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No. 672 Spring 1993

New Growth in Flour Milling

Reynold P. Dahl

Wheat is the most important food grain and the largest single agricultural commodity in world trade. During the 1970s U.S. wheat exports nearly tripled, reaching an all-time record of 1.8 billion bushels by the early 1980s. During the past decade competition has intensified in the export market, however. Wheat exports from the European Community rose sharply due to heavy subsidies. Improved production technologies led to increased production in many developing countries. American wheat exports declined, although they still totaled 1.4 billion bushels last year.

A bright spot in the U.S. wheat economy has been an impressive increase in the domestic consumption of wheat for food. It has increased over the past two decades, reaching a record 830 million bushels last year (Figure 1). Wheat flour milling is again a growth industry in the United States.

This article discusses the economics of the new growth demand, changes in mill location and transportation costs, structural change in the industry, and the outlook for wheat flour milling. It is of particular interest to Minnesotans since Minneapolis was known as the "mill city" for many years, and Minnesota continues to be one of the leading states in wheat flour milling.

Specific Uses for Five Different Wheats

Wheat is a complex grain comprising five classes (Figure 2). Specific bakery products depend on flour milled from the appropriate class.

Substitution among classes is limited by differences in physical (baking) characteristics.

Hard red winter (HRW), the largest class, is grown in the Central Plains states—Nebraska, Kansas (the leading producer), Oklahoma, Colorado, and Texas. Production of HRW in 1992 totaled 966 million bushels. HRW flour is used mainly for baking white pan breads.

Hard red spring wheat (HRS) is the mainstay of North Dakota (the leader), Minnesota, Montana, and South Dakota. The 1992 crop of HRS was a record 702 million bushels. The high protein content of HRS makes it ideal for hearth breads (those baked without

a pan), such as "French," "Italian," and "Jewish" breads and hard rolls. It is also used for blending with the lower protein HRW.

Durum is a hard spring wheat used to mill the semolina (very coarse flour) that goes into making pasta products such as spaghetti and macaroni. Regular durum flour is also used in noodles. Other classes of wheat cannot compete with durum in the pasta market. In 1992, durum production totaled 97 million bushels, much of it in North Dakota.

Soft red winter (SRW) and white wheat (WW) are relatively low in

(See *Growth* page 2)

Measuring the Size of Minnesota's Agricultural Economy

Dave Senf, Wilbur Maki, and James Houck

Farm production and food products processing and manufacturing account for a significant portion of Minnesota's economy. They constitute a \$22 billion "industry." Out-of-state shipments total over \$12 billion, exceeding any other single industry grouping.

How do we know this? We just completed a study using IMPLAN (Impact Analysis for Planning System), a widely accepted economic impact analysis and forecasting model and data base for the United States. Housed at the University of Minnesota, IMPLAN provides detailed estimates of the flows

of goods and services to and from individual counties and regions. These flows are used to measure and characterize economic activity.

One can think of Minnesota's overall economy as divided into two broad categories or sectors: (1) the set of industries that sells to producers and consumers residing outside of Minnesota and (2) the set of industries that sells to producers and consumers within the state. Each category contains several

(See *Economy* page 4)

(Growth continued from page 1)

protein, and so are suitable for pastries, cakes, cookies, and crackers. SRW is grown in Missouri, Illinois, Indiana, Ohio, and in several southeastern states, while WW production is centered in the Pacific Northwest. Production of SRW and WW in 1992 was 427 million and 266 million bushels, respectively.

Price differentials among classes of wheat vary with changes in the relative supply and demand balances among classes. Flour milling profitability is influenced by the ability of the miller to blend various classes and proteins as price spreads change among wheats.

Flour Production and Utilization

For several decades prior to 1970, the U.S. wheat flour milling industry showed little growth. Declines in per capita consumption year after year were just offset by increases in population, so total consumption showed only small yearly changes. A reversal in the long-term decline in per capita flour consumption occurred in the early 1970s: from an all-time low of 110 pounds in 1972, per capita consumption rose to 136 pounds in 1991 (Figure 3). As a result, U.S. wheat flour production (including semolina) increased from 250 million cwt. in 1972 to 374 million cwt. in 1991, an all-time record. Domestic

disappearance accounted for nearly all this production, rising from 231 million cwt. to 355 million cwt. during the period (*Milling and Baking News*, April 28, 1992).

The dramatic increase in per capita consumption resulted from several factors, including the rapid growth of the fast food industry (the so-called "bun revolution"). Flour consumption was also enhanced by a rapid expansion in the demand for variety breads and changed consumer perceptions of the nutrition of breads and other wheat-based foods. The increased popularity of pasta products is also reflected in the rapid rise in the per capita consumption of semolina and durum flour. The USDA's Economic Research Service estimates that this rose from 6.9 pounds in 1970 to 10.5 pounds in 1990. This increase of 52 percent was considerably larger than that for wheat flour (excluding durum), which rose 20 percent (from 104 to 124.6 pounds) over the same period (*Milling and Baking News*, June 26, 1992).

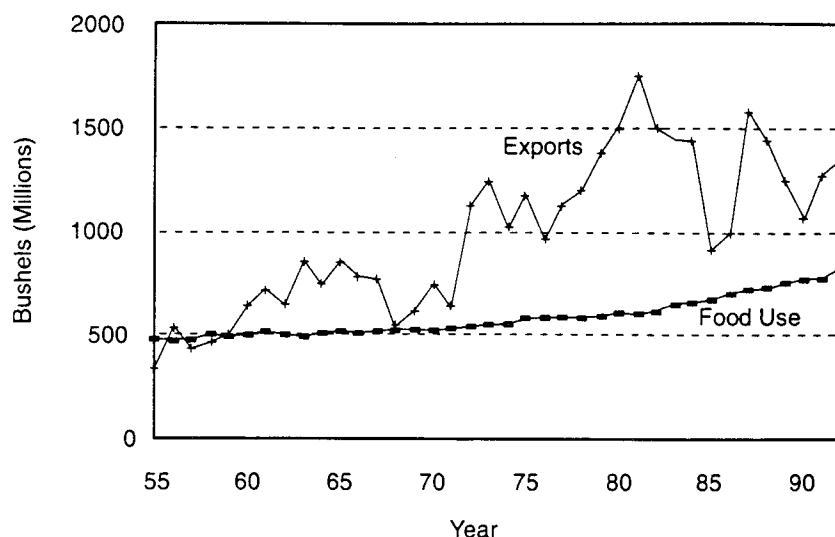


Figure 1. U.S. Wheat: Exports and Food Use

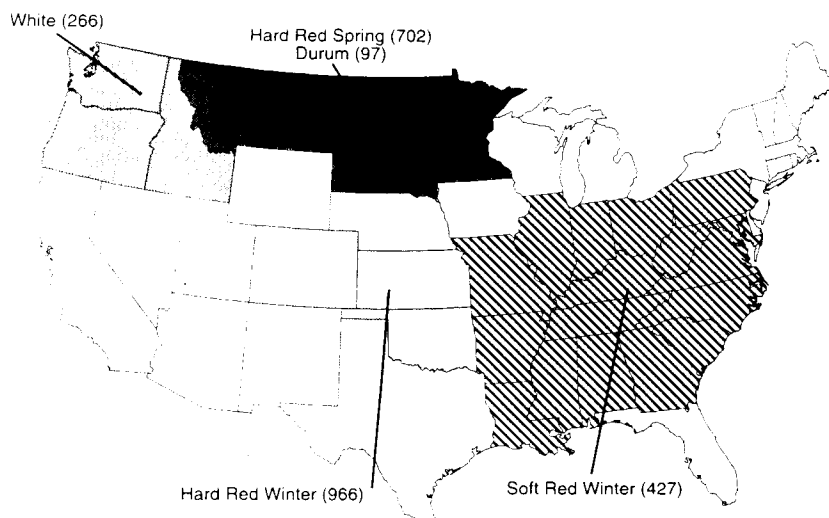


Figure 2. Major U.S. Wheat-Producing Areas and 1992 Production by Class (millions bu.)

Flour Exports

The flour export market is small relative to the domestic market. For example, only 5 percent of U.S. production was exported in 1991. U.S. flour exports suffered a long-term decline after World War II, reaching a record low of 12.4 million cwt. in 1975. There were two reasons for this. First, importing countries found it to their advantage to import wheat itself, rather than wheat flour. Second, flour exports are heavily dependent on relative levels of government subsidy. With the aid of export subsidies, the European Community share of world flour exports increased to 62 percent in 1991-92 (according to the International Wheat Council). The U.S. share declined to 16 percent by the same year.

The United States periodically subsidizes flour exports as well. The 37 million cwt. exported in 1983, for example, was due in large part to a special subsidized sale of 22 million cwt. to Egypt.

Changing Location of Flour Mills

Minneapolis became the nation's leading flour milling center in 1880. Technological change in flour milling enabled mills there to produce high

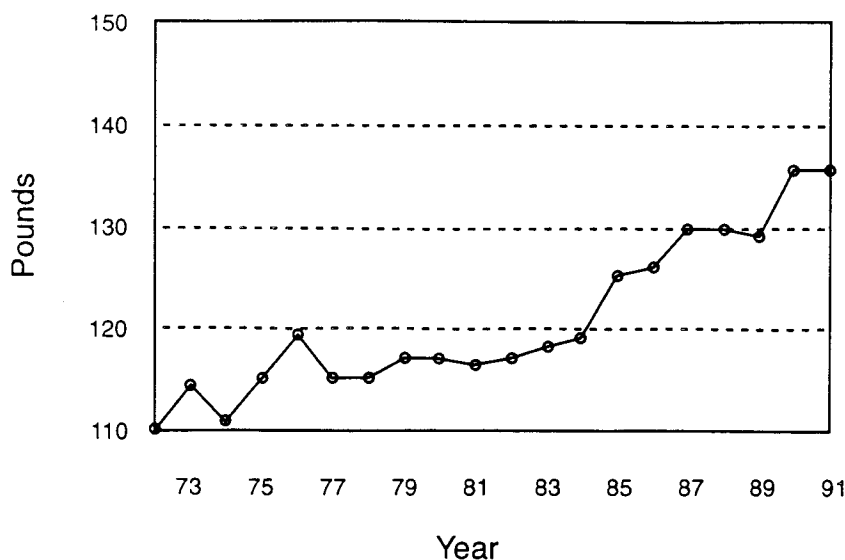


Figure 3. U.S. Annual Per Capita Consumption of Wheat Flour

quality flour out of hard red spring wheat that became known throughout the world. Flour production in Minneapolis peaked in 1916 and then declined, as did the relative importance of Minneapolis as a flour milling center.

Buffalo, New York, surpassed Minneapolis production by 1930. Wheat could be shipped more cheaply on the Great Lakes than could flour, so Buffalo mills were able to deliver flour to the large northeastern markets at lower prices. Buffalo mills also had easy access to all classes of western wheat, whereas Minneapolis concentrated on HRS and durum.

As Buffalo flour milling was on the ascent, production of hard red winter wheat was also increasing rapidly in the southwest. Introduced to Kansas as "Turkey Red" by Mennonites who emigrated from the Crimea in the 1870s, hard red winter wheat soon developed into the nation's largest class of wheat. It also became the basis for a rapid rise of flour milling in the southern plains states, with production centered in Kansas City.

The competitive position of flour mills in the southwest and other wheat-producing areas began to erode in the mid-1950s when U.S. railroad rate structures were modified and then deregulated. Several railroads offered lower multiple-car rates that applied to wheat, but not to flour. This was done to recoup rail grain traffic that had been lost to competing modes of transportation—river barges and trucks.

The effect of the new multiple-car wheat rates was to make it cheaper to ship wheat than an equivalent volume of flour. This provided an incentive for

milling companies to locate new mills closer to flour customers. Mills located near bakery customers in large metropolitan markets can now receive wheat by unit train and truck flour to nearby users. Transportation economics and service issues continue to favor the location of new flour mills nearer consuming markets (Farris et al. 1988).

Structural Change in U.S. Flour Milling

Excess capacity first appeared in the U.S. milling industry in the late 1880s and persisted for many years. This resulted in a highly competitive industry with narrow profit margins. Excess capacity was particularly burdensome following 1948 when U.S. flour exports declined with postwar recovery. Over-capacity, at that time estimated at 50 percent, precipitated the closure of many old, inefficient mills. From a World War I level of about 2,000, U.S. flour mill numbers dropped to 358 by 1970 and to 226 today. Although the number of flour mills has continued to decline, total daily flour milling capacity has increased from its low level of 1 million cwt. in 1970 to 1.4 million cwt. in 1992, an increase of over 30 percent. Semolina and durum flour milling capacity, included in the above numbers, nearly tripled (to 133,595 cwt.) during the same period. Capacity utilization has also increased. The average rate of flour milling operations in 1991 was above 90 percent of capacity, based on a six-day week (*Milling and Baking News*, June 26, 1992).

Many other structural changes characterize U.S. flour milling over the past two decades. New entrants, previously known mostly as primary handlers and processors of grain and other bulk commodities, have entered the business through acquisition. Today the nation's three largest flour milling companies (Con-Agra, Cargill, and Archer Daniels Midland) collectively operate 54 percent of the wheat flour-durum-rye milling capacity in the United States (Table 1). These three firms are also the largest multiple-facility grain companies in the United States and play a major role in grain exporting (Dahl 1992). Yet none of these giants ever appeared among the top 10 flour milling companies in 1970. The four largest at that time (Pillsbury, International Milling, Nebraska Consolidated Mills, and Peavey) accounted for 32 percent of the industry's total milling capacity (*Milling and Baking News*, June 26, 1992).

Much of this restructuring was due to acquisitions and consolidations. For example, the flour milling operations of both International Milling and Peavey were acquired by Con-Agra. Pillsbury, which had its origins in flour milling, is now a subsidiary of Grand Metropolitan and has sold all but four of its flour mills. In early 1992, it announced the sale of a 50 percent stake in its four remaining mills to ADM. The ownership of the four mills (Buffalo, Enid, Oklahoma, Minneapolis, and St. Louis) shifted to a 50-50 joint venture known as ADM/TPC Milling. This joint venture, reported to be operated by ADM, supplies flour to Pillsbury for its branded family flour and sack bakery flour.

It is of interest to note that Con-Agra, Cargill, and ADM have all acquired sizable interests in Canadian flour milling operations as well.

Outlook for Flour Milling

U.S. exports of flour might increase if more flour exports were subsidized. A provision of the 1990 Farm Bill set a goal of earmarking 25 percent of funds in the Export Enhancement Program (EEP) for the promotion of "value-added food products" (for example, subsidizing the export of flour rather than wheat).

Without such subsidies, it is difficult to be optimistic about prospects for flour exports. Both developed and developing countries find it advantageous to import wheat

Table 1. Largest U.S. Wheat Flour-Durum-Rye Milling Companies, 1992

Company	Number of Mills	Daily Capacity (1,000) cwt.	Percent Total Capacity
1. Con-Agra, Inc.	30	284.6	21.0
2. Cargill, Inc.	21	225.4	16.6
3. ADM Milling Co.	26	221.7	16.4
4. General Mills, Inc.	8	73.0	5.4
5. Cereal Food Processors	9	69.8	5.2
6. The Pillsbury Co.	4	69.4	5.1
7. Bay State Milling Co.	8	55.0	4.1
8. Italgrani U.S.A., Inc.	2	29.2	2.2
9. Nabisco Brands, Inc.	1	28.0	2.1
10. Amber Milling Co.	2	23.0	1.7
Others	115	275.0	20.2
Total U.S.	226	1,354.1	100.0

Source: "Milling Directory and Buyers Guide," 1992, *Milling and Baking News*

rather than flour. Wheat can be shipped at a lower cost, and locally produced millfeeds can usually be marketed more profitably for feeding local livestock. Also, because flour milling is not a complex or expensive technology, it can readily be initiated by developing countries. Hence, most developing countries that consume wheat flour have strong incentives to construct their own flour mills.

The future growth of the U.S. flour milling industry will likely be heavily dependent on continued growth in domestic markets. Economic forces generating the rapid growth in domestic consumption of wheat-based foods in the 1980s will likely continue in the 1990s. Also, the USDA's new food guide pyramid suggests that the grain group (bread, cereal, rice, and pasta) should form the base of the consumer

diet with 6-11 servings per day. Wheat continues to be our most important food grain and its use for food is likely to increase.

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(Economy continued from page 1)

hundred of the individual industries detailed in the IMPLAN model.

Regional economists commonly refer to the first set of industries as the state's "economic base," and refer to their sales as "exports." (Most export sales, in this sense, are to industries and consumers in other states, not in other nations.) Of the \$165 billion of output produced in Minnesota in 1990, approximately one-third, or \$55 billion, was exported.

Typical exports from this category would include shipments of packaged meats to grocery stores across the nation from meat-packing plants in Austin, Albert Lea, and Worthington. Sales revenues received by these industries are "injected" into the state's economy, primarily through labor earnings, thus creating additional income and employment as workers spend these earnings.

The other set of industries constitutes the "local sector" and sells to producers and consumers within the state. Examples of local sector activities are public utilities, medical services, state and local government services, and local truck transportation for local

businesses. Payments for these services originate entirely within the state and amounted to \$110 billion in 1990.

To fully measure the size of either sector, we must include all direct and indirect spending, as well as associated employment. For example, we categorized meat-packing plants as part of the state's export sector. But when we include all spending and employment, we see that these plants also purchase inputs from local suppliers and generate income and employment in the local sector. They pay their workers who then buy Minnesota-produced inputs. This creates another round of spending which entails more income and employment. The spending cycle is repeated several times but eventually ceases as income is either saved or "leaks out" of Minnesota through purchases of goods and services produced in other states and countries. This secondary spending is often called "indirect" economic impact.

The study summarized here measures Minnesota's agricultural economy as the sum of all such direct and indirect spending and associated employment. For purposes of this study, only spending that was "gener-

ated by" the production and processing of farm commodities qualified as part of the food and agricultural industry.

Sales

We define the "food and agricultural industry" here as *all firms involved in the production and processing of agricultural commodities, but not their distribution or sale*. So, for example, we include the baking and wrapping of bread, but we do not include its shipping or its retail outlet sales. This definition is different from that used in some government statistical reports, but we think it better fits the image most people have of the "agricultural economy." So-defined, the industry in Minnesota accounts for over \$12 billion in sales to out-of-state purchasers and \$10 billion in purchases from within-state sellers (Table 1). The export sales make up 22 percent of the state's economic base, as shown in Figure 1.

For most of Greater Minnesota (the 80 counties outside the metro area) the export-producing activity of the food and agricultural industry is even more important than it is for the state as a whole. More than 40 percent of all

export sales from Greater Minnesota are attributable to this industry. Food and agriculture provides between 26 and 29 percent of Greater Minnesota's economic base, whether measured by value-added, personal income, or employment.

Linkages

The food and agricultural industry has stronger ties to the rest of the state's economy than does any other major industry grouping analyzed here. Table 1 shows that for food and agricultural production, local input use (\$10 billion) is much larger than imports (\$6 billion). Furthermore, its purchases of local inputs are almost twice as large as those of the next largest user—high-tech manufacturing.

The high degree of in-state linkage results from a well-developed food and agricultural supply system. Much of the linkage is internal to the industry: more than \$6 billion of its purchases are "from itself," that is, from other farms and food-producing businesses in Minnesota.

An example of linkages at the farm level is the use of Minnesota-grown hay and corn for feed by the state's dairy and livestock producers. Another strong linkage is shown by the fact that Minnesota food processors, the bulk of whose input needs are farm products, buy more than 40 percent of the state's farm output. Minnesota's economy benefits even more when farm commodities are further processed before being sold out-of-state.

In addition to its within-industry sales, the food and agricultural industry also sells to other Minnesota industries. For example, Minnesota restaurants purchase more than \$500 million worth of products from food and agricultural processors and producers.

Employment

Of the state's 162,000 food and agricultural workers, 73,000 are directly involved in production for out-of-state markets, including sales to visitors from outside Minnesota. A canner in Sleepy Eye, a Red River Valley wheat farmer, a Rock County hog farmer, and a Northfield cereal manufacturing employee all can be thought of as contributing to the state's economic base, when defined as out-of-state sales.

An additional 257,000 local sector jobs are indirectly generated by out-of-state food and agricultural sales. When

Table 1. Sales to and Purchases from Minnesota's Food and Agricultural Industry in 1990

Industry	Sales to Industry (mil. \$)	Purchases from Industry (mil. \$)
<i>Within State</i>		
Food and agricultural	6,124.7	6,124.7
Manufacturing	57.3	793.5
Transportation/utilities	1.2	678.8
Wholesale/retail trade	509.1	991.3
Finance/insurance	0.0	861.9
Other industry	128.2	572.5
	<u>6,820.5</u>	<u>10,022.7</u>
Households and other	2,513.7	4,630.2
<i>Out-of-State</i>	<u>12,229.8</u>	<u>5,911.1</u>
Total	21,564.0	21,564.0

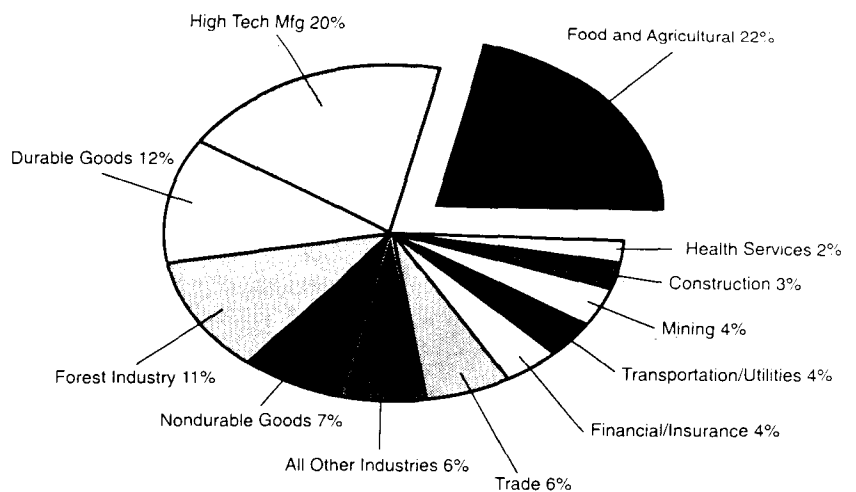


Figure 1. 1990 Sales to Out-of-State Purchasers (\$55.5 billion total, all Minnesota Industries)

both export and local sector jobs are combined, the food and agricultural industry accounts for 15 percent of total state jobs.

Figure 2 shows the percent of total regional jobs directly and indirectly generated by the food and agricultural industry. Western Minnesota depends on food and agriculture for almost half of its employment. In the southeastern and central portion of the state, the industry accounts for 3 of every 10 jobs. Only in the northeast and metro regions does the food and agricultural job category fall below 20 percent.

Another measure of the food and agricultural industry's contribution to the state economy is the state's strong "trade surplus" in food and agricultural products (Figure 3). (Again, this "trade" is with other states, not other nations.) The \$4.4 billion surplus in food and agricultural products allows us to run trade deficits in other products such as durable and nondurable manufactured goods purchased at the retail

level. This means that Minnesotans can have ready access to goods and services produced elsewhere in the United States and around the world.

No matter how its contribution to the state's economy is measured, the food and agricultural industry and its related sectors are crucial to the continued prosperity, stability, and vitality of Minnesota communities. The industry accounts for:

- 22 percent of Minnesota's \$55 billion in out-of-state sales
- 13 percent of the state's total economic activity
- \$6 billion in intermediate input purchases from Minnesota industries
- 73,000 workers directly involved in production for out-of-state markets
- 257,000 local sector jobs indirectly generated by food and agricultural exports
- \$4.4 billion in net exports, without which the Minnesota economy would face a much larger export deficit

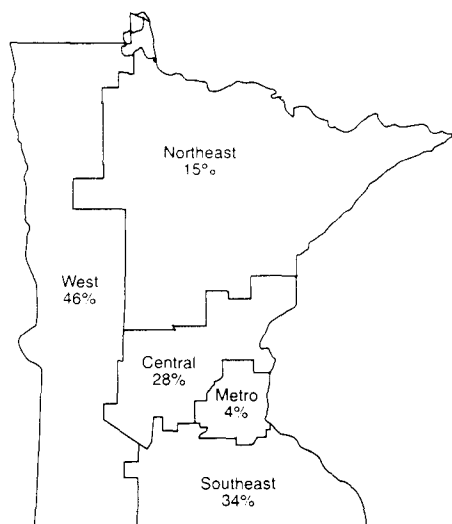


Figure 2. Percent of Regional Employment Generated by the Food and Agricultural Industry

We have much to learn from measuring an industry's contribution to a state's economic base and balance of trade. An industry that accounts for a large share of a state's economy must compete widely in both domestic and foreign markets. A favorable balance of trade for the food and agricultural industry, which trades in highly competitive domestic and global markets, is a remarkable accomplishment. This accomplishment, however, has a recurring cost—constant restructuring and loss of jobs. Workers and businesses in the food and agricultural industry are, in part, the victims of their own successes. But this is another story that must await another time for telling.

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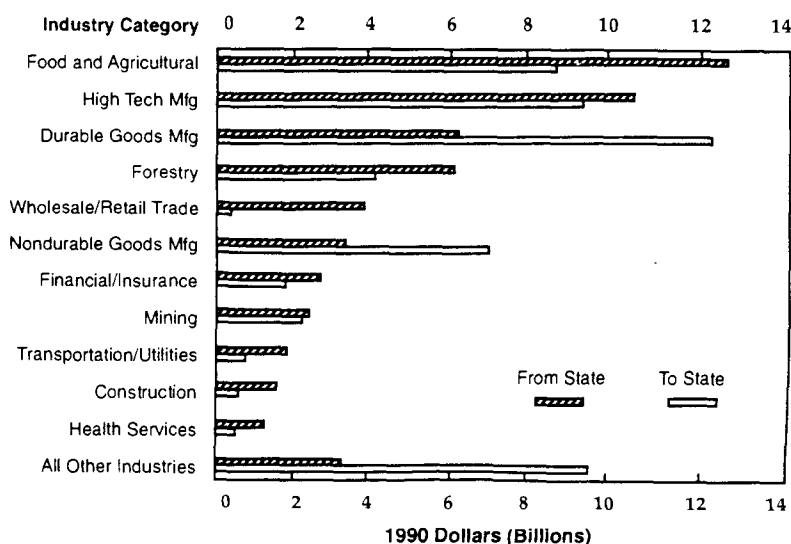


Figure 3. Sales to and from Minnesota

Input-Output Models: A Comment

Barbara Kanninen

Senf, Maki, and Houck demonstrate the importance of the agricultural industry to Minnesota's economy. They use an input-output model, which captures the interactions among different industries and economic agents and forms a picture of the overall workings of an economy.

An input-output model is an abstraction of the complex set of interactions among industries and other economic agents. Like all models, it requires certain assumptions to hold. The most restrictive of these is the assumption that factor inputs (labor, capital, land, and energy) are employed in fixed proportions to each other—even if output levels change substantially. This means that the model does not allow for the existence of economies of scale, nor does it allow for shifts in the proportional use of any factor input as production levels change. For example, as agricultural production increases over time, the purchases of new capital equipment required to accommodate the increase might proportionately exceed the additional labor input used.

Another assumption is that all prices in the economy remain fixed for the period of analysis, even as the quantities supplied and demanded change. This is reasonable when the firms are small and have no market or price-setting power, but it may not hold at the state and national levels. That is, as agricultural production expands on an aggregate level in the state, we should expect to see agricultural prices react, probably by decreasing. By remaining constant in the model, the result may be an overestimation of agricultural revenues.

Since the factor proportions and price effects are not fully accounted for in input-output analysis, the numbers reported here should be considered approximations, and not specific quantities. Input-output analysis can be extremely useful to policymakers, but should be used with caution. In particular, commonly reported indicators such as spending multipliers—which the authors are careful (and rightly so) not to use—have led many policymakers astray.

Barbara Kanninen is an assistant professor with the Hubert H. Humphrey Institute of Public Affairs.

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Minnesota **A**gricultural **E**conomist

No. 672 Spring 1993

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Prepared by the Minnesota Extension Service and the Department of Agricultural and Applied Economics. Views expressed are those of the authors, not necessarily those of the sponsoring institutions. Address comments or suggestions to Professor Steven J. Taff, Department of Agricultural and Applied Economics, University of Minnesota, 1994 Buford Avenue, St. Paul, MN 55108.

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