

MANUFACTURING IN DECLINE? A MATTER OF DEFINITION

DILEK CETINDAMAR KARAOMERLIOGLU and BO CARLSSON*

*Economics Department, Case Western Reserve University, 10900 Euclid
Avenue, Cleveland, OH 44106-7206, USA*

(Received 29 September 1997; In final form 21 September 1998)

This paper offers a new approach to the definition of manufacturing activities, placing them in a broader framework to capture the dynamics of manufacturing in the economy. After discussing why in many cases it may be appropriate to consider producer services and manufacturing industries together, the paper analyzes the development of manufacturing and producer service industries in the United States. We examine the factors leading to the growth of producer services, concluding that unbundling, the shift of some activities (such as legal, accounting, and data processing services) from manufacturing to producer services industries, is an important explanation for this growth. Finally, we discuss the relationship between manufacturing and producer services. Our analysis, based on a broader definition of manufacturing, shows that over the last two decades the U.S. manufacturing base has declined only slightly rather than radically as suggested in many studies.

KEY WORDS: Manufacturing, Producer services, U. S. economy

JEL Classification: L0, L6

It has been widely observed and often lamented that the share of the manufacturing sector in the economy is decreasing. In the industrial countries as a group, the share of manufacturing in the total labor force started shrinking around 1970, and the manufacturing share of GDP in current prices started declining even earlier. However, the share has been roughly constant since the mid-1970s if measured in constant prices (IMF, 1997).

The purpose of this paper is to show (1) that from several points of view, manufacturing as conventionally defined statistically should be broadened to include certain industry-related services, and (2) that if a broader definition is used, the share of manufacturing has remained fairly constant even if measured in terms of employment and has diminished even less if measured in terms of output or value added.

Why should anybody care whether or not the share of manufacturing in

*Corresponding author: Tel: 216. 368 4112, Fax 216. 368 5039, e-mail: bxc4@po.cwru.edu

the economy is declining?

First, it matters for public policy and for both private and public welfare whether or not people have a correct understanding of the state and direction of the economy.

Second, given that statistical definitions are in some ways arbitrary, it is incumbent upon economists as professional users of data to make sure that the definitions that are used are proper and relevant for the purpose at hand.

Third, if we ourselves have misperceptions, this will distort or limit our analyses and may lead us to draw erroneous conclusions.

This paper offers a new approach to the definition of manufacturing activities, placing them in a broader framework to capture the dynamics of manufacturing in the economy. Services growth and manufacturing growth are generally considered as opposites, because manufacturing employment in industrialized countries has been shrinking, while service employment has grown. In the United States, much of the discussion about this change has revolved around the concept of "de-industrialization," the perceived weakening of manufacturing industry in the overall economy. Whether losing the manufacturing base is harmful for the economy's long-term economic growth has been an issue of extensive debate (Cohen and Zysman, 1987). Moreover, these statistics have led people to believe that structural changes have happened which might not have actually happened. For example, in the UK the Thatcher government celebrated the rise of the service economy and researchers talked about the "post-manufacturing economy" (Hirst and Zeitlin, 1991). This paper shows that the decline in manufacturing is not large if producer services and manufacturing are considered together as a broadly defined manufacturing industry. We assert that producer services are complementary to manufacturing. When they are viewed as such, the picture of de-industrialization changes substantially.

As producer services and services in general are vague terms, we will first clarify the definitions used in this paper. In the second section, we will explain why in many cases it may be appropriate to consider producer services and manufacturing industries together when analyzing changes in the economy. The third section will analyze the development of both manufacturing and producer service industries in the United States. Then, we will examine the factors leading to the growth of producer services. Finally, we will discuss the relationship between manufacturing and producer services.

1. DEFINITIONS

Concerns about the decline of U.S. manufacturing and the corresponding growth of services arise partly from misconceptions regarding services. The service industry is difficult to define because it includes many diverse

activities such as haircutting, legal assistance, electronic data processing, medical services, and research and development (Delaunay, 1992). Although there is no consensus on the definition of a service industry, there is a broad agreement about the attributes of its products: they are not tangible; they are consumed at the same time they are produced; they have intangible value added; they are labor intensive. However, these product attributes do not necessarily apply all at once to all service industries. For example, many services (such as computer programming and life insurance) are not consumed at the time they are produced (Riddle, 1986:8).

This paper will use the term service industry as Gershuny and Miles (1983:3) defined it: "Service industry covers all those firms and employers whose major final output is some intangible or ephemeral commodity or, alternatively, that residual set of productive institutions in the formal economy whose final output is not a material good."¹ This definition implies that service industry activities may also be supplied in other industries. This is especially important in connection with producer services, which are highly interrelated with manufacturing industry and which are produced both in manufacturing and in the producer services industry.

Not only the definition but also the grouping of various services is difficult (Delaunay, 1992)². The most widely used classifications are based on the following three criteria:

a) The first criterion stems primarily from Marxist literature and classifies services into five groups according to their function or place within the socioeconomic system. Accordingly, services may be used in circulation (for example, banking); in reproduction of the social factors of production (for example, maintenance); in reproduction of the social conditions of accumulation (for example, government); in production itself; and in consumption (Martinelli, 1991 :17).

b) According to the second criterion, which is based on the type of demand for services, two types of services exist. Those consumed by individuals or in production of other services are called consumer services (such as domestic services, hotels, and lodging places), while those used in the production, distribution and consumption of material goods are called producer services (Gershuny and Miles, 1983:15).

¹Even though a good, especially a capital good, may be used as a source of intangible services, it is still possible to distinguish between the good and the services it produces. For example, cars are produced in the motor vehicle industry as material goods which can be used either directly by consumers or indirectly via a car rental company, a service provider. In the latter case, the service company delivers the service function by renting cars to customers but it does not produce the car, the material good.

²For an exhaustive survey of services, see Gershuny and Miles (1983), Daniels (1991: 1985), and Riddle (1986).

c) The third criterion, based on the production of services, was first defined by the Fisher-Clark model, which classifies economic activities into primary (agriculture, mining), secondary (manufacturing), and tertiary (residual) (Riddle, 1986:15). Tertiary activities that are all economic activities other than agriculture, mining, and manufacturing are defined as service industries.

In classifying services, this paper will use the second criterion, based on the type of demand for services, which considers producer services to be

“activities related to the mobilization of resources (banking, finance, engineering, recruiting and training), the conception and innovation of products and processes (R&D, design, engineering), the actual organization and management of production (consulting, information processing, accounting, legal services), production itself (quality control, maintenance, logistics), the promotion and distribution of products (transportation, commercial intermediation, marketing, advertising)” (Martinelli, 1991).

Defined as such, producer services are production-oriented activities. The products of these industries are used in the production and distribution of material goods. However, it is important to note that some industries, such as banks and railways, provide their services not only to industries but also to individuals, and it is difficult to distinguish between them.

In order to study the development of producer services, we will use Standard Industry Classification (SIC) codes to group industries as producer industries. It should be kept in mind that SIC groupings are to some extent arbitrary. For example, newspapers are classified in manufacturing, whereas computer programming is classified as a service industry. Similarly, when accountants or computer programmers are on a manufacturing firm's payroll, their work is classified as manufacturing. However, if their services were contracted for by the same manufacturing firm, they would be classified as service workers. The same holds for other activities, such as legal services, that can be performed within a firm or contracted out (Kutscher, 1988: 71). Although this leads to some limitations in the studies using SIC groupings, no comprehensive alternative exists. Accordingly, in this study, producer services consist of transportation and communication (SIC 4); wholesale trade (SIC 50,51); finance, insurance, and real estate (SIC 6); and business, legal, and engineering services (SIC 73, 81,87).

2. WHY SHOULD PRODUCER SERVICES BE CONSIDERED TOGETHER WITH MANUFACTURING?

Manufacturing and producer services consist of different sets of economic activities and industrial characteristics. However, in many respects they are complementary and interdependent industries. On one hand, the service sector is dependent on manufacturing because its activities mostly complement the production of manufactured goods. Although some studies argue that many goods would be provided in the United States no matter where they are manufactured (Quinn and Guile, 1988b), it would be difficult to maintain the producer services industry without having manufacturing in the country. The reason is that producer service firms must locate near their market because of two important features, namely, the close interaction between suppliers and users; and customization of producer services to the user's particular needs (Martinelli, 1991; Leo and Philippe, 1991:323). However, this does not necessarily mean that producer service firms must always be located near the market, but rather that these services must be considered together with the location of the manufacturing activities they serve (O'Farrell et al. 1993:385; Daniels, 1985). Accordingly, although producer services are increasingly concentrated in industrialized countries, especially in a few central metropolitan regions, these heavily concentrated service firms continue to open many branches, within their own countries and abroad, in order to locate in areas where manufacturing is dense (Porterfield and Pulver, 1991; Martinelli, 1991:73-78; Leo and Philippe, 1991). Therefore, an important portion of producer services is still heavily dependent on the location of manufacturing, although some producer services may not be affected by manufacturing's movement to other regions or countries because they restructure themselves accordingly (Marshall, 1989:148).

Another important point regarding the location of producer services may be shown by means of trade statistics. Although there is substantial trade in some service categories such as travel and license fees, international trade in many producer services (such as business, professional, and technical services) is very small (Sondheimer and Bargas, 1993). This may be explained by the fact that these services are best supplied by firms located near their customers. For example, 1992 exports of advertising, legal, and computer and data processing services (excluding those involving parent companies and their foreign affiliates) only amounted to between 1% and 3% of receipts by U.S. producer services firms (Sondheimer and Bargas, 1993:122). Thus, even though producer services have been among the most productive and fastest-growing in the U.S. economy, direct exports of producer services have been low. Instead, exports of producer services are often indirect (embodied in manufacturing products). Also, the international activities of service companies often take the form of foreign direct investment rather than exports; providers of producer services seem to prefer to locate close to manufacturing centers.

A healthy manufacturing sector is dependent on services for many reasons. First, producer services can improve productivity and (or) value added in manufacturing (Hansen, 1994:189). A high percentage (75-85%) of all value added and costs in manufacturing are due to service activities including planning, accounting, inventory, quality assurance, transportation, design, advertising, and distribution (Quinn, 1988b:35). For example, 60-70% of the value added in the computer market comes from software or maintenance services (Gershuny, 1987:111). Moreover, the role of producer services in providing employment is increasing in many countries. For example, a study of producer service employment in Britain estimates that it amounted to 30% of all employment, while production employment accounted for 25-30% and consumer-orientated services for 40-45% (Wood, 1986:40). Thus, the presence of efficient, well-developed services leads to high value added, increased productivity, and the growth of employment and skills.

Second, producer service firms play an important role in innovation, especially in small manufacturing firms, by providing information and expertise that may not be available elsewhere. In fact, the role of services in infrastructure, particularly for communication and information, may be the most important function that makes services inseparable from manufacturing, especially in the case of manufacturing of multi-locational, multinational firms. Another reason is that all sorts of services, including producer services, are the major markets for consumer and commercial products. For instance, transportation services are the main buyers of trucks and planes.

Third, manufacturing success increasingly requires rapid feedback from the marketplace, more customized products, and accurate delivery over shorter cycles (Coffey and Bailly, 1991:100-2). For example, integrated manufacturing systems help firms to become more competitive in the market. Firms like Exxon and General Motors argue that information management is as important as their production activities (Quinn, 1988b:35).

Finally, service is sometimes an important way for firms to differentiate their offerings. For example, Ford Motor Company supplies financial services to customers to compete more efficiently with other car manufacturers. These financial service activities, which are provided by a subsidiary company, represent one third of Ford's total revenues (ABCNEWS, 1998).

Our thesis is that as manufacturing and producer services become more interdependent, they must be analyzed and understood in relation to each other. This does not necessarily imply a redefinition of all industrial categories. Rather, we argue that as the structure of the economy is changing, we cannot always rely on traditional categories. In order to improve our assessment of the economic transformation taking place, we need to incorporate the production-related services into the analysis of manufacturing, while for other purposes they should continue to be treated separately.

To demonstrate how such an approach enriches the analysis of industrial

structure, section 3 will explore the changes in manufacturing and producer services, taking as a case study the United States during the period 1975-95. As shown in table 1, the trend towards declining shares of employment in manufacturing and increasing shares in manufacturing-related services (particularly financing, insurance, real estate and business services) over the last two decades can be observed not only in the United States but also in many other advanced industrial countries.³

Table 1. Share of Civilian Employment in Manufacturing and Manufacturing-Related Service Industries in Various Countries 1976, 1986 and 1996

	1976	1986	1996
<i>Canada</i>			
Manufacturing	20.3	17.3	15.2
Wholesale & retail trade, restaurants and hotels	21.6	23.8	23.8
Transport, storage and communication	7.5	6.7	6.4
Financing, insurance, real estate, and business services	8.4	10.3	12.6
Sum of above	57.8	58.1	58.0
<i>France</i>			
Manufacturing	27.3	22.7	n.a.
Wholesale & retail trade, restaurants and hotels	15.7	16.6	n.a.
Transport, storage and communication	6.1	6.5	n.a.
Financing, insurance, real estate, and business services	6.5	8.4	n.a.
Sum of above	55.6	54.2	n.a.
<i>Germany</i>			
Manufacturing	n.a.	32.2	27.0
Wholesale & retail trade, restaurants and hotels	n.a.	16.2	15.1
Transport, storage and communication	n.a.	5.9	6.1
Financing, insurance, real estate, and business services	n.a.	7.5	8.9
Sum of above	n.a.	61.8	57.1
<i>Italy</i>			
Manufacturing	n.a.	22.9	22.8
Wholesale & retail trade, restaurants and hotels	n.a.	21.4	21.6
Transport, storage and communication	n.a.	5.4	5.4
Financing, insurance, real estate, and business services	n.a.	3.6	8.4
Sum of above	n.a.	53.3	58.2
<i>Japan</i>			
Manufacturing	25.5	24.7	22.3
Wholesale & retail trade, restaurants and hotels	21.8	22.9	22.6

³Unfortunately, the industries for which comparable international data are available are broader than they should be for our current purposes - see further below. Nevertheless, the data show that the U.S. trends are not unique but appear to be representative of the major advanced countries.

Table 1. Share of Civilian Employment in Manufacturing and Manufacturing-Related Service Industries in Various Countries 1976, 1986 and 1996 (continued)

	1976	1986	1996
<i>Japan</i>			
Transport, storage and communication	6.5	6.0	6.3
Financing, insurance, real estate, and business services	5.2	7.1	8.6
Sum of above	59.0	60.7	59.8
<i>Sweden</i>			
Manufacturing	26.9	22.9	19.4
Wholesale & retail trade, restaurants and hotels	14.5	13.9	15.2
Transport, storage and communication	6.7	7.1	6.6
Financing, insurance, real estate, and business services	5.9	7.7	11.6
Sum of above	54.0	51.6	52.8
<i>Turkey</i>			
Manufacturing	12.5	14.0	14.7
Wholesale & retail trade, restaurants and hotels	7.7	10.8	12.6
Transport, storage and communication	3.9	4.3	4.3
Financing, insurance, real estate, and business services	2.0	1.7	2.3
Sum of above	26.1	30.8	33.9
<i>United Kingdom</i>			
Manufacturing	30.2	24.3	19.3
Wholesale & retail trade, restaurants and hotels	18.4	20.1	20.0
Transport, storage and communication	6.3	6.0	6.2
Financing, insurance, real estate, and business services	6.6	9.7	13.8
Sum of above	61.5	60.1	59.3
<i>United States</i>			
Manufacturing	22.8	19.1	16.2
Wholesale & retail trade, restaurants and hotels	21.8	22.2	22.1
Transport, storage and communication	5.6	5.4	5.4
Financing, insurance, real estate, and business services	7.5	10.3	11.2
Sum of above	57.7	57.0	54.9

Source: OECD, *Labour Force Statistics 1976-1996*. Paris: OECD, 1997

3. DEVELOPMENTS IN U.S. MANUFACTURING AND PRODUCER SERVICES

In this section we examine the role of producer services in the U.S. economy by observing their share in gross domestic product and employment. Additionally, we analyze the interactions of producer services with other industries through the buyer and supplier industries of producer services obtained from the U.S. 1994 input-output (I/O) table as well as a comparison of 1994 data with 1987 I/O data.

Table 2 shows that between 1977 and 1990, the manufacturing indus-

try's share in real GDP decreased from 23.9% to 18.5%, while the "producer services" share (as defined in the table) increased from 30.7% to 33.0%. But this definition of producer services excludes business services, legal services, and engineering and management services. These sectors are not shown separately but are included in the "Services" sector instead. These fast-growing sub-sectors are responsible for most of the increase in the service industry share from 34.3% to 39.4% of total GDP. This analysis suggests that the United States is losing its manufacturing base and becoming a service-based country.

However, this scenario changes completely if we consider producer services and manufacturing in the broader category of manufacturing-related industries as suggested in the previous section. Considered together, they constituted 54.6% of GDP in 1977 and 51.6% in 1990. First of all, this shows that the total manufacturing base is reduced only 5.6% which is far less than the decrease in the share of manufacturing alone which declined by 22.4% (from 23.9% in 1977 to 18.5% in 1990). Second, the loss in manufacturing is offset by the gain in producer services. This may be due to the shift of some of the production from manufacturing to services. More importantly, this analysis shows that manufacturing-related industries continue to be important forces in the U.S. economy, since they still accounted for more than half of GDP in 1990. This development is also observed in some other industrialized countries. For example, a Swedish study shows that if the manufacturing sector is defined to include manufacturing-related services, the share of this sector in GDP fluctuated between 42 and 50 percent during the period 1950-91, with no particular time trend (Sjöholm, 1993:205).

Table 2. Real Gross Domestic Product by Industry Group, (Percentage) 1977-1990

<i>Industry</i>	<i>1977</i>	<i>1982</i>	<i>1987</i>	<i>1990</i>
Agriculture	2.1	1.5	1.6	1.5
Mining	2.8	4.7	1.8	1.6
Construction	4.8	4.1	4.7	4.4
Manufacturing	23.9	20.6	18.2	18.5
Services*	34.3	35.6	37.5	39.4
Producer services	30.7	32.2	33.7	33.0
Transportation and public utilities	9.2	9.3	9.2	8.8
Wholesale trade	7.1	6.9	6.7	6.5
Finance, insurance, and real estate	14.5	16.0	17.8	17.7

* Includes government services.

Source: Richard M. Beemiller and Ann E. Dunbar, 1993. Gross State Product, 1977-90, *Survey of Current Business*, December, 42.

With respect to employment, the developments in manufacturing are sharply different from those in service industries. As shown in table 3, manufacturing employment was almost constant in absolute terms over the period as a whole (approximately 18 million). However, its share in total U.S. employment decreased by 34% (from 23% in 1975 to 15% in 1995). During these years, employment in services more than doubled. It increased by 18.6 million new jobs, i.e., by more than the total number of people employed in manufacturing. This corresponds to an increase of the service share in total employment from 17% in 1975 to 27% in 1995. Although producer services also experienced a rapid growth (1.8-fold) in the same period, it created "only" 13.4 million new jobs. The slower growth of producer services compared to other services may be explained partly by technological change and partly by this sector's dependence on the manufacturing sector.

Table 3. Industrial Employment, (Thousands) 1975-95

<i>Industry</i>	<i>1975</i>	<i>1980</i>	<i>1985</i>	<i>1990</i>	<i>1995</i>
Agricultural services	168	247	363	488	552
Mining	738	1,002	898	689	577
Construction	3,537	4,298	4,576	4,985	5,131
Manufacturing	18,326	20,356	19,212	19,104	18,507
Services (except producer services)	13,910	17,863	21,948	27,836	32,497
Producer services	16,297	20,206	23,274	27,307	29,734
Transportation, communication, and public utilities	4,511	5,112	5,205	5,774	6,045
Wholesale trade	4,423	5,289	5,694	6,195	6,278
Finance, insurance, and real estate	4,189	5,151	5,941	6,685	6,857
Business services	1,768	2,661	3,808	5,270	6,949
Legal services	343	500	696	906	950
Engineering and management services	1,063	1,493	1,930	2,477	2,655
Total employment	77,412	90,914	97,779	109,965	116,892
Producer services and manufacturing	34,623	40,563	42,487	46,410	48,241

Source: Regional Financial Associates.

When we begin to analyze employment in manufacturing and producer services together, we encounter a different picture. First of all, we see that the combined employment of both industries increased by 39% (from 34.6 million in 1975 to 48.2 million in 1995). Second, the analysis mentioned

earlier shows a sharp reduction in manufacturing's share of total employment, while our analysis indicates a moderate reduction of only 3.5 percentage points (from 44.7% in 1975 to 41.2% in 1995). It is worth noting that these two industries constituted more than 40% of total employment in the U.S. economy during the entire period, as shown in chart 1.

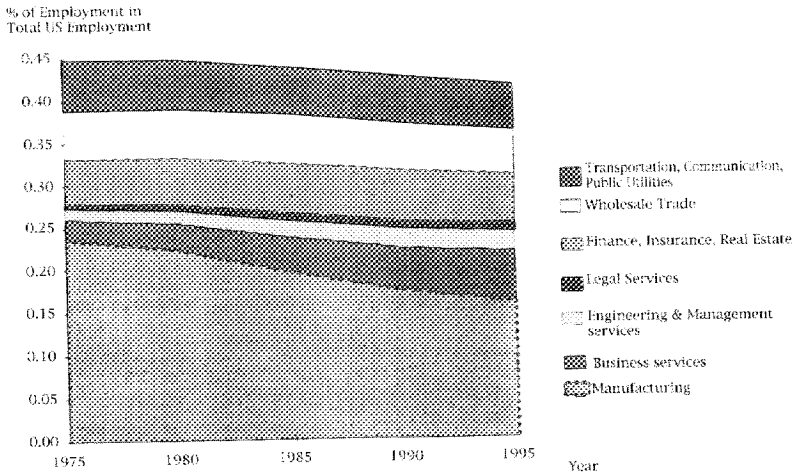


Chart 1. Employment in Manufacturing and Producer Services in the United States as a Share of Total Employment, 1975-1995 (percent)

Source: Regional Financial Associates.

Furthermore, our analysis shows the interactions between industries in depth. A close examination of employment in the sub-sectors of producer services as defined in table 3 indicates that the highest growth is experienced in services that are mainly production oriented. The high-growth sub-sectors are business services (3.8-fold increase), legal services (3.9-fold increase), and engineering and management services (2.4-fold increase). These employment increases correspond to a fundamental change in the functions of producer services. At first glance it may not be clear how legal services contribute to manufacturing, but they play a significant role. For example, many biotechnology and pharmaceutical firms rely on legal service firms' expertise in patenting or filing regulative forms, which are required by government agencies such as the Food and Drug Administration.

In order to observe the relationship between producer services and man-

ufacturing, we will further analyze input-output tables, which show the production linkages (Engelbrecht, 1992). For instance, the commodity-by-industry table shows the cost of products purchased from all industries in order to produce \$1 of output in an industry. (Data computed from both the 1994 and the 1987 I/O tables for the United States are given in appendix A.) On the basis of these tables, we will investigate the buyer and seller relationships between industries.

Table 4 (last column, bottom panel) shows that of every \$100 worth of producer services produced in 1994, \$28.75 was purchased as inputs, the remainder (\$61.25) being sold to final consumers. Nearly half (47.6%) of the \$28.75 went as inputs into manufacturing industries, while 28.5% went into other producer services and 20.8 % into other service industries. Similarly, of every \$100 of manufactured goods, \$42.03 went as input into the production system (and the remaining \$57.79 went to final consumption). More than 80 % (82.4 %) of the inputs of manufactured goods went to other manufacturing industries, while 4.9 % went to producer services and 10.4% to service industries.

If we look at the output side instead (top panel in table 4), we find that of the \$12.01 purchased from other industries by producer services for every \$100 of output, \$8.19 came from other producer service providers and \$2.07 from manufacturers. Of the \$53.71 purchased by manufacturers for every \$100 of output, \$34.64 came from other manufacturers and \$13.68 from producer service firms.

Thus, the largest purchases by manufacturers from non-manufacturers were from producer service providers, and the largest purchases by producer service firms from outside their own industry were from manufacturers. The picture is similar on the input side, except that the service sector (by virtue of its sheer size), not the producer service industry, was the largest non-manufacturing buyer of manufactured goods. The main point here is that manufacturing and producer services are closely related via their input-output linkages and are each other's largest customers.

A comparison of the input/output tables for 1994 and 1987 (see table 4 and Appendix B) shows that the buyer-supplier relationships between manufacturers and producer service providers have tightened over time. The purchases of these industries from each other roughly doubled per unit of output between 1987 and 1994. This was probably a result of a general increase in specialization and outsourcing; for example, the value of manufacturing output which became input into other industries increased from \$22.14 to \$42.03 of every \$100 worth of manufacturing output. The corresponding numbers for producer services are \$15.85 and \$28.75. Manufacturing remained the biggest buyer of producer services, while the service industry's purchases of manufactured goods grew even faster than did the producer service industry's purchases, surpassing the latter.

Table 4. The Distribution of Producer Services' and Manufacturing Industries' Output and Input Across Industries, (Input/Output Coefficients) 1994

	<i>Agriculture</i>	<i>Mining</i>	<i>Construction</i>	<i>Manufacturing</i>	<i>Producer Services</i>	<i>Services</i>	<i>Total</i>
Output purchased by producer services from:	0.02 (0.2%)	0.41 (3.4%)	0.33 (2.7%)	2.07 (17.2%)	8.19 (68.2%)	0.99 (8.2%)	12.01 (100%)
Output purchased by manufacturing from:	1.84 (3.4%)	1.86 (3.5%)	0.47 (0.9%)	34.64 (64.5%)	13.68 (25.5%)	1.22 (2.3%)	53.71 (100%)
Input from producer services into:	0.25 (3.5%)	0.48 (1.7%)	0.17 (0.6%)	13.68 (47.6%)	8.19 (28.5%)	5.98 (20.8%)	28.75 (100%)
Input from manufacturing into:	0.32 (0.8%)	0.33 (0.8%)	0.28 (0.7%)	34.64 (82.4%)	2.07 (4.9%)	4.39 (10.4%)	42.03 (100%)

Source: Derived from the 1994 US Input-Output Table provided by CAMP (Cleveland Advanced Manufacturing Program).

Note: The numbers in parentheses show the percentage share. The two largest numbers in each row are presented in boldface.

The changes in services' purchase pattern may be a good indicator of our argument of how manufacturing and producer services complement each other. The large jump in producer services' input into service industry is, by and large, related to its heavy investment in manufactured goods, since service firms needed producer services to utilize material goods purchased from manufacturing industry. For example, computers are of no use unless software is installed. Therefore, the example of service industry's purchase of both manufactured goods and producer services shows us two facts: first, even though the input of both manufactured goods and producer services into services increased significantly during the period 1987-94, the input of manufactured goods to producer services and the input of producer services to manufacturing industry increased significantly, too. Second, the integration of manufactured goods and producer services does not necessarily take place in either of these industries, but in a third industry like services.

Thus, the examination of the I/O tables indicates that manufacturing industry among all non-producer services is the most important buyer and supplier to producer services and it has high input from producer services. In other words, producer services is highly dependent on manufacturing industry as both supplier and buyer. Manufacturing industry, however, relies on producer services only as the most important supplier outside the manufacturing industry itself.

4. WHAT ARE THE CAUSES OF GROWTH IN PRODUCER SERVICES?

The literature discusses many possible causes of the growth of employment in producer services. Five of these factors — total economic growth, low productivity of services, change in demand, change in supply, and unbundling — merit attention.

The first factor, total economic growth, is the conventional argument that as the economy grows, demand shifts towards services (Kindleberger, 1958). The average annual rates of growth of real gross domestic product (GDP) in selected major sectors of the U.S. economy between 1977 and 1990 are shown in table 5. Manufacturing grew during these years. But it increased at a lower rate than the economy as a whole, except in the 1982-90 period, when manufacturing grew 3.6% annually while the economy as a whole grew at a 3.4% annual rate. Unlike manufacturing, services and producer services had consistently higher growth than the whole economy throughout the 1977-90 period. While the share of GDP in some services, such as utilities, has diminished, the share of some others, especially the share of producer services such as communications, has increased significantly.

Table 5. Average Annual Growth Rates of Real Gross Domestic Product by Industry Group, 1977-90 (percent)

	1977-90	1977-82	1977-87	1982-90
Gross domestic product	2.7	1.7	2.9	3.4
Agriculture, forestry, and fisheries	3.1	2.8	3.3	3.2
Mining	0.4	-2.6	-0.1	2.3
Construction	0.7	-2.9	1.1	3.0
Manufacturing	2.3	0.2	2.5	3.6
Producer services	3.5	2.7	3.7	4.0
Transportation	2.5	-0.3	2.7	4.2
Communications	5.1	6.6	5.7	4.2
Utilities	1.7	-1.5	1.2	3.8
Wholesale trade	5.1	5.1	5.9	5.0
Finance, insurance, and real estate	2.9	3.5	3.1	2.6
Other services	3.8	3.1	3.8	4.2
Government	1.6	1.3	1.4	1.7
Retail trade	3.2	1.2	3.3	4.5

Source: Robert P. Parker, 1993. Gross Product by Industry, 1977-90, *Survey of Current Business*, May, 34.

Total economic growth, though a partial explanation, cannot explain why the growth of producer services has been larger than that of the econ-

omy as a whole, since subcategories of producer services show different trends in terms of growth.

Another traditional way to explain producer services' growth is related to the lower rate of labor productivity growth in the service sector relative to manufacturing (Riddle, 1986; Gershuny and Miles, 1983). According to this argument, even if demand growth were equally distributed across the sectors, it would require a continuous transfer of labor to the service sector. There are clearly many difficulties involved in measuring output and hence productivity in service industries (see e.g. Quinn and Baily, 1994). But if we use conventional measures, we see that the productivity growth rate of services is low compared to that of manufacturing (see table 6). However, the productivity growth rates vary greatly among service sub-sectors. As shown in table 6, some producer services, such as communication, had higher productivity growth rates than manufacturing industries during the period 1977-93. Thus, the growth of producer services cannot result simply from the phenomenon of low productivity growth in services.

Table 6. Annual Growth Rates of Productivity, 1977-93 (percent)

	<i>Productivity Annual Growth Rate</i>
All private industries	0.8
Manufacturing	2.2
Services	0.3
Communication	4.6
Wholesale trade	3.2
Transportation	1.6
Retail trade	0.6
Legal services	-3.0
Auto repair	-2.1
Health services	-1.7
Personal services	-1.5

Source: U. S. Department of Commerce, Bureau of Economic Analysis.

The third explanation of producer services growth argues that changes in demand for producer services have been the main impetus (Ray, 1986; Martinelli, 1991). This demand increase can be explained, first and foremost, by the fact that producer services are an outgrowth of increased technical and social division of labor within production. That is why the transformation of the production system from fordism to post-fordism had important repercussions on the demand side of producer services (Coffey and Baily, 1991:100). A significant increase in demand for accounting, R&D, advertising, and engineering services has arisen from knowledge-

oriented production, which uses more design inputs than standardized products (Daniels, 1985:157). Moreover, because of the application of new technologies in the 1980s, producer services substitute directly for manufactures in many cases. As Quinn (1988a:18) argues,

“new CAD/CAM software can substitute for added production or design equipment, and improved transportation or handling services can lower a manufacturer’s costs as effectively as cutting its direct labor or material inputs. These investments in service activities improve productivity or add value just like any other new investment in physical-handling machinery or product features.”

Therefore, when industrial production entered a new phase along with the application of new technologies, it affected producer services and increased the demand for them.

The demand for producer services is also influenced by changes in firm structures (Coffey and Bailly, 1991:102). Firms are undergoing various forms of restructuring ranging from downsizing, subcontracting, and strategic alliances to reorganization of multinationals and their suppliers. This restructuring is accelerated by the developments in information and telecommunication technologies that are used extensively in producer services firms. For example, large multinationals demand more producer services in order to separate their production, organization, control, and distribution functions (Martinelli, 1991: 23; Marshall, 1989). This, in turn, has intensified demand for specialized, sophisticated producer services and has increased international trade in services. But as pointed out earlier, a lot of this trade is indirect, via manufactured goods. Another reason for this growing demand has been the increase in complex government and international regulations, which create problems requiring the experience of firms that specialize in laws affecting banking, environment, labor relations, safety, and other services (Coffey and Bailly, 1991:100; Quinn, 1988b).

There are also changes on the supply side which provide a plausible explanation for the growth of producer services. When producer services firms can supply services more cheaply or efficiently than manufacturing firms can provide them internally, manufacturing firms prefer to buy from specialized producer services firms (Daniels, 1985:53; Goe, 1991:120). This has happened to a significant degree, since the application of new technologies has given producer services new capabilities and economies of scale and scope. Information technologies, particularly, have accelerated the specialization and globalization of services by introducing greater flexibility and adaptability of information storage and transfer. These tech-

nologies have also lowered costs while expanding the variety and geographical distribution of producer services (Quinn and Baily, 1994:33).

All these changes in the supply of producer services make them more desirable and foster their growth. When producer services started to become large-scale and complex activities, firms began to standardize some of their highly customized activities and invest in information technology. For example, in the 1960s and 1970s the daily volume of shares traded on the New York Stock Exchange was 10-12 million. In the 1980s, this number was 500 million. This increase in the number of transactions was handled easily because of the electronic systems used for automated trading (Quinn, 1988b:27). But more importantly, new technologies transform the quality features of the existing services such as complexity, timeliness, flexibility, response times, reliability, safety, accuracy, and consistent levels of performance (Quinn and Baily, 1994:29). These are some of the reasons why producer service firms are growing and supplying a large variety of services at lower costs.

The fifth factor used to explain the growth of producer services, "unbundling," refers to the shift of some activities, such as accounting, logistics, communications, and marketing from manufacturing to producer service industries (Kutscher, 1988:60; Coffey and McRae, 1989:67). Some studies call this phenomenon externalization, while others name it subcontracting or outsourcing, but in essence all these studies examine the division of labor among manufacturing and producer services industries.

Unbundling is explained largely by market uncertainty and increased competition, which force firms to subcontract their services in order to decrease their economic burdens in cases of crisis (Goe, 1991; Daniels, 1985; Carlsson, 1996). Moreover, technology plays an important role in the unbundling process. Although firms demand greater quantities of producer services due to changes in firm structure and focus in general as well as in their production systems, firms have limited capabilities to develop expertise on various producer services because of knowledge, personnel or cost limitations (Coffey and Baily, 1991:101). Considering the rapid changes taking place, particularly in information technologies, these limitations increase over time. Therefore, firms tend to purchase producer services from specialist firms.

Even though unbundling is widely accepted as a factor determining the growth of producer services (Greenfield, 1966; Ray, 1986:30; Fournier and Axelsson, 1993:285)⁴, there is also a discussion as to whether new functions supplied by producer services firms should be considered unbundling. For example, by the introduction of the Internet in the late 1980s, many manufacturing firms started to use web pages for their advertising and sales

⁴Only a few studies argue that unbundling has been negligible (Kutscher, 1988: 61).

activities. These are in many cases prepared and run by producer service firms. When a manufacturing firm with no previous advertising on web pages hires a producer service firm to prepare its web page, this can still be called unbundling. This is because the use of web page advertising (new function) will reduce the firm's in-house advertising activities in conventional forms (old functions). These new functions could, of course, be performed by the manufacturing firms themselves, but in many cases they are performed by producer service firms. Thus, there is an important element of unbundling of activities even for new functions which replace or reduce old ones performed by manufacturing firms.

Our analysis of the U.S. economy confirms that unbundling plays an important role in the growth of producer services, for two reasons. First, although changes in the supply of producer services can explain some of the growth in producer services, they do not exclude the unbundling effect, but rather support it. Changes in the supply of business and engineering services may be one reason why these services shift from manufacturing to the producer services industry. In fact, the analysis of I/O tables showed that producer services are the second most important supplier for manufacturing industry after itself and that the supply of producer services to manufacturing nearly doubled between 1987 and 1994.

Second, most of the growth in demand for producer services has come from manufacturing. But manufacturing employment and its occupational distribution remained stable in absolute terms during the 1977-90 period. Meanwhile, the gross domestic product in manufacturing increased from \$741 billion in 1977 to \$922 billion in 1990 (in 1987 prices) (USDC-ESAOPD, 1996). As production growth in manufacturing was accomplished with stable employment, it seems plausible that the requirements for producer services were satisfied outside manufacturing industry, in the producer service industry itself. This conclusion is also consistent with the results of our I/O analysis, namely that manufacturing industry is the largest customer for producer services, buying approximately 48% of total producer services both in 1987 and 1994.

In brief, the unbundling factor can explain most of the growth of producer services. It also enables us to construct a comprehensive approach for exploring the relationship between manufacturing and producer services.

5. CONCLUSIONS

During the last two decades, a significant shift of activities has occurred from manufacturing to producer services. There is strong and increasing interdependence between these industries and increased blurring of the boundaries between them. This suggests that for some purposes the two should be considered jointly within a broader definition of manufacturing when studying

structural change in the economy. Our analysis shows that when such a broadened definition is used, the results regarding the role of manufacturing and producer services in the economy differ greatly from those when the role of each industry is viewed separately. If one employs a broader definition of manufacturing, it turns out that the U.S. manufacturing base has not declined radically over the last two decades, as has often been argued. Instead, the total employment in U.S. manufacturing more broadly defined declined only slightly. There is evidence, some of which has been presented in this paper, to suggest that the development in the United States is not unique but is similar to that in other advanced economies. The results reported here confirm those obtained in a previous study of Sweden (Sjöholm 1993).

APPENDIX A

Table A1. Commodity by Industry Direct Requirements, 1994

<i>Commodity</i>	<i>Industry</i>	<i>Agriculture</i>	<i>Mining</i>	<i>Construction</i>	<i>Manufacturing</i>	<i>Services</i>	<i>Producer Services</i>
Agriculture		0.342	0.001	0.005	1.844	0.088	0.019
Mining		0.002	0.229	0.008	1.857	0.028	0.411
Construction		0.011	0.018	0.004	0.466	0.438	0.326
Manufacturing		0.323	0.335	0.280	34.639	4.392	2.070
Services		0.052	0.028	0.058	1.224	2.421	0.990
Producer Services		0.259	0.481	0.166	13.676	5.982	8.195

Source: Derived from the 1994 U.S. Input-Output Table provided by CAMP (Cleveland Advanced Manufacturing Program).

Note: This table is prepared by Regional Economic Models Incorporated (REMI), based on data from the official 1987 Input-Output Table. The original model has an I/O table of 53 industrial sectors, which can also be disaggregated into 466 sub-sectors. However, for the purpose of this paper, we aggregated data under six groups.

Table A2. Commodity by Industry Direct Requirements, 1987

<i>Commodity</i>	<i>Industry</i>	<i>Agriculture</i>	<i>Mining</i>	<i>Construction</i>	<i>Manufacturing</i>	<i>Services</i>	<i>Producer Services</i>
Agriculture		0.999	0.000	0.006	0.515	0.052	0.024
Mining		0.003	0.264	0.008	0.957	0.348	0.348
Construction		0.038	0.051	0.001	0.325	0.615	0.423
Manufacturing		0.590	0.444	0.293	18.437	2.381	1.698
Services		0.707	0.809	0.222	8.084	8.106	6.007
Producer Services		0.612	0.751	0.169	7.557	6.755	5.136

Source: Derived from the 1987 US Input-Output Table given in 1995 NESE-DB (National Economic, Social, and Environmental Databank) Database.

APPENDIX B

Table B1. The Distribution of Producer Services' and Manufacturing Industries' Output and Input Across Industries, (Input/Output Coefficients) 1987

	<i>Agriculture</i>	<i>Mining</i>	<i>Construction</i>	<i>Manufacturing</i>	<i>Producer Services</i>	<i>Services</i>	<i>Total</i>
Output purchased by producer services from:	0.02 (0.2%)	0.35 (4.1%)	0.42 (4.9%)	1.70 (20.0%)	5.14 (60.5%)	0.87 (10.2%)	8.5 (100%)
Output purchased by manufacturing from:	0.51 (1.8%)	0.96 (3.4%)	0.32 (1.1%)	18.44 (65.1%)	7.56 (26.7%)	0.53 (1.9%)	28.32 (100%)
Input from producer services into:	0.61 (3.8%)	0.75 (4.7%)	0.17 (1.1%)	7.56 (47.7%)	5.14 (32.4%)	1.62 (10.2%)	15.85 (100%)
Input from manufacturing into:	0.59 (2.7%)	0.44 (2.0%)	0.29 (1.3%)	18.44 (83.3%)	1.70 (7.7%)	0.68 (3.1)	22.14 (100%)

Source: Derived from the 1987 US Input-Output Table given in 1995 NESE-DB (National Economic, Social, and Environmental Databank) Database.

Note: The numbers in parentheses show the percentage share in total. The two largest numbers in each row are presented in boldface.

ACKNOWLEDGMENT

We are grateful to Paul Geroski, an anonymous referee, and the attendants of the 24th European Association for Research in Industrial Economics Conference for numerous helpful comments on an earlier draft. Support for research underlying this paper was provided by the Cleveland Advanced Manufacturing Program and Center for Regional Economic Issues (Case Western Reserve University), whose contributions are also gratefully acknowledged.

References

- ABCNEWS (1998) Ford to Spin off Associates, <http://www.abcnews.com/sections/business/DailyNews/ford303/index.html>, March 3.
- Beemiller, R. M. and A. E. Dunbar (1993) Gross State Product, 1977-90. *Survey of Current Business*, December, 28-49.
- Carlsson, B. (1986) Produktion och konsumtion av tjänster i privat och offentlig regi (Production and Consumption of Private and Public Services), in G. Eliasson, B. Carlsson, E. Deiaco, T. Lindberg and T. Pousette, *Kunskap, information och tjänster – en studie av svenska industriföretag* (Knowledge, Information and Services – a Study of Swedish Industrial Companies).

- Stockholm: Industriens Utredningsinstitut, 215-250.
- Carlsson, B. (1996) Small Business, Flexible Technology and Industrial Dynamics, in Z. Acs, B. Carlsson, and R. Thurik (eds.) *Small Business in the Modern Economy*. Oxford: Blackwell, 63-125.
- Coffey, W.J. and A. S. Bailly (1991) Producer Services and Flexible Production: An Exploratory Analysis. *Growth and Change*, Fall, 95- 117.
- Coffey, W.J. and J. J. McRae (1989) *Services Industries in Regional Development*. Nova Scotia: Institute for Research on Public Policy.
- Cohen, S.S. and J. Zysman (1987) *Manufacturing Matters. The Myth of the Post-Industrial Economy*. New York: Basic Books.
- Daniels, P.W. (1985) *Service Industries: A Geographical Appraisal*. London: Methuen.
- Daniels, P.W. (1991) Service Sector Restructuring and Metropolitan Development: Processes and Prospects. In P. W. Daniels and F. Moulaert (eds.) *The Changing Geography of Advanced Producer Services*. London: Belhaven Press.
- Delaunay, J.C. (1992) *Services in Economic Thought: Three Centuries of Debate*. Dordrecht Kluwer: Academic Publishers, Dordrecht.
- Engelbrecht, H. J. (1992) New Perspectives on Intersectoral Relationships Between Manufacturing and Services. *Economics of Planning*, 25, 165-178.
- Fournier, S.F. and S. Axelsson (1993) The Shift from Manufacturing to Services in Sweden. *Urban Studies*, 30(20), 285-298.
- Gershuny, J., and I. D. Miles (1983) *The New Service Economy*. London: Frances Pinter.
- Gershuny, J. I., (1987) The Future of Service Employment. In O. Giarini (ed.) *The Emerging Service Economy*. New York: Pergamon Press.
- Goe, W.R. (1990) Producer Services, Trade and the Social Division of Labor. *Regional Studies*, 24(4), 327-342.
- Goe, W.R. (1991) The Growth of Producer Services Industries: Sorting Through the Externalization Debate. *Growth and Change*, Fall, 118-139.
- Guile, B.R. and J. B. Quinn (1988a) *Managing Innovation: Cases from the Services Industries*. Washington: National Academy Press.
- Guile, B.R. and J. B. Quinn (1988b) *Technology in Services: Policies for Growth, Trade, and Employment*. Washington: National Academy Press.
- Greenfield, H. I. (1966) *Manpower and the Growth of Producer Services*. New York: Columbia University Press.
- Hansen, N. (1994) The Strategic Role of Producer Services in Regional Development. *International Regional Science Review*, 16(1&2), 187-195.
- Hirst, P., and Zeitlin, J. (1991) Flexible Specialization vs. post-Fordism: Theory, Evidence and Policy Implications. *Economy and Society*, 20 (1), 1-56.
- IMF (1997) *World Economic Outlook*. Washington, D.C.: IMF.
- Kindleberger, C.P. (1958) *Economic Development*. New York: McGraw Hill.
- Khayum, M.F. (1995) The Impact of Service Sector Growth on Intersectoral Linkages in the United States. *The Service Industries Journal*, 15(1), 35-49.
- Kutscher, R.E. (1988) Growth of Services Employment in the United States. In B.R. Guile and J. B.Quinn (eds.) *Technology in Services: Policies for Growth, Trade, and Employment*. Washington, D.C.: National Academy Press, 47-76.
- Leo, P. and Y. Philippe (1991) Networked Producer Services: Local Market and Global Development. In P. W. Daniels and F. Moulaert (eds.) *The Changing Geography of Advanced Producer Services*. London: Belhaven Press.
- Marshall, J.N. (1989) Corporate Reorganization and the Geography of Services:

- Evidence from the Motor Vehicle Aftermarket in the West Midlands Region of the UK. *Regional Studies*, 23(2), 139-150.
- Martinelli, F. (1991) A Demand-Oriented Approach to Understanding Producer Services. In P.W. Daniels, and F. Moulaert (eds.) *The Changing Geography of Advanced Producer Services*. London: Belhaven Press, 15-30.
- O'Farrell, P. N., Moffat, A. R., and D. M.W. N. Hitchens (1993) Manufacturing Demand for Business Services in a Core and Peripheral Region: Does Flexible Production Imply Vertical Disintegration of Business Services? *Regional Studies*, 27(5), 385-400.
- Parker, R. P. (1993) Gross Product by Industry, 1977-90. *Survey of Current Business*, May, 33-54.
- Porterfield, S. L. and G. C. Pulver (1991) Exports, Impacts, and Locations of Services Producers. *International Regional Science Review*, 14(1), 41-59.
- Quinn, J. B. (1988a) Services Technology and Manufacturing: Cornerstone of the US Economy. In B. R. Guile and J. B. Quinn (eds.) *Managing Innovation: Cases from the Services Industries*. Washington, D.C.: National Academy Press, 9-36.
- Quinn, J.B. (1988b) Technology in Services: Past Myths and Future Challenges. In B. R. Guile and J. B. Quinn (eds.) *Technology in Services: Policies for Growth, Trade, and Employment*. Washington, D.C.: National Academy Press, 16-46.
- Quinn, J. B. and M. N., Baily (1994) Information Technology: Increasing Productivity in Services. *Academy of Management Executive*, 8(3), 28-51.
- Ray, G. F. (1986) Services For Manufacturing. *National Institute Economic Review*, August, 30-32.
- Riddle, D. (1986) *Service-Led Growth: The Role of the Service Sector in World Development*. New York: Praeger.
- Sjöholm, K.-R., 1993 "Bilaga I: Den reviderade industrisektorn" (Appendix I: The Revised Manufacturing Sector). In T. Andersson, P. Braunerhjelm, B. Carlsson, S. Fölster, L. Jagren, E. Kazamaki Ottersten, and K. -R. Sjöholm (eds.) *Den långa Vägen - den Ekonomiska Politikens Begränsningar och Möjligheter att föra Sverige ur 1990-talets Kris*. Stockholm: Industrial Institute for Economic and Social Research (IUI), 203-298.
- Sondheimer, J.A. and S. E. Bargas (1993) US International Sales and Purchases of Private Services. *Survey of Current Business*, September, 120-156.
- UN (1995) *World Tables 1995*. (UN: New York).
- USDC-ESAOPD (United States Department of Commerce, Economics and Statistics Administration Office of Policy Development) (1996) *The New Face of American Manufacturing*. Washington, D.C.: USDC.
- Wood, P.A. (1986) The Anatomy of Job Loss and Job Creation: Some Speculations on the Role of the 'Producer Service' Sector. *Regional Studies*, 20(1), 37-46.