes and their causes in manufacturing and services.

Economic sectors and the causes of employment growth

We divide the economy into three sectors: resources and construction, manufacturing, and services. Resources include agricultural services, forestry, fisheries, and mining. Services consist of TCU (transportation, communications, and utilities), trade, FIRE (finance, insurance, and real estate), and personal and business services. We also single out the personal and business service sector in order to compare its progress with the other three broader categories.[4]

We investigated three important causes of changes in employment:

1) labor productivity,
2) business practices, and
3) final demand.

An increase in labor productivity causes a decrease in employment per unit of output. As workers' skills and training are enhanced and the equipment they work with becomes more

productive, output per worker rises. Constant and noticeable improvements in labor productivity are fairly common in many manufacturing industries; they are somewhat less common in personal and business services. One reason for this difference is that measurement of productivity in the service sector is difficult and controversial.

Changes in business practices can cause changes in employment. Business practices are the ways in which firms produce their goods and services. They reflect the pattern of inputs, such as labor, that firms use in order to produce their output(s). Over time, with changes in technology, changes in relative prices of inputs and regulations and industry structure, firms change their business practices and hence their demand for labor, among other things (Kutscher 1988). For example, as an economy passes from an industrial to a post-industrial stage, the demand for manufactured goods is likely to fall and the demand for services likely to rise. Unbundling is one example of a change in business practice. Unbundling occurs when firms contract out work that was hitherto done within the firm. There are also business practice changes which do not constitute unbundling. For example, a new environmental regulation might cause a firm to switch to an alternative, less polluting technology, which may employ fewer people than before. In this article, we assume that *all* declines in manufacturing employment due to changing business practices constitute unbundling. We make this assumption in order to get an upper bound for unbundling.

Changes in final demand can cause changes in employment. Final demand consists of expenditures on consumption, investment, government and net exports (imports minus exports). Final demand affects employment growth by raising the demand for one sector's output and reducing the demand for a different sector's output (Kutscher 1988). There are two basic types of final demand changes: 1) a change in the size of final demand, and 2) a change in the composition of final demand. A change in the size of final demand results from a change in the size of the economy. For example, when an economy grows, its population may grow, thereby raising the demand for consumer goods, resources for investment, government services and net exports. A change in the composition of final demand results from a change in consumer preferences or firm capital formation requirements. For example, an aging population is likely to demand more personal and business services, such as health care and retirement housing. Or, the increasing participation of women in the labor force may raise the demand for personal and business services such as day care and, perhaps, fast food restaurants (Duchin 1988). This unbundling of household activities is similar to the unbundling of personal and business services in manufacturing. Furthermore, as the output of portable and durable services rises, the likelihood of exporting these services rises too. A portable service is one that can be transported across distances. For example, a business consulting firm based in Chicago may provide strategic planning services for a pension plan of a Connecticut-based firm. A durable service is one that retains its value and usability over time. For example, a computer-based inventory control software package retains its value over time.[5]

Often, an event affects both business practices and final demand. Consider a firm that purchases energy efficient motors. This purchase should lead to lower energy costs for the firm (a change in business practices) but also higher capital expenditures (a change in final demand). In addition, the new motors may raise labor productivity, which could also affect employment. These simple examples show that the economy has a complicated structure, and that a change in employment often has a cause which is more complicated than a mere expansion or contraction of the economy.

Econometric and input-output models

Employment changes occur when firms are created or dissolved, and when firms expand or contract. In order to analyze these changes, we need to distinguish between the direct and indirect effects that firms can have on employment. Suppose that a firm expands and hires 10 new workers. This is an example of a direct effect. To give a very simple example of an indirect effect, suppose further that as a consequence of expansion, the firm demands more supplies. As a result, the supplier expands its operations and hires 5 new workers. It is easy to see that estimating the indirect effects in a realistic case would be

very complicated. In order to estimate both the direct and the indirect effects that a firm typically has on Chicago metropolitan employment, we use input-output analysis and econometric modeling. Our method is valid for analyzing changes in economy-wide employment, because total economy-wide employment is the sum of individual firms' employment.

Companies interact with each other and final consumers (consumers within and outside of the region, governments, and investment agents) via purchases and sales. Because the transactions of a buyer (purchases) and a seller (sales) represent two sides of the same transaction, it is not necessary to record both. We choose to record only purchases. For our study, we tabulate the purchases made by industries from other industries and from individuals. We record these purchases as shares of total expenditures, rather than as dollar values.[6] The input-output table is in matrix form, with rows depicting selling sectors and columns representing purchasing sectors. Thus, going down any column of an input-output table, one can see what proportion of a particular sector's output is accounted for by purchases from other sectors. These shares represent a purchasing pattern of inputs necessary to produce one dollar's worth of the sector's output. A given share multiplied by the total revenue represents the total dollar purchase of a given input by the sector (see Figure 1 for a simple illustration).

In this study, we compare input-output tables representing the Chicago economy during the two historical periods, 1972-79 and 1980-87. This is done in order to compare the Chicago economy before and after 1980—the year in which service employment exceeded manufacturing employment in Chicago.

Typically, consistently recorded input-output tables for different years are not available for regional economies.[7] We generated input-output tables using simulations from the Chicago Region Econometric Input-output

FIGURE 1

Input-output table

Sales/purchases	Resources & construction	Manufacturing	Services	Final demand	Total output (sales)
Resources & construction	10	15	15	60	100
Manufacturing	20				
Services	25				
Value added and other payments	45				
Total output (revenue)	100				

SIMPLE PICTURE OF INPUT-OUTPUT TABLE. We present a hypothetical transaction flows table from which the table of input-output coefficients can be derived. For simplicity, we present and interpret data for only one sector (resources and construction); a similar interpretation holds for all other sectors. The values in the second column of the table represent purchases by the resource and construction sector. Thus, in order to produce $100 worth of output (revenue), the resource and construction sector purchases $10 worth of goods from itself, $20 worth of goods from the manufacturing sector, and $25 worth of goods from services. The remaining $45 consists of value added to output via extraction or construction, wages paid, and other payments. The values in the second row of the table represent sales by the resource and construction sector to all other sectors in the economy. Thus, the resource and construction sector sells $10 of goods to itself, $15 to the manufacturing sector, $15 to the service sector, and $60 to the final demand sector. Adding up across the row, we get total output (sales) equal to $100.

Model (CREIM). These tables represent the average technology for Chicago over each period. See Box 1 for details of CREIM.

Analysis

In order to determine the changes in employment over time in different sectors, we need to compare input-output tables at different points in time. The data for Figure 2 were obtained by subtracting the 1972-79 input-output table from the 1980-87 input-output table. Note that Figure 2 represents only the changes in direct expenditures, that is, the changes in business practices across the two periods.

Figure 2 illustrates the percentage changes in the consumption of personal and business services and manufacturing goods by all industries across the two periods. The figure shows that all sectors of the economy demanded more personal and business services per unit of output in the second period than in the first. The sharpest rise in demand for personal and business services per unit of output was in the services sector (TCU, TRD, FIRE, and personal and business services). At the same time, demand for manufacturing goods per unit of output declined among all sectors, no doubt resulting in the decline in manufacturing employment.

Box 1: The Chicago Region Econometric Input-output Model

The Chicago Region Econometric Input-output Model, or CREIM, combines detailed inter-industry information (obtained from the input-output table) with time series data (obtained from the econometric model). Input-output tables model purchases and sales in an economy. However, these models can not adequately describe changes over time. On the other hand, econometric models do not have enough data to describe detailed inter-industry relationships. Therefore, the combination of these two models results in a comprehensive model for the Chicago economy, capable of predicting changes in final demand and business practices, along with all other variables typical of regional econometric and input-output models. Key aspects of CREIM are presented below.[8]

The geographical coverage of our study is the six county Chicago metropolitan region consisting of Cook, DuPage, Kane, Lake, McHenry, and Will counties. Currently formulated on a one-digit Standard Industrial Classification (SIC) code 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.

In CREIM, the Chicago economy faces two sets of demands: (1) exports going outside the region constituting *external* demands, and (2) demands from the various economic sectors within the Chicago economy constituting *internal* demands.

In the first stage, exports are estimated 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 U.S. industrial output) are obtained from Data Resources Incorporated (DRI). In the second stage, as firms respond to external demand, they give rise to a set of local inter-industry demands. The individual output equations capture these internal demands using input-output relationships. Unlike many other models which use national input-output coefficients, CREIM uses coefficients from a Chicago-specific input-output model (also constructed at REAL). Inter-industry coefficients are adjusted for time changes, allowing for new inter-industry 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 combined with projections of the labor force participation rate and the unemployment rate to obtain population forecasts. 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, that is, external demands.

The personal income and population figures obtained above are used to estimate the final demand sector, which consists of consumption, investment, and government purchases. In the analysis, four types of consumption expenditures and three types of investment expenditures are considered, along with one type of state and local government expenditure.

Initially, the entire stimulus to the Chicago economy comes from external demand, that is, exports. For example, an increase in the nation's

The evidence in Figure 2 explains why manufacturing employment in Chicago declined and employment in personal and business services increased from period 1 to period 2. However, we cannot tell from Figure 2 whether this is due to a real shift in employment or is just a statistical reshuffling as proponents of the unbundling hypothesis claim. The fact that the manufacturing sector itself reduced its consumption of manufactured goods and raised its consumption of personal and business services supports the view that changing business practices, i.e., unbundling, were responsible for at least some of the change in employment. However, Figure 2 does not show the relative effects of changes in labor productivity, final demand and business practices on employment. Also, Figure 2 only accounts for direct, first order impacts, and does not include the indirect effects of employment change in any given industry. These issues are addressed by the analysis in Tables 1 and 2.

Average total employment in Chicago rose from 3.048 million in the first period (1972-79) to 3.279 million in the second period (1980-87), an increase of about 7.6 percent. As shown in Table 1, this total growth of 7.6 percent can be broken up into growth from each of the three economic sectors—resources

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 inter-industry demands. The increase in output would give rise to 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 leads to an increase 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 a second set of demands driving the model, that is, final demand from within the Chicago economy.

The modeling cycle is completed when the above described final demand feeds into the output sector. The increase in final demand further raises output. This time though, the output increase comes about in response to increased *internal* demand for goods and services, both private and public, and not in response to a demand for exports coming from outside the Chicago economy. This increased 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.

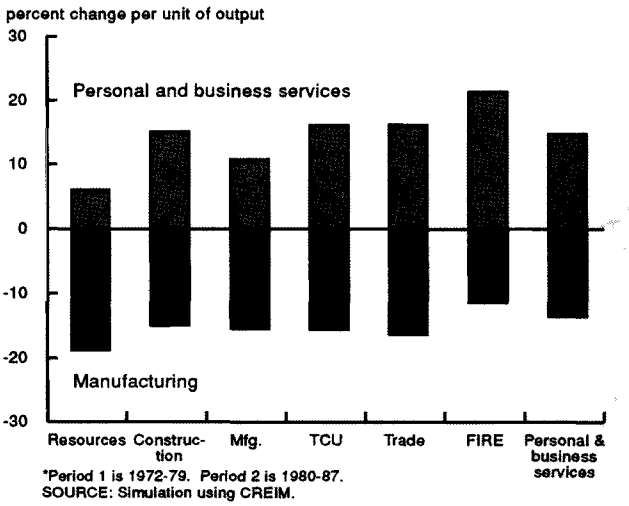
The input-output block of CREIM is a conventional, static input-output model. It differs from other conventional regional input-output models, which are typically constructed by regionalizing a national input-output model. In our input-output block, we use unpublished, establishment-based, Chicago-specific information for the manufacturing block. These data on industrial purchases and sales are obtained from the U.S. Bureau of Census.[9]

The two input-output tables generated for this article correspond to the periods 1972-79, and 1980-87, and should be viewed as representing the average technology across each of those periods. The tables are generated from CREIM in the following manner. An input-output table, say A, represents a matrix of expenditure shares for the various inputs. We then obtain the *Leontieff inverse* B, as $(I-A)^{-1}=B$, where I is the identity matrix. Elements of the Leontieff inverse represent the effect of a unit change in final demand on the output of each industry, that is each element, b_{ij}, of B is a partial derivative of the change in industry output to the change in final demand. Final demand is represented by the vector $Y = y_j$. Using these notations, $b_{ij} = \partial(x_i)/\partial(y_j)$, where the output vector $X = x_i$, and $i,j = 1,...,n$, denote the sectors in the economy.

Elements of the Leontieff inverse b_{ij} were generated by running a number of simulations using CREIM. We ran two sets of simulations, one for each period. Within each period, we investigated the impact of $1 billion annual increase in real output for each of the following eight sectors: resources, construction, durable manufacturing, nondurable manufacturing, TCU, trade (TRD), FIRE, and personal and business services. From these simulations, we obtained total and partial output multipliers, which were then used to construct our input-output tables as explained in Box 2.

FIGURE 2

Change in business practices from Period 1 to Period 2*



*Period 1 is 1972-79. Period 2 is 1980-87.
SOURCE: Simulation using CREIM.

and construction, manufacturing, and services (TCU, trade, FIRE, and personal and business services). Box 2 provides the derivations underlying Tables 1 and 2.

A small increase in resources and construction employment from the first period to the second caused total employment to rise by about 0.2 percent. Increases in services employment were significant, leading to a 12.9 percent rise in total employment. Thus, employment gains in the resources and construction and services sectors caused overall employment to rise by 13.1 percent from the first to the second period. These gains were diminished, however, by a sizeable drop in manufacturing employment from period 1 to period 2. This drop in manufacturing employment pulled total employment down by about 5.5 percent. The sum total of changes in these three sectors (+0.2 percent, +12.9 percent, -5.5 percent) resulted in total employment in the second period rising by about 7.6 percent relative to the first.

According to Table 1, changes in labor productivity resulted in a 3.8 percent decline in total employment. Of that 3.8 percent decline, improvements in manufacturing labor productivity accounted for 2.8 percent, while the remaining 1 percent was caused by improvements in service sector labor productiv-

TABLE 1

Decomposition of employment growth

	(1)	(2)	(3)	(4)	(5)	(6)
	Period 1* employment decomposition $\hat{\mu}_1 B_1 Y_1$	**Labor productivity effects** $\Delta\hat{\mu} B_1 Y_1$	**Business practice effects** $\hat{\mu}_2 \Delta B Y_2$	**Final demand effects** $\hat{\mu}_2 B_1 \Delta Y$	**Period 2** employment decomposition (5)=(1)+(2)+(3)+(4)**	**Rate of growth** (6)=(5)-(1)
	(fraction of total employment)	*(----change from period 1 to period 2----)*				
Sectors						
Resources & construction	0.055	0.000	-0.000	0.001	0.057	0.002
Manufacturing	0.290	-0.028	-0.033	0.006	0.234	-0.055
All services	0.654	-0.010	0.036	0.103	0.783	0.129
Total	**1.000**	**-0.038**	**0.002**	**0.111**	**1.075**	**0.076**
Personal & business services	0.240	0.003	0.017	0.064	0.325	0.085

SOURCE: Simulation using the Chicago Region Econometric Input-Output Model (CREIM).
NOTE: Totals may not equal sum of components due to rounding errors.
*Period 1 is 1972-79
**Period 2 is 1980-87

TABLE 2

Decomposition of final demand effect on employment
(Rate of change from Period 1 to Period 2))

	Effects of change in composition $\hat{\mu}_2 B_1 \Delta Y_c$	Effects of change in size $\hat{\mu}_2 B_1 \Delta Y_s$	Total final demand effect $\hat{\mu}_2 B_1 \Delta Y$
Industry			
Resources	0.001	0.001	0.002
Construction	-0.006	0.006	0.000
Total resources & construction	**-0.005**	**0.007**	**0.002**
Manufacturing durable	-0.026	0.021	-0.005
Manufacturing nondurables	-0.001	0.011	0.010
Total manufacturing	**-0.026**	**0.032**	**0.006**
Transportation, communication, utilities	-0.001	0.008	0.007
Trade	-0.016	0.031	0.015
Finance, insurance & real estate	0.006	0.011	0.017
Personal & business services	0.035	0.030	0.065
Total all services	**0.024**	**0.079**	**0.103**
Total economy	**-0.007**	**0.118**	**0.111**

SOURCE: Simulation using CREIM.
NOTE: Totals may not equal sum of components due to rounding errors.

ity. As firms in both manufacturing and services became more productive, they needed fewer workers to produce the same amount of output.

Total employment grew by 0.2 percent as a result of changes in business practices. Sectorially, changes in manufacturing business practices resulted in a 3.3 percent drop in total employment. This was in contrast to a change in business practices in the service sector, which resulted in a 3.6 percent increase in total employment. The combined effect of changes in business practices and labor productivity caused total employment to decline by about 3.6 percent.

Changes in final demand had a dramatic impact on total employment, raising total employment by 11.1 percent in period 2 relative to period 1. This 11.1 percent rise was coupled with the above discussed 3.6 percent drop (caused by changing labor productivity and business practices) resulting in an overall increase of 7.6 percent in employment. As shown in the final demand column in Table 1, 10.3 percent of the total impact of 11.1 percent came from the services sector. Thus, over 90 percent of the final demand impact was caused by a change in final demand in the services sector. Table 1 also shows that within the services sector, a large proportion (58 percent) of the impact was caused by personal and business services.

Earlier, we observed that changes in the size of the economy led to changes in the size of final demand. We also observed that changes in consumer preferences and firm input requirements led to changes in the composition of final demand. In Table 2, the final demand effect is decomposed into these two components.

Box 2: Components of employment growth

We decompose employment growth into three components: labor productivity, business practices, and final demand. Our methodology is a straightforward extension of standard input-output analysis.

Denote the ratio of labor per unit of output as a vector μ, where each element corresponds to a single-digit (SIC) sector. Let $\hat{\mu}$ be a diagonal matrix with μ on the principal diagonal. Let Y denote the vector of final demand. Then, the employment vector E_1 can be determined as:

$$E_1 = \hat{\mu}_1 B_1 Y_1$$

Next, denote changes from period 1 to period 2 as Δ, and let subscripts denote periods 1 and 2. Then, employment in period 2, E_2, can be decomposed as follows:

$$E_2 = \hat{\mu}_1 B_1 Y_1 + \Delta\hat{\mu} B_1 Y_1 + \hat{\mu}_2 \Delta B Y_2 + \hat{\mu}_2 B_1 \Delta Y$$

The first term, $\hat{\mu}_1 B_1 Y_1$, is employment in period 1. The second term, $\Delta\hat{\mu} B_1 Y_1$, denotes employment change from period 1 to period 2 caused by changes in labor productivity. The third term, $\hat{\mu}_2 \Delta B Y_2$, represents employment change caused by changing business practices. The last term, $\hat{\mu}_2 B_1 \Delta Y$, represents employment change caused by changes in final demand. All elements of equation (2) are in vector form.

Our next step is to decompose the last term of equation 2, employment change due to changing final demand ($\hat{\mu}_2 B_1 \Delta Y$), into two additional terms: a) employment change due to a change in the composition of final demand, and b) employment change due to a change in the size of final demand

$$\begin{aligned} E_2 &= \hat{\mu}_1 B_1 Y_1 + \Delta\hat{\mu} B_1 Y_1 + \hat{\mu}_2 \Delta B Y_2 + \hat{\mu}_2 B_1 \Delta Y \\ &= \hat{\mu}_1 B_1 Y_1 + \Delta\hat{\mu} B_1 Y_1 + \hat{\mu}_2 \Delta B Y_2 + \hat{\mu}_2 B_1 (Y_2 - Y_1) \\ &= \hat{\mu}_1 B_1 Y_1 + \Delta\hat{\mu} B_1 Y_1 + \hat{\mu}_2 \Delta B Y_2 + [\hat{\mu}_2 B_1 \{(Y_2 - rY_1) + (rY_1 - Y_1)\}] \\ &= \hat{\mu}_1 B_1 Y_1 + \Delta\hat{\mu} B_1 Y_1 + \hat{\mu}_2 \Delta B Y_2 + \hat{\mu}_2 B_1 \Delta Y_c + \hat{\mu}_2 B_1 \Delta Y_s \end{aligned}$$

where $r = (1^T Y_2)/(1^T Y_1)$ (r represents the ratio of final demand in period 2 to final demand in period 1).

The last row of Table 2 shows that at the aggregate economic level, virtually all the growth in employment due to the final demand effect was the result of an increase in the size of the economy. Within the aggregate economy, however, the manufacturing and service sectors displayed considerably different behavior. Changes in final demand led to a small rise (0.6 percent) in manufacturing employment. But behind this small number lay considerable activity, with a growing economy tugging manufacturing employment in one direction, and changes in final demand composition tugging in another. Manufacturing employment grew by 3.2 percent as a result of increased final demand caused by a growing economy. Nearly two-thirds of this gain of 3.2 percent took place in the durable manufacturing sector. Over the same period, changes in the composition of final demand reduced manufacturing employment by 2.6 percent. Almost all this 2.6 percent decline in manufacturing employment took place in the durable manufacturing sector. Thus, changes in final demand had much larger effects on employment in durable manufacturing than initially appeared.

As shown in Table 1, total employment in the personal and business service sector grew by about 8.5 percent from period 1 to period 2. Of that 8.5 percent, 1.7 percent was the result of changing business practices, 0.3 percent caused by changes in labor productivity, and 6.5 percent caused by changes in final demand. Table 2 decomposes this 6.5 percent increase into size and composition effects. A growing economy leading to increased final demand caused personal and business service employment to grow by 3 percent. The remaining 3.5 percent was due to changes in the composition of final demand. In summary, changes in the composition of final demand caused manufacturing employment to fall by 2.6 percent and personal and business service employment to rise by 3.5 percent.

These results indicate that for the personal and business service industry, changes in final demand were far more significant than changes in business practices. In particular, changes in the economy affected the personal

and business service sector primarily through changing final demand, rather than through changing business practices. If the unbundling hypothesis were true, we would have expected the increase in service employment to be explained primarily by changes in business practices. Thus, our results in Tables 1 and 2 cast serious doubts upon the unbundling hypothesis.

Conclusions

In this article, we examined the Chicago metropolitan economy in an attempt to understand the patterns underlying employment growth. On the surface, employment growth was modest, averaging 7.6 percent from the period of 1972-79 to the period of 1980-87. We analyzed aggregate growth in two ways. First, we looked at individual sectors of the economy, in an attempt to answer the question: which industries were responsible for the employment growth? In investigating this issue, we found a striking pattern. The economy-wide employment growth of 7.6 percent was caused by a dramatic increase in service sector employment, which more than compensated for the decline in the manufacturing sector's employment.

Second we looked at causal factors underlying this sectorial change in an attempt to answer the question: what factors caused these changes? We focused on three causal factors of employment growth: changes in labor productivity, changes in business practices and changes in final demand. We further disaggregated final demand effects into size and composition effects. Advances in labor productivity led to a decline of nearly 4 percent in economy-wide employment, while changes in final demand resulted in an increase of nearly 11 percent in economy-wide employment. On an aggregate level, almost all the change in employment due to changing final demand resulted from a growing economy. The story was much more complicated at the sectorial level. Our results confirmed our hypothesis that, at the sectorial level, changes in the composition of final demand exerted considerable influence on employment changes in Chicago.

Advances in manufacturing labor productivity and changing business practices decreased manufacturing employment, while changes in final demand had little effect on aggregate manufacturing employment.

The most striking impact on Chicago's aggregate employment resulted from changes in final demand for personal and business service sector goods. The impact of these changes on aggregate employment growth was nearly four times as strong as the impact caused by changing business practices. This dramatic growth in employment was the result of both a growing economy as well as a substantial change in the composition of final demand. These results strongly suggest that changes in final demand were the primary cause of significant employment growth in the services sector. This was true in spite of the fact that manufacturing generates more indirect jobs per direct job than the service sector. Recent results indicate that the Chicago manufacturing employment multiplier may be nearly twice as high as the Chicago service employment multiplier. Nevertheless, our findings suggest that advances in manufacturing productivity together with changing business practices mean that it is even less likely that manufacturing will be an important source of new jobs. In Chicago, we would expect that a large proportion of employment growth is likely to originate from the service sector, caused primarily by changes in the final demand for service sector goods. It is unlikely that this outlook could be changed by public policy.

We must qualify our conclusions with the following observations. Our analysis discusses unbundling only within the six county Chicago metropolitan area. It does not account for the possibility of, say, a Big Three automobile manufacturer in Detroit closing down its accounting department and hiring a Chicago-based accounting firm to manage its accounts. We are working towards developing a consistent set of multi-regional models similar to CREIM, for the Seventh District states. When those models are completed, we will be in a position to address such issues. Also, just as the United States is not a homogeneous country, the Seventh District states themselves display substantial differences in structure. Thus, one should exercise caution in extending the results presented in this article to other metropolitan areas. Finally, in order to fully understand the changing structure of Chicago's economy, we need to look at the changes in occupations across industries. Current re-

search at REAL is focused in that direction, and we hope to present those results in future articles.

Can the above findings be generalized? In other words, should other regions and cities focus more on the final demand aspect of the service sector and pay less attention to the manufacturing sector? Based upon historical evidence, it is reasonable to assume that growth in the service sector has proceeded, and is likely to proceed, independently of growth in manufacturing in other regions. It is also reasonable to assume that improvements in manufacturing labor productivity, as well as changes in manufacturing business practices, are fairly widespread throughout the economy and not restricted to Chicago alone. Thus, future employment growth is less likely to come from manufacturing in other regions as well as in Chicago. Whether other regions should pay more attention to the service sector and particularly to final demand effects cannot be determined based on our results in this article because regional economies differ.

FOOTNOTES

[1]See Allardice (1990) for a description of REAL.

[2]See Kutscher (1988) and Tschetter (1987) for recent work on this subject.

[3]Much of this work has been conducted at the Bureau of Labor Statistics by Kutscher (1988), Tschetter (1987) and others.

[4]Using the Standard Industrial Classification—SIC—codes, we define the resources and construction sector as SICs 0 and 1, the manufacturing sector as SICs 2 and 3, and the services sector as SICs 4-8, with the TCU sector as SIC 4, Trade as SIC 5, FIRE as SIC 6, and personal and business services as SICs 7 and 8.

[5]For additional examples, see Kutscher (1988).

[6]For details regarding input-output tables and models, see Hewings (1985), or, for a more technical presentation, Miller and Blair (1985).

[7]The only exception that we are aware of for the United States are the Washington input-output tables. See Bourque (1987).

[8]CREIM is based upon the Washington Projection and Simulation Model (WPSM). For details, see Conway (1990).

[9]Details are reported in Hewings and Israilevich (forthcoming).

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