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Manufacturing's Changeover to Services in the Great Lakes Economy

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The much-ballyhooed economic shift from manufacturing to services raises many important questions, not the least of which concerns our understanding of the nation's economic structure. Is "what is good for General Bullmoose" still "good for the U.S.A."? Are we still tied to manufacturing? The latter question is especially relevant to the Great Lakes economy because of its strong historical dependence on manufacturing as its economic base. In earlier years, it was possible to monitor the Great Lakes economic performance as an outgrowth of its manufacturing sector. Now, this understanding of the region's economic structure has come under scrutiny as the region's growth in manufacturing output has trailed total regional product, and as manufacturing's employment share has plummeted (Tables 1-2).

This paper provides information to show that, although manufacturing's role has diminished, the manufacturing sector retains a critical role as the engine of the Great Lakes economy. When compared to the U.S., the manufacturing sector remains highly concentrated in the region. Moreover, in viewing the manufacturing industry alone, the importance of manufacturing to the Great Lakes economy is shown to be understated. Much of what used to be regarded as manufacturing in the Great Lakes region can now be found under the guise of the service sector. While the manufacturing sector has lost ground to the service sector, this can be partly explained by the service sector taking over some of the work of manufacturing companies. For this reason, the region's economic ties to manufacturing, as broadly defined to include services purchased by manufacturing companies, are shown to remain very strong.

Measuring a Region's Orientation to an Industry

In assessing whether the national economy is changing its orientation to manufacturing--whether the economy is deindustrializing or reindustrializing--other studies have deflated manufacturing and other industry output so

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as to look at shares of "real" product by industry. Such an approach is appropriate for large national economies wherein a large portion of what is produced by the nation is also consumed. If so, a constant share of real industry output, e.g. manufacturing, reflects the fact that the nation maintains its standard of living in producing and, ultimately, *consuming* goods from the industry sector.

Table 1

	Manufacturing employment		Manufacturing/ total employment		Concentration index; Great Lakes vs. United States
	Great Lakes	U.S.	Great Lakes	U.S.	
	(----------thousands----------)		(-------percent------)		
1969	5,953	20,531	29.1	22.9	1.27
1970	5,633	19,677	27.7	21.9	1.26
1971	5,383	18,851	26.6	20.9	1.27
1972	5,506	19,344	26.5	20.9	1.27
1973	5,871	20,414	27.1	21.1	1.29
1974	5,813	20,402	26.5	20.7	1.28
1975	5,209	18,660	24.3	19.2	1.27
1976	5,403	19,375	24.6	19.4	1.27
1977	5,625	20,094	24.8	19.4	1.27
1978	5,835	20,964	24.8	19.4	1.28
1979	5,850	21,490	24.3	19.3	1.26
1980	5,338	20,776	22.8	18.5	1.23
1981	5,213	20,643	22.4	18.2	1.23
1982	4,717	19,254	20.9	17.1	1.22
1983	4,593	18,899	20.3	16.6	1.22
1984	4,885	19,850	20.7	16.6	1.24
1985	4,879	19,768	20.1	16.0	1.25
1986	4,817	19,479	19.4	15.4	1.25

Note: The Great Lakes region is herein defined by the states of Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin.

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

However, in assessing the importance of an industry sector to a smaller geographic area, such as a state or region, it is income accruing from the industry sector which more often reflects an industry's importance to the

region. The industry in question as the region's economic engine, be it manufacturing or agriculture or mining, must generate sufficient income for its residents to maintain the area's population and/or standard of living. This is so regardless of real output produced by the sector. For example, the State of Illinois may have increased soybean production by ten-fold in comparison to 20 years ago when measured by a real quantity such as bushels. But if the price of soybeans has fallen one hundred fold, the industry's importance in supporting jobs and income in the state will have fallen.

Table 2

Manufacturing and total output in The Great Lakes and U.S.--1963 and 1986

	Manufacturing output		Total output		Mfg./Total output	
	Great Lakes	U.S.	Great Lakes	U.S.	Great Lakes	U.S.
	(----------$ billion 1982=100----------)					
1963	130	397	416	1,863	31.3	21.3
1969	174	537	530	2,395	32.8	22.4
1979	208	697	644	3,138	32.3	22.2
1980	186	665	612	3,111	30.4	21.4
1981	183	676	612	3,166	29.9	21.4
1982	163	635	582	3,104	28.0	20.5
1983	173	675	596	3,205	29.0	21.1
1984	199	758	645	3,433	30.9	22.1
1985	208	790	669	3,569	31.1	22.1
1986	213	812	691	3,681	30.8	22.1

Source: U.S. Dept. of Commerce, Bureau of Economic Analysis, *Gross State Product Estimates.*

Direct Earnings From Manufacturing

One way of measuring the region's ties to the manufacturing sector, then, is to look at labor earnings paid out to the region's residents by manufacturing firms. These earnings, which accrue from both proprietor's income and from the wages and salaries of employees, indicate the current share of income flowing into the pockets of the region's residents from manufacturing as opposed to other industry sectors.

As recently as 1967, 38 percent of the region's earnings derived from manufacturing in comparison to 29 percent for the overall nation, the same as 1947 (See Table 3). By 1987, however, manufacturing's share of labor income had dropped precipitously in both the Great Lakes region and the U.S. Nationally, manufacturing accounted for only 20 percent of labor income by 1987. In the Great Lakes region, the share had fallen from 38 percent, down to 29 percent of labor income.

Table 3

Labor and proprietor's income in manufacturing as a share of total labor earnings

	1947	1957	1967	1977	1987
	(----------percent----------)				
Illinois	34.7	35.7	33.3	30.0	20.9
Indiana	38.7	43.1	42.3	41.1	33.3
Michigan	46.0	46.4	44.2	43.6	35.7
Minnesota	18.8	23.7	25.3	23.8	22.9
Ohio	41.9	44.2	41.5	39.0	31.0
Wisconsin	35.7	39.3	37.2	35.1	29.9
Great Lakes* (5)	39.5	41.5	39.3	37.3	29.2
Great Lakes (6)	37.9	40.2	38.2	36.2	28.6
Rest of U.S.	25.0	27.8	26.4	23.3	18.5
U.S.	28.2	30.9	29.1	26.2	20.4

*excludes Minnesota.

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

In absolute terms, then, the manufacturing industry has been shrinking as a source of earnings for the region. Relative to the nation, however, the region remains specialized in manufacturing. The implication is that manufacturing fortunes continue to have a magnified impact on the household income of Great Lakes residents in comparison to the nation.

The Hidden Manufacturing Sector

In tracking the manufacturing sector's contribution to regional income, one must consider that the activities involved in manufacturing can move from one industry sector to another as the underlying economics dictate. In fact, the boundaries of the set of activities which we call "manufacturing" are fluid and not fixed. For example, a steel-producing company may shed its maintenance workforce and contract out or "outsource" maintenance work to a service sector company. Accordingly, an activity which was formerly counted as manufacturing output could now be counted under the service sector even though, perhaps, the physical amount of steel produced by the economy has remained the same.

Recently, the U.S. industrial companies have been rapidly changing through takeovers, mergers, and internal restructuring as U.S. companies have divested and recombined activities under new corporate umbrellas. One motivation behind this broad movement has been the desire to "unbundle" in-house support services such as clerical, data processing, maintenance, and strategic planning.[1] In the process of producing manufactured goods, industrial manufacturing companies produce and/or purchase important services whose value becomes embodied into the final value of the manufactured goods. These business service sectors include computer and data processing, telecommunications, temporary office help, accounting, finance, insurance, real estate, wholesaling, advertising, and managerial consulting. In order to boost productivity and to trim costs, companies have increasingly chosen to purchase support services from outside firms rather than continue to generate the services within the company.

In Table 4 we examine the inputs purchased from major service sectors by key manufacturing sectors in the Great Lakes economy. Generally speaking, most industries have significantly increased their purchases of service inputs when measured against their own overall activity. These industries include food processing, printing, chemicals and drugs, and communications equipment. However, other industry notables such as farm and garden machinery and engines and turbines report the opposite effect.

Table 4

Purchased services by selected manufacturing industries according to the 1963 and 1983 U.S. Input-Output Tables

Industry	Ratio of purchased services to value added		Ratio of purchases from SIC 73 to value added		Great Lakes employment	Great Lakes index of concentration relative to U.S.
	1963	1983	1963	1983	1986	1986
					(000's)	
Food and kindred products	.42	.48	.11	.14	291,626	1.07
Printing and publishing	.29	.35	.06	.13	326,467	1.16
Chemicals and selected chemical products	.23	.53	.05	.13	60,225	.89
Drugs, cleaning and toilet preparations	.52	.59	.35	.37	70,985	1.24
Primary iron and steel manufacturing	.25	.27	.03	.04	192,695	2.41
Engines and turbines	.17	.14	.04	.03	47,795	2.62
Farm and garden machinery	.30	.18	.08	.03	32,175	1.92
Construction machinery	.20	.17	.03	.04	71,110	1.68
Metalworking machinery	.15	.12	.03	.04	140,111	2.67
Electrical industrial equipment and apparatus	.16	.20	.03	.04	89,904	1.72
Radio, T.V., and communication equipment	.17	.53	.05	.15	91,939	.65
Motor vehicles and equipment	.19	.20	.04	.06	303,369	2.08

Note: The services purchased are from the following sectors: transportation and warehousing, communications, radio and T.V. broadcasting, real estate and rental, finance and insurance, and business services. The SIC 73 industry is defined as business services--e.g. data processing, advertising, window washing.
Source: Bureau of Economic Analysis, *Survey of Current Business*, and Bureau of the Census, *County Business Patterns*.

Although experiences were mixed among individual industries, the aggregate trend toward greater use of purchased services can be illustrated for the manufacturing sector by comparing "services purchased by manufacturing" from the 1963 and the 1983 *Input-Output Table of the United States* (BEA). Therein, the ratio of purchased services to the activity of manufacturing companies increased from 25 percent to 32 percent over the 1963-83 period (Table 5).

Table 5

Services purchased by all manufacturing industries

	Services as a percent of value added in manufacturing	
Purchased from	1963	1983
Transportation and warehousing	6.0	7.2
Communications (except radio and T.V.)	1.1	1.2
Wholesale and retail trade	8.1	9.6
Finance and insurance	1.5	2.0
Real estate and rental	2.4	2.3
Business services	6.2	9.8
Total	25.4	32.0

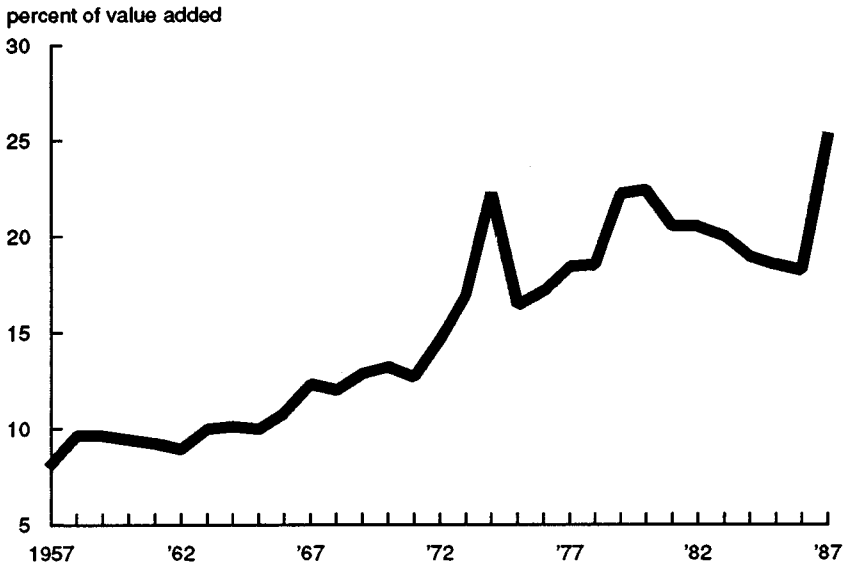
Source: U.S. Dept. of Commerce, Bureau of Economic Analysis, "Input-Output Tables of the U.S."

Another way of viewing the increasing importance of the service sector to manufacturing involves the manufacturing value added data that are produced by the Bureau of the Census. The Bureau's method in computing value added is somewhat peculiar because it includes, not only the manufacturing company's contribution to the value of products, but also the value of intermediate services purchased by the company. This peculiarity is useful for our purposes because a parallel "value added" (called "gross product originating") is concurrently produced by the BEA and it does *not* include the value of purchased services. With some minor adjustments, we can estimate the value of services purchased by manufactures by taking the simple difference between Census value added for the nation and the BEA's estimate of manufacturing activity.[2] As a reference point, we present purchased services as a share of total activity, both manufacturing and purchased services, i.e., Census value added in manufacturing. In doing so, it is seen

that these services would have comprised less than 10 percent of manufacturing value added in 1957 (Figure 1). By 1977, this figure had climbed to over 18 percent. By 1987, the last reported year, purchased services were estimated to occupy 25 percent of overall manufacturing activity.[3]

Figure 1

Purchased services by manufacturers



At the same time that purchased services are expanding, service-type activities are also becoming an increasingly important component of the value of manufactured goods *within the firm itself.* One recent study reports that the payroll share of auxiliary establishments of manufacturing firms, i.e., corporate headquarters, R&D labs, data processing centers etc., increased from 6 percent in 1958 to almost 11 percent in 1986 (Israilevich and Testa 1989). In part, this phenomenon has much to do with the changing and sophisticated nature of today's products and services. As one effect, many physical products are jointly consumed by final customers in conjunction with services provided by manufacturing companies such as user training and product repair. As another effect, many more of today's manufacturing employees support the manufacturing process through advertising, product

design and research, and corporate planning. Still others are involved in product sales and distribution. The overall effect can best be illustrated by citing a concrete example. Xerox Corp. is reported as a manufacturing company. Yet, only one of seven of its employees are actually engaged in the activity of "manufacturing" or physical assembly of its products.

Manufacturing Found

The upshot of the increasing service orientation of manufacturing companies and the "unbundling" of many service activities from manufacturing companies is that a growing segment of the Great Lakes economy has moved into the service sector which would have formerly been recognized as manufacturing. Consequently, by attributing these activities to the service sector, we are understating manufacturing's contribution to both the national and regional economy.

Accordingly, it would be helpful if we could consistently measure, using a stable definition, a larger or "manufacturing-augmented" sector over time so as to comprehend any real changes to the region's economic base. In particular, services purchased locally by manufacturers are conceptually equivalent to manufacturing in being part of the region's traded goods sector or "economic base". If a local service becomes embodied into the value of a manufactured good and that good is ultimately exported from the region, then the value of the service is concurrently exported. Accordingly, we define the manufacturing sector broadly to include these "purchased services" of manufacturers. In doing so, the movement of these services between the manufacturing and service industry sectors will not affect our reckoning of the region's economic structure and base.

In considering this augmented manufacturing sector which includes purchased services, a far different picture of the importance of manufacturing to the region emerges (Table 6). For the portion of the United States excluding the Great Lakes, the decline in the share of manufacturing earnings is muted (in percentage change terms) by the inclusion of purchased services, although it has still declined, from 32.4 to 24.4 over the past 24 years. This result arises from the growing role of services which was illustrated in Figure 1. Many of these related services are being outsourced to parts of the service sector.

In the Great Lakes region, the role of manufacturing as a stable source of regional income is also pronounced. When services purchased by Great

Lakes manufacturers are included with the manufacturing sector proper, labor income derived from this sector amounted to 36.8 percent in 1987. Moreover, the region's concentration in manufacturing relative to the nation continued to exceed the nation by over 50 percent.[4]

Table 6

Manufacturing and augmented manufacturing sector earnings (including purchased services) as a percent of total earnings

	Manufacturing sector earnings/total earnings		
	1963	1983	1987
Great Lakes Region	38.5	32.3	28.6
Rest of U.S.	26.5	21.8	18.5
Index (G.L./U.S.)	1.45	1.48	1.55
G.L. share of U.S. (percent)	29.3	23.8	20.4
	Augmented manufacturing sector earnings/total earnings		
	1963	1983	1987
Great Lakes Region	47.7	41.7	36.8
Rest of U.S.	32.4	28.7	24.4
Index (G.L./U.S.)	1.47	1.45	1.51
G.L. share of U.S. (percent)	36.4	31.2	26.7

Source: U.S. Department of Commerce, Bureau of Economic Analysis; and staff estimates.

As a word of caution, however, these estimates are dependent on a number of crude assumptions, not the least of which is that the region retains a share of manufacturing-supporting activities in its service sector that is proportionate or larger to its manufacturing sector proper. This could mean that services purchased by Great Lakes manufacturing companies are purchased locally and not from outside the region. Alternatively, service exports by the region's service sectors to outside manufacturers are sufficient to offset any "leakages", i.e., services purchased by Great Lakes manufacturers from outside the region.

Location of Purchased Services: How Does the Region Fare?

There is a wide geographic range over which services are traded. This implies that services purchased by manufacturers cannot be thoughtlessly assigned to the same location as the manufacturing companies themselves.

It is now being recognized that, similar to traded goods, services are increasingly "exported" across regional boundaries. Two examples among many of the wide-ranging export of services can be cited from the North American continent alone (Daniels 1984). In the United States, a recent survey of 2000 firms in the Puget Sound area found that approximately 34 percent of service production was sold outside the region. Over 1100 firms drawn from the transport services, FIRE, business and professional services, and utilities and communications reported that over 10 percent of their sales were made to the outside (Beyers, Alvine, and Johnson 1985). And across our northern border in Canada, data collected from more than 400 establishments in mining, manufacturing, retailing, wholesaling, retail trade, and business services, show that only 44 percent of the flow of expenditure on business services originated within the home region consisting of the townships of eastern Quebec Province (Polese 1982).

The causes behind a reported expansion of business services tell us something of the spatial implications of service location and the region-to-region direction of service flows. While the causes behind the trend toward service-related manufacturing are not completely understood, several reasons have been advanced. J.I. Gershuny has pushed the thesis that economies have moved toward being "self service" economies over the course of the 20th century. Much of the underlying growth in services employment overlies a transition from personal service employment to substitution of manufactured products which are operated by the consumer (1978; 1983). These products include home appliances, television, and cars. However, these products must be supported (i.e. jointly consumed) by a growing mass and variety of business service functions. Accordingly, labor has become increasingly employed in complementary functions to manufacturing such as education and training in the use of products, research and design, sales and service, packaging and distribution, and the repair of manufactured goods.

This expansion of manufacturing-related service activity can be partly seen from the general expansion of business service employment. The business services sector, SIC 73, which includes such activities as computer

programming, data processing, temporary help agencies, and maintenance firms, almost doubled in employment from 1976 to 1986 in the U.S. (Table 7). Robust growth was also recorded for the closely related categories of legal services and finance, insurance and real estate.

Table 7

U.S. employment in business--type services

	Percent of total U.S. employment		Change in jobs	Percent change
	1976	1986	1976-1986	1976-1986
			(000's)	
Transportation and communications	4.6	4.3	670.5	23.2
Wholesale trade	6.8	6.5	1,191.9	28.1
Fire, insurance, and real estate	6.9	7.4	1,872.9	43.3
Business services	6.1	9.0	3,697.1	96.7
Legal	.6	.9	382.5	105.3
Total business services	25.0	28.1	7,814.8	50.0

Source: U.S. Dept. of Commerce, Bureau of Economic Census, *County Business Patterns.*

There has also been a significant tendency toward the vertical disintegration of manufacturing firms and the need to contract out service functions. The economics of specialization and division of labor has evolved into a situation in which manufacturing companies themselves are contracting out an increasing volume and proportion of related service activity. Service activities that were formerly performed by manufacturers are now performed by service companies. In summarizing the literature to this effect, P.W. Daniels states: "The ability of organizations to create their output by employing the appropriate specialist staff in-house has decreased as occupational skills and knowledge, especially in information and technology-related activities, have become highly specific and therefore expensive to retain. It is now becoming more cost-effective, even in large enterprises, to buy in services if only because those providing them are, through their continuing and diverse experience with the specialization, able to provide the most up-to-date and comprehensive service."[5] This phenomenon is not universally true for all functions. Certainly, the advent of the personal

computer has led to adoption of services "in house" for many firms (J.N. Marshall 1989). Nonetheless, most studies suggest the opposite on net. For example, Rajan and Pearson estimate that out of 700,000 jobs created in distribution, finance, and business services in the U.K between 1979 and 1985, perhaps 300,000 arose from contracting out by non-specialist producers (1986).

Still another explanation for the service-growth phenomena is offered (for the U.S. economy) by Jane Sneddon Little (1989). In part, the U.S. manufacturing evolution toward service orientation derives from the dollar's 50 percent appreciation between late 1979 and 1985. As a result, employment reportedly shifted from the industries most susceptible to foreign competition to those which were less vulnerable. The latter industries include service-oriented manufacturing industries specializing in research, design, and customer service. As a consequence, Little reports the number of nonproduction workers in manufacturing to have risen by 615,000 in the U.S. from 1979 to 1985 while production workers fell by 2 million. These changes were not subsequently reversed with the dollar's depreciation. Rather, the structural changes have become embedded in the U.S. economy.

Urban Business Service Hubs

The spatial and geographic implications of these trends on regional growth and development are beginning to emerge. These business service functions exhibit an agglomerative or synergistic tendency to locate in proximity to one another in large urban areas. Face-to-face contact continues to be important for many producer service functions, including those with client relationships. In addition, the attraction of a diverse and highly skilled labor pool, highly developed transport, and communication facilities also contributes to mutual siting of such functions. Highly-concentrationed business-service activity in particular urban areas accordingly flows outward in an urban-hierarchy to smaller metro areas in exchange for manufactured and other goods.

Within the urban hierarchy, i.e., the system of cities by size class, opinions are widely shared that many of the largest metro areas have benefitted from the specialization and expansion of business services. Evidence to this effect can be found in the 1980s turn-around in urban-rural growth of the U.S. in the 1970s. Vertical disintegration and continued specialization of service functions require close proximity of these varied functions to each other. For this reason, Stanback and Noyelle believe that the expansion of producer

services is strengthening the position of the many of the larger cities in the hierarchy. Rather than harboring manufacturing functions, successful cities are those which can support a myriad of functions including producer services, financial and legal specialists, corporate headquarters and divisional offices, professional and trade organizations and other highly specialized support functions (1980; 1982).

However, not all service functions have experienced a sharpened locational advantage in urbanized areas. Advances in telecommunications have allowed data processing operations such as credit card processing and airline reservations to be outsourced to rural or less urban locales where labor costs are lower.

Interregional Specialization

The inter-regional implications of this business service specialization are relevant in assigning manufacturing support services to particular states and regions. Across U.S. regions, these trends suggest that service flows will, if anything, tend to originate in the regions hosting business service firms and the corporate headquarters offices of manufacturers and flow toward those peripheral regions that are specialized in branch production plants.

Evidence from the U.K suggests that services provided internally by the manufacturing firm are largely concentrated at or near corporate headquarters-type facilities of industrial companies. These services are either produced by the corporate facilities themselves or else purchased from nearby service producers and exported from head offices to branch locations (Marshall 1977). For example, Crum and Gudgin have found that branch plants in the U.K. have a greater tendency to maintain organizational service linkages rather than local service linkages the farther they are from London (1977). So, too, Burrows and Town report that branches are more likely to purchase services such as banking, insurance, accounting and legal services from outside the area (1971). Such tendencies have also become evident in studies of organizational changes. In a study of corporate takeovers occurring in the food, chemicals, textiles, and clothing industries in the U.K., Lee and North found that, in studying takeovers and mergers, local service linkages were severed and substituted with both internal services and service arrangements with service firms that were located in proximity to the new, aggressor company (1978) (see also Smith 1979).

However, while the bulk of the evidence suggests that a high concentration of corporate headquarters offices and other ancillary establishments to the manufacturing firm is indicative of both internal and external service flows to peripheral or "branch plant" regions, this connection cannot be made with certainty. Headquarters also rely on the purchase of specialized computer, financial, and trade services which may be purchased from outside the region. And certain internal services have displayed a decentralization tendency in the direction of branch plants. For example, in a recent study of the automotive industry in the U.K., Marshall reports that product distribution functions are being decentralized to peripheral locations which enjoy easier access to market (1989).

But despite these caveats, the best working assumption in tracking the interregional flow of services related to manufacturing across U.S regions is that services purchased by manufacturers flow away from headquarters-type facilities and toward production branches. Accordingly, those regions with ample shares of corporate headquarters and other specialized service establishments of manufacturing companies are also likely to retain their respective share of services that are directly purchased by manufacturers from service firms.

Manufacturing auxiliaries in the Great Lakes region

The Great Lakes region has managed to hold onto its pre-eminent share of auxiliary activities over the past three decades (Table 8). The Great Lakes' share of the nation's payroll for auxiliary manufacturing establishments has held constant at 31-32 percent of the nation. This is surprising in light of the fact that the region's share of total payroll has concurrently slipped to 27 percent and payroll at nonauxiliary establishments slipped to 26 percent. In 1958, the region's economy was no more specialized in these auxiliary service activities than the nation. Since then, the Great Lakes region has climbed to a relative specialization in auxiliary activity which was approximately 19 percent greater than the nation in 1986 (as measured by CM payroll data). Increasingly, then, the region has become more specialized in these service-type activities that are generated by manufacturing companies themselves.

Nor has the region's increasing specialization in auxiliary activity occurred solely because manufacturing production plant activity has migrated to other regions, leaving behind an isolated and dwindling corporate headquarters presence. The auxiliary establishment base has grown in absolute terms. While the region lost over 500,000 jobs in overall manufacturing between 1976 and 1986, manufacturing employment at auxiliary establishments is estimated to have increased by over 33,000 according to *County Business Patterns* (Table 9). As a result, employment at auxiliary establishments increased from 42 percent above the nation in 1976 to 62 percent by 1986.

Table 8

Great Lakes shares of auxiliary and nonauxiliary payroll

	Great Lakes share of U.S. manufacturing		
	Total payroll	Auxiliary payroll	Nonauxiliary payroll
1958	30.7	31.0	30.7
1963	30.7	32.3	30.6
1967	30.7	32.8	30.6
1972	30.9	33.0	30.7
1977	30.9	34.8	30.6
1982	25.2	32.5	24.4
1986	26.9	31.9	26.3

Concentration index of auxiliary payroll--Great Lakes versus U.S.

	Illinois	Indiana	Michigan	Minnesota	Ohio	Wisconsin	Great Lakes
1958	1.01	.29	1.84	1.19	.79	.55	1.01
1963	1.07	.34	1.74	1.25	.87	.63	1.05
1967	1.05	.27	1.73	1.62	.90	.70	1.07
1972	1.09	.32	1.61	1.54	1.00	.55	1.07
1977	1.28	.35	1.57	1.80	.95	.69	1.13
1982	1.59	.31	1.74	1.67	1.23	.82	1.29
1986	1.40	.33	1.42	1.82	1.14	.80	1.19

Source: U.S. Dept. of Commerce, *Census of Manufactures.*

Table 9

Employment concentration in selected business service industries--Great Lakes Region

	G.L. employment 1986	Change in employment 1976-1986	Index of concentration versus U.S. 1976	1986
	(000's)	(000's)		
Manufacturing auxiliaries	406.5	33.3	1.42	1.62
Other industry auxiliaries	336.1	106.0	.92	93
Motor freight-transport and warehousing	274.1	17.4	1.07	1.08
Water transportation	10.4	.6	.24	.32
Transportation by air	72.9	27.0	.61	.73
Transportation services	47.7	23.5	.76	.81
Communications	190.8	-9.4	.80	.78
Wholesale trade-durable goods	626.7	98.8	.98	1.00
Wholesale trade-nondurable goods	408.1	62.8	.86	.95
Depository institutions (SIC 60 & 61)	429.7	94.6	.89	.90
Securities and commodities brokers	55.8	29.1	.69	.76
Insurance (SIC 63 & 64)	390.5	81.1	.97	1.05
Real estate	170.3	24.4	.80	.72
Real estate and combined	3.1	-1.4	.69	.65
Holding & other investment offices	35.1	-5.6	1.19	.86
Business services	808.7	408.6	.85	.90
-advertising	38.4	12.2	1.04	1.06
-mailing, reproduction, art and photo	44.3	23.5	1.01	1.15
-services to buildings	101.2	36.6	.76	.82
-computer programming & software	27.4	19.8	.71	.63
-computer-related services NEC	9.1	7.4	.56	.69
-research and development labs	19.5	5.0	.89	.68
-management and public relations	97.2	57.3	.82	.89
Legal services	120.1	53.9	.82	.83
Membership organizations	362.7	107.5	1.07	1.10
Engineering and architectural service	99.1	39.4	.78	.72
Noncommercial research organizations	4.7	-1.5	.46	.34
Accounting, auditing, bookkeeping	76.2	30.9	.93	.91
Total (all above services)	4,922.4	1,221.1	.93	.95

Source: Bureau of Economic Analysis, *County Business Patterns.*

Other business service categories are generally less concentrated in the region than in the U.S., though this reflects a high employment concentration in manufacturing rather than weakness in service industry *per se* (Table 9). In addition, auxiliaries of nonmanufacturing industry sectors are less concentrated here, although the Great Lakes region has gained slightly on the U.S. in this regard. And overall, business services increased in concentration in the Great Lakes region over the 1976-86 period. Of course, unlike manufacturing auxiliary employment, these business services serve nonmanufacturing industries as well as manufacturing. Accordingly, trends in these business service categories alone do not necessarily reflect any increasing tendency in backward linkages from manufacturing companies to service firms over the 1976 to 1986 period.

The fact that the region hosts a significantly larger share of its manufacturing activity in auxiliary activity than the nation suggests that the region is a net exporter rather than a net importer of inter-regional service flows between the service sector and manufacturing. On the other hand, some particular services may run counter to this assumption. For example, New York's pre-eminence in the advertising industry probably represents net regional import of services by the Great Lakes region's manufacturers of consumer products. However, the increasing tendancy of the Great Lakes region as an intra-firm service provider to manufacturing suggests that this assumption of net service export is more reliable in the present than in the past.

Conclusions

The role of the Great Lakes region continues to evolve away from manufacturing production activity and towards service provision. Nonetheless, this should not be confused to mean that the region maintains a weak linkage to manufacturing. Much of the apparent growth in service activity is closely linked with manufacturing activity within the region and elsewhere. Moreover, manufacturing activity itself, as measured by labor income derived from this industry, remains significantly above the nation's average. For these reasons, the strength of manufacturing nationwide and within the region will continue to call the tune of the Great Lakes economy in the foreseeable future.

Footnotes

[1]For a discussion see Peter F. Drucker, "Sell the Mailroom", Wall Street Journal, Tuesday, July 25, 1989.

[2]The BEA gross domestic product includes indirect taxes (except property). For comparison purposes with Census value added, the BEA figure is reduced by 4 percent. The other notable difference is that the Census calculates inventory change using the data as reported by the manufacturer. BEA adds to these "book value" inventories an inventory valuation adjustment which converts them to a replacement cost valuation (see CM 1977 p. XXIII).

[3]This data construction is only meant to be suggestive of the overall growth of service inputs into the manufacturing process. The value of purchased services themselves will include purchases from other sectors including manufacturing, construction, and government. In other words, the value of purchased services is not strictly a "value added" by the service sector alone.

[4]The methodology is as follows: First, we estimated the purchased services percent of manufacturing value added for each 2-digit manufacturing industry for the U.S. by subtracting U.S. value added (adjusted for indirect taxes) from BEA GPO in manufacturing:

$$\% \text{ purchased service} = (VA^{US}_{i} - GPO^{US}_{i}) - (GPO^{US}_{i})$$

for each industry i. This percent or augmentation factor was applied to both the industry-specific earnings distribution for the Great Lakes region and for the U.S. Accordingly, the differing industry mix between the region and U.S. will affect the estimated volume and proportion of purchased services. In addition, we are assuming that all services are purchased locally although, as we will discuss in the following section, this need not be the case.

[5]See P.W. Daniels, *Service Industries: A Geographical Appraisal*, Methenen, London, 1985, Chapter 7, p. 157.

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Appendix I

Business Services Concentration by State

States in the Great Lakes region vary widely in their propensity to host business service activities. Accordingly, the following disaggregated tables are offered as evidence to this effect (and for the general interest and use by analysts and planners working at the state rather than at the regional level).

Appendix I-a

Auxiliary payroll as a percent of total payroll (in manufacturing)

	Illinois	Indiana	Michigan	Minnesota
1958	5.8	1.7	10.5	6.8
1963	7.1	2.3	11.6	8.3
1967	6.9	1.8	11.4	10.7
1972	8.6	2.5	12.7	12.1
1977	10.7	2.9	13.1	15.0
1982	16.0	3.1	17.5	16.9
1986	15.0	3.6	15.1	19.5

	Ohio	Wisconsin	Great Lakes	United States
1958	4.5	3.1	5.8	5.7
1963	5.8	4.2	7.0	6.6
1967	5.9	4.6	7.1	6.6
1972	7.9	4.3	8.4	7.9
1977	7.9	5.7	9.4	8.3
1982	12.4	8.2	13.0	10.1
1986	12.2	8.6	12.7	10.7

Source: U.S. Department of Commerce, Bureau of the Census, *Census of Manufactures* and *Annual Survey of Manufactures*.

Appendix I-b

Employment concentration of Great Lakes States in business service industries--1976 and 1986

	Illinois		Indiana		Michigan		Ohio		Minnesota		Wisconsin	
	1976	1986	1976	1986	1976	1986	1976	1986	1976	1986	1976	1986
Manufacturing auxiliaries	1.51	1.58	.56	.50	2.20	2.36	1.27	1.68	1.74	1.89	.80	1.16
Other industry auxiliaries	1.11	1.15	.78	.75	.69	.65	.89	1.00	1.01	1.28	.43	.59
Motor freight-transport and warehousing	1.05	1.01	1.16	1.33	.86	.92	1.17	1.10	1.13	1.02	1.09	1.26
Water transportation	.23	.35	.36	.23	.11	.15	.32	.57	.26	.13	.15	.22
Transportation by air	1.18	1.35	.17	.24	.35	.38	.28	.33	1.41	1.78	.17	.30
Transportation services	1.31	1.27	.36	.41	.69	.74	.49	.61	.81	.93	.46	.61
Communications	.82	.82	.79	.78	.76	.79	.83	.75	.80	.74	.71	.73
Wholesale trade-durable goods	1.09	1.15	.90	.89	.85	.92	.98	1.01	1.13	1.05	.85	.84
Wholesale trade-nondurable	1.00	1.06	.85	.87	.64	.74	.76	.98	1.14	1.07	.92	.97
Depository institutions	1.01	1.09	.82	.81	.85	.82	.83	.81	.87	.95	.83	.84
Securities and commodities brokers	1.32	1.54	.24	.28	.42	.44	.45	.46	.82	.86	.49	.53
Insurance	1.21	.134	.88	.96	.85	.80	.80	.93	1.01	1.10	.99	1.15
Real estate	.98	.89	.83	.54	.65	.58	.73	.77	.89	.85	.66	.52
Real estate and combined	.98	.86	1.09	1.19	.37	.41	.27	.34	1.04	.76	.75	.58
Business services	1.09	1.06	.51	.65	.78	.99	.83	.84	.91	.96	.68	.69
Advertising	1.74	1.64	.43	.64	.95	1.05	.75	.76	.97	1.12	.71	.70
Mailing, reproduction, art and photo	1.76	1.64	.31	.59	.94	1.55	.75	.75	.80	1.00	.68	.89
Services to buildings	.88	.86	.58	.67	.65	.69	.84	.94	.76	.92	.65	.76
Computer and related services	.79	1.25	.32	.46	.77	1.40	.54	.71	1.60	.90	.63	.51
Research and development labs	1.79	1.08	.09	.16	.22	.83	1.35	.77	.19	.22	.15	.22
Management and public relations	1.15	1.14	.46	.80	.71	.80	.88	.90	74	.91	.50	.49
Legal services	.95	1.07	.58	.54	.81	.82	.74	.72	.92	.92	.86	.76
Membership organizations	1.15	1.08	1.03	1.12	.94	.97	1.00	1.06	1.33	1.30	1.12	1.28
Engineering and architectural	.96	.78	.48	.49	.92	.93	.68	.68	.82	.76	.58	.50
Noncommercial research organizations	.26	.32	.29	.26	.59	.54	.68	.25	.49	.49	.43	.13
Accounting, auditing, bookkeeping	1.13	1.00	.65	.69	.96	.85	.84	.89	.99	1.14	.85	.85
Total (all above services)	1.08	1.11	.77	.77	.88	.90	.87	.92	1.06	1.07	.79	.84

Source: U.S. Department of Commerce, *County Business Patterns.*

Appendix II

Nonproduction Occupations in Manufacturing

Further evidence on the service orientation of Great Lakes manufacturing can be gleaned from data covering employment by occupation within the manufacturing sector. In the last section of the preceding paper, employment at auxiliary establishments (i.e. service-only establishments of manufacturing companies) are examined to illustrate the Great Lakes trend of rising service orientation. However, service functions in manufacturing occur at all manufacturing establishments, including production plants and not only at auxiliaries such as R&D and corporate headquarters establishments. In fact, activities such as strategic planning, advertising, R&D, warehousing, and the like can be found at manufacturing establishments which are classified as operating plants. Accordingly, a look at occupational data covering all establishments can bear further evidence on the rising service orientation of manufacturing companies.

A word of caution concerning the occupational data reported herein. Occupational data, which is gathered by the decenial Census of Population, is self-reported. Census respondents identify their own industry of employment and their own occupation. Aside from a possible high degree of error in identifying industry, there may be differences in the professions that people identify from region to region, even for identical occupational activities.

For 1980, the data show that, unlike the auxiliary data reported earlier, the Great Lakes region displays a slightly lower intensity of service occupations relative to the nation. This holds for professional and specialty occupations in manufacturing including scientists and engineers, and executive and administrative positions. Some occupations, including service and transport and material handling occupations are more concentrated than the nation.

These tendencies display a wide variation across Great Lakes states. Illinois and Minnesota report a higher-than-national share of service occupations in manufacturing. Michigan's high concentration of scientists and engineers is also notable.

Over time, specifically from 1970 to 1980, the Great Lakes orientation toward service activity in manufacturing has risen, albeit very modestly. At the same time, intra-region specialization has widened with Illinois, Michigan, and

Minnesota all increasing their service intensity relative to the nation; Wisconsin decreasing its service orientation; and Ohio and Indiana remaining much the same.

Appendix II-a

Service-oriented occupational activities within Great Lakes manufacturing industries--1980

	Great Lakes employees	Great Lakes share of total manufacturing employment	Concentration index: Great Lakes relative to U.S. manufacturers
		(--percent--)	
Managerial and professional occupations	756,533	13.7	.94
Executive, administrative and managerial	457,036	8.3	.95
Professional specialty occupations	299,497	5.4	.92
-engineers, architects, and surveyors	178,174	3.2	.98
-computer systems analysts and scientists, operations systems and mathematical scientists	21,769	.4	.87
-natural scientists	18,975	.3	.93
Technical, sales, and administrative support	1,013,512	18.3	.97
Technical and related support	160,426	2.9	.92
Sales occupations	156,683	2.8	.90
Administrative support, including clerical	696,403	12.6	1.00
Service occupations	139,566	2.5	1.12
Transportation and material moving occupations	248,777	4.5	1.08
Total service oriented occupations	2,158,388	39.0	.98

Source: U.S. Department of Commerce, Bureau of the Census, *1980 Census of Population.*

Appendix II-b

Concentration of employment in nonproduction activities in manufacturing industries 1970-1980

	1970	1980
Illinois	1.06	1.07
Indiana	.86	.86
Michigan	.91	.94
Minnesota	1.16	1.19
Ohio	.96	.96
Wisconsin	.94	.93
Great Lakes Region	.97	.98

Share of employment in nonproduction activities in manufacturing industries--1970-1980

	1970	1980
Illinois	39.9	42.4
Indiana	32.2	34.3
Michigan	34.4	37.5
Minnesota	43.7	47.5
Ohio	35.9	38.1
Wisconsin	35.5	36.9
Great Lakes Region	36.5	39.0
U.S.	37.6	39.8

Note: Nonproduction activities include occupations within the managerial and professional; technical, sales and administrative support; service; and transportation and material moving categories.
Source: U.S. Dept. of Commerce, *Census of Population.*

Appendix II-c

Manufacturing employees by occupation--concentration index relative to U.S. in 1980

	IL	IN	MI	MN	OH	WI
Managerial and professional occupations	1.04	.73	.95	1.29	.91	.84
Executive, administrative and managerial	1.13	.71	.87	1.34	.91	.90
Professional specialty occupations	.91	.76	1.06	1.21	.90	.74
-engineers, architects, and surveyors	.88	.86	1.22	1.16	.98	.76
-computer systems analysts and scientists, operations systems and mathematical scientists	.84	.61	1.06	1.67	.77	.59
-natural scientists	1.03	.96	.88	1.04	1.01	.55
Technical, sales, and administrative support	1.11	.84	.87	1.23	.95	.93
Technical and related support	.85	.80	.89	1.59	.91	.86
Sales occupations	1.13	.69	.77	1.21	.85	.85
Administrative support, including clerical	1.17	.89	.89	1.14	.98	.97
Service occupations	1.09	1.19	1.23	.97	1.08	1.08
Transportation and material moving occupations	.96	1.26	1.12	.83	1.12	1.13
Total service oriented occupations	1.07	.86	.94	1.19	.96	.93

Source: U.S. Department of Commerce, Bureau of the Census, *1980 Census of Population.*

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