The Food Manufacturing Industry in the Midwest

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Introduction

The food manufacturing industry in the five states encompassing the Seventh Federal Reserve District[1] is an important source of high-quality, nutritional food products to consumers throughout the world. As one of the principal links in the food marketing chain, these manufacturers typically undertake the initial transformation of raw agricultural commodities into the products found on grocery store shelves or in food service establishments. These products include consumer items such as pork, breakfast cereals, and candy, as well as intermediate goods that are utilized as components in the assembly of other products. An example of the latter would be soybean oil, used in the production of salad dressing and cooking oil as well as biodiesel fuel.

The industry also makes an important contribution to regional income and employment. Among 20 major manufacturing groups, food manufacturing ranks second in Seventh District states in both sales and value added[2] and fourth in employment (table 1). The industry holds similar rankings at the national level. Moreover, food manufacturing is an important source of jobs in rural America, with a greater tendency to locate plants in nonmetropolitan counties than other types of manufacturers. Approximately 40% of all food manufacturing plants are located in rural areas, compared to 23% for non-food manufacturers (Testa, 1992). In addition, rural leaders and policymakers often look to food manufacturing firms as a means to spur local economic development (Leistritz, 1992).

Table 1 Major Manufacturing Groups in District States Ranked by Value Added, 1994

	Value added	Value of shipments	Employment
	(bil $)	(bil $)	(000)
Transportation equipment	37.16	104.87	364.7
Food and kindred products	33.58	86.25	259.4
Industrial/commercial mach. & computer equipment	32.47	61.18	429.9
Chemicals	26.01	44.38	124.3
Fabricated metal products	21.54	42.72	342.4
Printing and publishing	17.63	27.37	256.0
Electronic and other electrical equipment	17.49	32.94	231.9
Primary metals	14.77	35.98	181.9
Rubber and misc. plastics products	12.67	24.60	202.9
Paper and allied products	11.35	25.00	120.9
Measuring, analyzing, controlling equipment	8.76	13.87	91.7
Furniture and fixtures	5.59	10.52	88.2
Stone, clay, glass, concrete products	5.08	9.44	65.1
Lumber and wood products	3.79	8.51	82.3
Miscellaneous manufacturing	3.70	6.50	56.8
Apparel	2.25	4.91	51.8
Petroleum refining	2.23	15.27	13.0
Leather and leather products	0.63	1.32	11.5
Textile mill products	0.35	0.73	5.8
Tobacco products	n.a.	n.a.	n.a.

Source: U.S. Department of Commerce.

Agricultural exports include bulk commodities—-such as wheat, corn, and soybeans—-as well as higher-value and manufactured consumer items. Improving export sales of bulk agricultural commodities has generated considerable excitement in recent months. But the consumer-oriented food segment of agricultural exports has outperformed its bulk counterpart during the 1990s with larger and more consistent gains. The growth of consumer food exports has the added benefit of providing further support to domestic income and employment. And unlike exports of bulk commodities, which tend to show significant year-to-year variations, the annual gains in foreign sales of processed food products will likely be sustained by rising incomes in developing nations, a growing taste for Western-style foods, and the desire for greater convenience in food preparation (Tse, 1993).

The purpose of this paper is to examine the recent performance of the Midwest food manufacturing industry. To this end, we identify the key food manufacturing industries within Seventh District states and go a step further by tagging a group of individual industries as either "high performers" or "poor performers" based upon changes in employment and value added from 1982 through 1992. Data from the *Census of Manufactures* are used in the analysis. We also categorize food manufacturing industries by their tendency to locate near major demand areas or areas that are major sources of raw agricultural commodities, then examine the relative growth rates of these groups. Finally, a simple statistical model is used to predict the future growth of food manufacturing in the Seventh District and make comparisons to the rest of the nation.

Major Industries

The top 15 food manufacturing industries in Seventh District states, ranked by value added, are shown in table 2. For this study, an individual industry is defined at the four-digit level using the standard industrial classification system (Office of Management and Budget). Value added was used to identify the top 15 industries rather than sales or employment. It is a more useful measure of economic activity because it avoids the double counting that may occur when adding together sales of different industries. For example, an end product of wet corn milling—-high fructose corn syrup—-is also a production input for soft drink manufacturing. Likewise, flour is an output from the wheat milling industry and is used as an input in the production of bakery goods. It should be noted, however, that choosing the top 15 industries by sales or employment would result in a nearly identical list, though the individual rankings would change. Moreover, table 2 is not a complete list, as there are nearly 50 industries that make up the food and kindred products sector. However, the top 15 food manufacturing industries account for approximately 75% of the economic activity that stems from food manufacturing in the Seventh District, regardless of how that contribution is measured.

The industries shown in table 2 also underscore the ties between local food manufacturers and the region's production agriculture. The principal farm commodities produced in the Seventh District are corn, soybeans, pork, beef, and milk. The linkages between these commodities and several food manufacturing industries (such as corn milling, cheese production, and meat packing) are obvious. Some, though, are not so clear. For example, confectionery and soft drinks are connected to corn production through the large-scale use of corn sweeteners, which in turn are a

product of corn milling. Frozen specialties, which include frozen dinners, pizzas, waffles, and a host of other items, are heavy users of meat, cheese, and vegetable products.

Table 2 Major Food Processing Industries in Seventh District States

Industry	Rank		Value added		% of all District food processing	
	1982	1992	1982	1992	1982	1992
			(bil. $)			
Breakfast food	3	1	1.26	3.47	6.9	10.6
Confectionery	2	2	1.47	2.49	8.0	7.6
Wet corn milling	5	3	0.90	2.39	4.9	7.3
Cheese	8	4	0.79	2.19	4.3	6.7
Meat processing	7	5	0.80	1.85	4.4	5.7
Meat packing	1	6	1.56	1.74	8.5	5.3
Processed milk	9	7	0.78	1.69	4.3	5.2
Soft drinks	6	8	0.85	1.65	4.6	5.1
Bread	4	9	1.11	1.48	6.1	4.5
Cookies and crackers	15	10	0.52	1.21	2.8	3.7
Canned fruits & vegetables	17	11	0.50	0.94	2.7	2.9
Flavorings	16	12	0.52	0.90	2.8	2.8
Fluid milk	14	13	0.55	0.89	3.0	2.7
Frozen specialties	18	14	0.39	0.86	2.1	2.6
Animal feeds	13	15	0.58	0.74	3.1	2.3
Top 15			12.58	24.48	68.7	74.9
All food processing						
District states			18.31	32.69	100	100
U.S.			88.42	156.84		

Source: U.S. Department of Commerce.

Table 2 also highlights the meat packing industry's rather sluggish growth compared to many other food industries from 1982 to 1992. During this period, its ranking dropped from first to sixth. This change is particularly noteworthy given the traditional role played by District farmers in livestock production. Recent reports from the U.S. Department of Agriculture show that District states account for about 45% of hogs on farms and about 10% of beef cattle in the U.S. The lack of growth in meat packing relative to other industries over the period under study partly reflects a decline in the District's share of U.S. beef production as well as an overall decrease in cattle numbers. Nor does the future look particularly bright for growth in the meat packing industry, as some observers have suggested the District may also be at risk of losing market share of pork processing to areas where the growth of "mega" hog farms is occuring.[3] However, the relative decline in meat packing was somewhat offset by the

growth in meat processing. This activity adds further value to meat products at the manufacturing level in response to the desire shown by consumers for greater convenience and variety at the retail level.

Individual Industry Performance

Given that sustained growth in economic activity and employment are important gauges of a region's economic well-being, which of the many food manufacturing industries exhibited the strongest performance in recent years? Which industries showed the least staying power? To answer these questions, the growth in value added and employment for each industry was examined from 1982 to 1992 and the following categorizations were made: If an industry ranked among the top 15 in terms of value added growth, and ranked among the top 15 in employment growth, then it was termed a "high performer." Those that fell in the bottom 15 in terms of value added and employment changes were designated as "poor performers." These results (shown in table 3) are encouraging. Of the eight industries classified as high performers, five are relatively large, and rank among the District's top 15 food industries in terms of value added, employment, or sales. These are poultry processing, cheese, frozen specialties, meat processing, and processed milk. Not only did these industries register solid growth from 1982 to 1992, they did so from relatively large initial bases.

Table 3 High and Poor Performers among Food Manufacturing Industries in District States

	Percent change: 1982–92	
	Employment	**Value added**
High performers		
Flour mixes	98	167
Poultry processing	83	249
Cheese	31	178
Ice cream	14	224
Frozen fruits & vegtables	33	97
Frozen specialties	18	119
Meat processing	32	131
Processed milk	14	116
Poor performers		
Spirits	–39	–5
Beer	–61	–9
Dried fruits & vegtables	–39	–9
Pasta	–37	–12
Cooking oils	–37	–29
Pet food	–49	–35
Pickles & sauces	–15	17
Flour	–18	–2
Beet sugar	–27	21
Frozen fish	–71	24
All food processing		
District states	–5	78
U.S.	1	77

Source: U.S. Department of Commerce.

Combined, they accounted for over one-fifth of the value added by District food manufacturing firms in 1992. In comparison, none of the poor performers listed in table 3 are among the District's major food manufacturing industries.

Locational Types

Firms or industries may be classified as supply-oriented, demand-oriented, or footloose (Connor and Schiek, forthcoming). A *supply-oriented* food manufacturing firm or industry tends to locate near the source of raw agricultural inputs because those commodities are either perishable, expensive to transport, or both. Dairy processing is an excellent example of a supply-oriented industry. The primary input, milk, is bulky, costly to move, and subject to bacterial contamination. It is much more efficient to conduct processing activities near production areas and then ship the final products, such as cheese and butter, to the demand points.

In comparison, the firms in a *demand-oriented* industry are inclined to locate near population centers because distribution costs of the final product are relatively large. An example of this would be bread manufacturing, where the output is rather bulky and expensive to transport relative to its weight. Freshness and speedy delivery are also important issues. Each Seventh District state has a significant bread manufacturing industry, yet wheat is not a major farm commodity in District states. Furthermore, there is a high correlation between bread manufacturing and population within District states, and the proportion of bread manufacturing held by each state parallels its share of District population.

In contrast, *footloose* food manufacturing firms do not appear to be constrained by transportation costs (Rainey, 1992). This group also contains those industries not easily categorized as supply- or demand-oriented. The firms in this category are more likely to consider factors such as taxes, utility costs, the availability and cost of labor, infrastructure, and the availability of services when making location decisions. There would likely be a tendency to locate in areas favorable to manufacturing firms in general. District states already comprise an important manufacturing center, accounting for 17% of all U.S. manufacturing employment (compared to a population share of 13%). This presence suggests the region would be an attractive location for footloose food manufacturing industries. Indeed, the District accounted for one-fifth of U.S. employment in footloose food manufacturing industries, also above the region's population share.

Growth rates by locational type for employment, value added, and the value of shipments (sales) are shown in table 4. This table shows that the demand-oriented food manufacturing industries in Seventh District states registered below-average growth from 1982 to 1992. The likely cause of the relatively poor performance of the demand-oriented industries is the link between this group and the local/regional population. Population growth in District states was less than stellar over this period, rising about five percent (about half the U.S. growth rate) and encouraging relatively modest sales growth within this group. As previously noted, demand-oriented firms are generally thought to be constrained from competing outside local or regional markets due to high transportation costs. In contrast, footloose and supply-oriented firms are better able to take advantage of increased demand in distant markets.

Table 4 Growth of District Food Processing Industries by Type

Type	Percent change: 1982-92 Employment	Value added	Value of shipments
Supply-oriented	11	93	44
Demand-oriented	–19	39	24
Footloose	–5	92	69
All food processing			
District	–5	78	41
U.S.	1	77	44

Source: U.S. Department of Commerce.

Future Growth

To evaluate the potential for future growth in District food manufacturing, a simple model formulation developed by Christy and Connor (1989) was utilized:

1) $$\Delta VS_j = f(\Delta POP_j, WAGE_j).$$

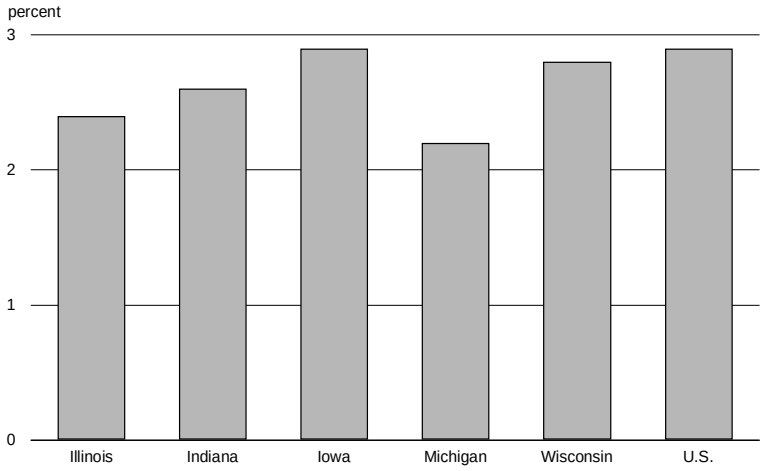
The dependent variable, ΔVS_j, is the percent change in the value of food manufacturing shipments from 1982 to 1992 in state *j*. Changes in food demand and shipments of manufactured food products tend to follow population trends in developed countries (Kinsey, 1994). Therefore, the first independent variable, ΔPOP_j, is the percentage change in state *j's* population from 1982 to 1992. The expected sign of this variable is positive. The second independent variable, $WAGE_j$, is the average compensation paid to food manufacturing workers in 1982, the first year of the period under study. The wage variable was calculated by dividing the annual payroll reported by the *Census of Manufactures* by the number of employees. Wages represent an important production cost that is likely to vary across regions. One would expect a negative relationship to exist between wages and the growth in shipments, because states with relatively lower wages would likely have more success in expanding output, other things being equal. Furthermore, Duffy (1994) found wage rates to be significant in explaining regional food manufacturing growth.

The results from the OLS regression of cross-sectional state data are shown as follows:

2) $$\Delta VS_j = 72.3 + 1.01\,(\Delta POP_j) - 0.02\,(WAGE_j).$$
$$(2.94)\quad (3.28)\qquad\qquad (-1.33)$$

The signs of the independent variables were as expected. The t-statistics are shown in parentheses. The intercept and population variable were significant at the .05 level while the wage variable was not. The F-statistic was 6.69 and was significant at the .05 level while the R^2 was 22.5%.

Figure 1 Predicted Annual Growth Rates in Value of Food Manufacturing Shipments, 1992–2002



The above results were used to generate projections of the percentage increase in the value of shipments for individual states from 1992 to 2002. Projections from the Bureau of Economic Analysis were used to determine state population gains. The average wage per employee in a given state in 1992 was derived from *Census of Manufactures* data. The projections were then converted to annual compound rates. Results for the five Seventh District states are shown in figure 1. The five District states did not fare well relative to other states, ending up in the bottom half of the rankings. This is primarily due to two reasons, both reflected within the above model. First, wages per employee are relatively high in District states compared to other states. Second, while Illinois and Iowa are near the center of the distribution of state population growth projections, Indiana, Michigan, and Wisconsin are in the bottom half, providing a further drag on growth. In short, it appears the impact of wages and population growth will tend to slow future gains in District food manufacturing relative to other states.

Other studies (see Duffy, 1994, for example) suggest that additional factors such as energy costs and taxes may be important explanatory variables for a model of food manufacturing growth. And to the extent that simply using two data points does not adequately capture time trends across a given period, a model using combined time-series and cross-sectional data may better account for trends in the data. Finally, a more detailed approach geared to estimating separate regressions by locational type or by three- or four-digit industry breakdowns could provide more insight regarding further growth in District food manufacturing relative to other states.

Conclusions

The greatest potential for food manufacturing growth in states of the Seventh Federal Reserve District lies with firms that are members of supply-oriented and foot-

loose industries. Given the regional strength in supply-based food manufacturing industries—i.e., meat packing and corn, soybean, and dairy processing—policymakers that look to food manufacturing as a way to maintain or boost rural employment and income would do well to focus on what may be done to support these industries. However, comparative trends in regional pork production do not favor District meat packing. To the extent that footloose food manufacturing industries tend to locate where other manufacturers already are, firms in this group could be targeted and encouraged to expand or to open new facilities in District manufacturing centers. But it does not appear that relative population gains and wage rates will favor growth in food manufacturing in Seventh District states.

The new farm legislation, the Freedom to Farm Act of 1996, also raises issues worth noting. Most analysts do not believe that corn and soybean acreage will undergo a significant expansion, despite the removal of set-asides and the uncoupling of planting decisions and support program payments. However, there will be greater potential for corn and soybean price volatility and shifts in the number of acres planted from year to year. Therefore, it would likely be in the interests of grain processors to pay more attention to managing the risk of price and quantity swings than in years past. In addition, increased volatility of grain prices and supplies could have an adverse effect on livestock and dairy producers, which would feed back to meat packers, milk processors, and, ultimately, consumers.

Notes

[1]Those five states are Illinois, Indiana, Iowa, Michigan, and Wisconsin.

[2]Value added is primarily the value of production less material and energy costs.

[3]For more information on these trends, see Benjamin (1996).

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