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How Big is Minnesota's Food and Agricultural Industry?

by

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How Big is Minnesota's Food and Agricultural Industry?

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Abstract

This report shows that the state's food and agricultural industry is still a significant component of the economy, although probably less so than in earlier years due mainly to agricultural commodity price declines. Agricultural output amounted to 8 percent of the state's total output in 1999, while employment in the industry represented 5 percent of total employment and 3 percent of the labor income generated in the state. Agricultural exports out of the state were 19 percent of the state's total exports. These agricultural exports generate additional indirect sales such as feedgrains sold to pork producers and farm machinery sales to crop farms. The indirect impact measures are derived using the IMPLAN input-output software package. The food and agricultural industry accounts for 213,000 jobs, or 6 percent of the state total, when these secondary impacts of exports are considered. When all food and agricultural industry final sales for export and in-state use are used as the direct measure rather than just exports, the total number of jobs directly or indirectly generated comes to 350,000, or 11 percent of the state total. The importance of agriculture is greater on a percentage basis for the western and southeastern portions of the state. Another measure of the food and agricultural industry's contribution to the state economy is the state's strong \$8 billion "trade surplus" in food and agricultural products.

How Big is Minnesota's Food and Agricultural Industry?

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This paper summarizes a study of Minnesota's food and agricultural industry using IMPLAN (Impact Analysis for Planning System), a widely accepted economic impact analysis and forecasting model and database for the United States. IMPLAN is a computer program that was developed originally by the USDA Forest Service in cooperation with the Federal Emergency Management Agency and the USDI Bureau of Land Management to assist in land and resource planning. It was developed further at the University of Minnesota and then privatized in 1993 with the formation of the Minnesota IMPLAN Group, Inc. of Stillwater, Minnesota which has continued development of the software and database. 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. Our analysis is based on data for 1999.

Our study is a revision of an earlier one by Senf, Maki, and Houck published in issue 672 of the Minnesota Agricultural Economist, in the spring of 1993¹. That report focused on agricultural exports

Assistance from Vernon Eidman and Steve Taff in preparing this analysis is gratefully acknowledged.

¹ The 1993 article was followed by a note by Barbara Kanninen of the Hubert H. Humphrey Institute of Public Affairs which discussed the assumptions that underlie input-output models and cautions about their use. Her comments apply equally to this revision, so are included here in their entirety:

“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 proportionally 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.”

and their direct and secondary impacts on the state's economy. The discussion of exports from that report is retained here where appropriate and simply updated with our more recent numbers. This report also includes additional analysis of the impacts of all final sales from agricultural producers and processors including sales to in-state buyers as well as exports. A section was also added that compares impacts for the state as a whole against those for sub-state regions.

Agriculture in Minnesota has changed a lot in the 1990s, including consolidation of the swine and dairy industries and the growth of the ethanol industry. This report shows that the state's food and agricultural industry is still a significant component of the economy, although probably less so than in earlier years. The two sets of numbers are not directly comparable, however, because of changes in the structure of the IMPLAN database. One change is that the procedure for arriving at the value of agricultural production (output), labor income, and employment has been revamped. The IMPLAN data is drawn from a number of sources including the Census of Agriculture and National Agricultural Statistics Service reports. The second change in the IMPLAN database is that the fraction of agricultural production value that is paid to other industries for input purchases and how much is left for labor and proprietor income, is now based on the national 1992 Benchmark Input-Output study by the U.S. Department of Commerce's Bureau of Economic Analysis (BEA). This national study develops estimates of how much each industry of the economy buys and sells to every other industry. The Senf, et al. analysis was based on an earlier benchmarking study done in 1982. Any differences in the inter-industry transactions found in those two national studies a decade apart will affect the IMPLAN results. The third major change in the IMPLAN database is that the multipliers are calculated using a "social accounting matrix" (SAM) methodology that accounts for commuting, social security tax payments as well as household income taxes and savings. The SAM multipliers also account for government expenditures, resulting in estimates that are presumably more accurate than was possible in the earlier study. These changes in the agriculture industry data, the input-output studies, and the multiplier methodology make it difficult to tell exactly how much agriculture's significance has changed over the decade.

The size of a composite industry such as "agriculture" can be measured in different ways. One approach is to identify and add up the value of output from those industries that are directly related to agricultural production, such as feed grains and dairy farms, and agricultural and food processing industries such as meat packing plants and cereal manufacturers. A different approach would be to count not just industries directly involved in agriculture, but also "secondary" effects on other industries that sell to them such as farm machinery manufacturers as well as industries that benefit from consumer spending by agricultural workers. Numbers based on both approaches are presented in this analysis.

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. Regional economists commonly refer to the first set of industries as the state's "economic base," and refer to their sales as "exports." (Export sales are to industries and consumers in other states as well as in other nations.)

Typical agricultural exports include shipments of packaged meats to grocery stores across the nation from meat-packing plants in Austin 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 non-exporting set of industries constitutes the "local sector" (sector 2 above) 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.

If we include all direct and secondary spending and employment in an analysis of the meat-packing plants referred to above, 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.

When secondary effects are included, one must be careful to avoid double-counting of sales from one agricultural industry to another – if we include hog sales to a Minnesota meat packer as a secondary effect of having the meat packing plant here, we would not want to include the same hog sales as a direct impact. So, secondary effects are included here but are based on only that portion of direct sales that are not to another agricultural industry. Two measures of direct sales are compared: 1) exports to other states or countries, and 2) exports plus in-state industries outside of agriculture, such as that to consumer households, restaurants and hospitals.

Agriculture's Direct Impacts

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 “food and agricultural industry.” So-defined, food and agriculture constitutes a \$25 billion “industry,” in terms of the dollar value of output (Table 1, first column). The 21 agricultural production industries and 46 processing industries are listed in Table 2. The production industries generate one-third of this output with the other two-thirds coming from processing. Employment directly related to this production amounts to 150,000 jobs. These employees and proprietors earn \$3.8 billion in labor income. “Value-added” of \$6.4 billion is a broader measure of productivity that includes this labor income plus other property income such as rents, and business taxes.

Senf, et al. found the output volume of the food and agricultural industry to be \$22 billion based on 1990 data, so our \$25 billion figure indicates that the industry grew by 14 percent over the nine years between 1990 and 1999. As mentioned above, changes in the IMPLAN database make comparisons of the two studies difficult, but other government statistics show that agriculture’s lesser importance in 1999 can be attributed mainly to agricultural commodity price declines over the decade. That is, the index of prices received by U.S. farmers in 1999 was nine percent below its 1990 level. So, while the overall U.S. gross domestic product (a measure of value-added) rose 60 percent between 1990 and 1999, the analogous number for agricultural production only rose 17 percent. When adjusted for inflation, agriculture still lagged the rest of the economy with a 27 percent increase compared to an overall 32 percent, so growth in physical terms is taking place both in agriculture and elsewhere but the price decline masks some of the agricultural growth. This trend comparison pertains to the agricultural production industries listed in Table 2 only. The processing side is more difficult to compare because it is combined with other manufacturing in the statistical reports.

Agricultural output amounts to 8 percent of the state’s total output, while employment in the industry represented 5 percent of total employment and 3 percent of the labor income generated in the state. Employment and labor income may be better measures of size than is output, since as mentioned earlier output is counted each time a product is sold from one industry to another. The larger output percentage may just indicate that agricultural goods are sold more often than are, say, manufactured goods as they move from initial source to final consumer. The IMPLAN employment estimates are annual estimates of all jobs, full-time and part-time. The fact that agriculture accounts for 5 percent of the jobs but only 3 percent of labor income could indicate that agricultural jobs are more likely to be part-time than elsewhere in the economy, or that agricultural wage rates are less on average.

Secondary Impacts of Sales

Turning to an economic-base perspective of the economy, all Minnesota industries together exported \$56 billion in 1999. This was 18 percent of Minnesota's \$311 billion of output. The largest export industry in the state is manufacturing, with 36 percent of the total (Figure 1).

Agricultural exports out of the state were \$11 billion which was 19 percent of the state's total exports. These agricultural exports generate additional indirect sales such as feedgrains sold to pork producers and farm machinery sales to crop farms. When these secondary impacts are included, the total output impact is \$26 billion or 8 percent of the \$311 billion of state output from all industries.

In addition to exports and their secondary impacts, the food and agricultural industry also sells to other Minnesota industries in the state that would otherwise need to import to meet their needs. For example, Minnesota restaurants purchase more than \$650 million worth of products from food and agricultural processors and producers. Total agricultural sales for export and in-state sales to non-agricultural industries (referred to here as "all final sales") is \$17 billion, and the total direct and secondary impacts of this output is \$45 billion or 14 percent of the total Minnesota economy in 1999.

Employment

Of the state's 152,000 food and agricultural workers, 58,000 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. Additional local sector jobs are indirectly generated by these out-of-state food and agricultural sales. The food and agricultural industry accounts for 213,000 jobs, or 6 percent of the state total, when these secondary impacts of exports are considered.

When all food and agricultural industry final sales are used as the direct measure rather than just exports, the total number of jobs directly or indirectly generated comes to 350,000, or 11 percent of the state total.

Non-Metropolitan Minnesota

For most of non-metropolitan Minnesota (the 80 counties outside the seven-county metro area of Anoka, Carver, Dakota, Hennepin, Ramsey, Scott, and Washington Counties) the export-producing activity of the food and agricultural industry is even more important than it is for the state as a whole. Almost a quarter

of all export sales from Greater Minnesota are attributable to this industry, considering the secondary effects of exports out of the region plus in-region sales to non-agricultural purchasers. Food and agriculture provides 17 percent of Greater Minnesota's employment.

Figure 2 shows the percentage of total regional jobs directly and indirectly generated by the food and agricultural industry. Western Minnesota depends on food and agriculture for 28 percent of its employment. The industry accounts for 1 out of 5 jobs in the southeastern portion of the state and 14 percent in the central region. Only in the northeast and metro regions does the food and agricultural job category fall below 10 percent.

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 3 shows that for food and agricultural production, local input use (\$15.2 billion) is much larger than imports (\$2.9 billion). Furthermore, its purchases of local inputs are 60 percent as large as those of the largest user—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: \$7.7 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 60 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.

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. (Again, this “trade” is with other states as well as with other nations.) The \$7.6 billion surplus in food and agricultural products allows us to run trade deficits in other products such as manufactured goods purchased at the retail level (Figure 3).

The Role of Region Size

The size of the region considered in an economic impact analysis can affect the results, as Tables 4 and 5 show. The five sub-state regions' total economy outputs sum to the same \$311 billion state total that we found in the state-level analysis, and total numbers of jobs also match. Agricultural exports plus in-region sales at the regional level sum to \$21 billion (Table 4, bottom line, second column), however,

while the state sales came to only \$17 billion (top line). The extra \$4 billion probably represent exports from one region to another that remained within the state. While the regional total sales are greater than the state total, when the secondary impacts are added the total economic impacts at the regional level are less - \$36 billion compared to \$45 billion total in the state-level analysis. The difference in total economic impact is probably due to inputs and services that agricultural producers and processors purchase from outside their local area but within the state. While at the state level each dollar of agricultural output generated \$2.65 in total economic impacts, this “leakage” out of the sub-state regions reduces the regional output multipliers to between \$1.50 and \$1.83. The same phenomenon is apparent in the employment numbers – the numbers of jobs directly related to agricultural exports appears greater from the perspective of a smaller region, but the multiplier effect of secondary spending is also reduced. The state captures economic benefits from the food and agricultural industry that escape any given locality.

Concluding Comments

No matter how its contribution to the state’s economy is measured, the food and agricultural industry and its related industries are crucial to the continued prosperity, stability, and vitality of Minnesota communities. In percentage terms, however, its impact is probably less significant than in earlier years due mainly to agricultural commodity price declines. The importance of agriculture is greater on a percentage basis for the western and southeastern portions of the state than for the state as a whole. 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.

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.

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Table 1. Measures of Minnesota's Food and Agricultural Industry in 1999

	Output (\$billion)	Employment (000 jobs)	Labor Income (\$million)	Total Value Added (\$million)
Total Minnesota Economy, All Industries	\$311	3,294	\$115,000	\$173,000
Total Minnesota Exports from All Industries	\$56			
Total Minnesota Exports as a Percent of The Total Minnesota Economy	18%			
<i>Total Output of the Food and Agricultural Production and Processing Industry (Includes Intermediate Sales to Other Agricultural and Food Firms as Well as Final Sales to In-State Buyers In Other Industries, and Exports Out of the State):</i>				
Agricultural Production Industries	\$8	98	\$1,373	\$2,281
Agricultural and Food Processing Industries	17	54	2,432	4,128
Overall Food and Agricultural Industry	\$25	152	\$3,805	\$6,409
Agriculture As a Percent of the Total Minnesota Economy	8%	5%	3%	4%
<i>Direct and Secondary Impacts of the Agricultural Production and Processing Industry:</i>				
Agricultural Exports, Direct Impacts	\$11	58	\$1,648	\$2,803
Agricultural Exports as a Percentage of Total Minnesota Exports	19%			
Direct and Secondary Impacts Related to Agricultural Exports	\$26	213	\$6,401	\$10,560
Agriculture As a Percentage of the Total Minnesota Economy	8%	6%	6%	6%
All Agricultural Final Sales to Export & In-state Buyers, Direct Impacts	\$17	88	\$2,667	\$4,572
Direct and Secondary Impacts Related to All Agricultural Final Sales	\$45	350	\$10,803	\$17,685
Agriculture As a Percentage of the Total Minnesota Economy	14%	11%	9%	10%

Table 2. Industries included in the Overall "Food and Agricultural Industry"

<u>Agricultural Production</u>	<u>Agricultural and Food Processing (continued)</u>
Dairy Farm Products	Frozen Fruits, Juices and Vegetables
Poultry and Eggs	Frozen Specialties
Ranch Fed Cattle	Flour and Other Grain Mill Products
Range Fed Cattle	Cereal Preparations
Cattle Feedlots	Rice Milling
Sheep, Lambs and Goats	Blended and Prepared Flour
Hogs, Pigs and Swine	Wet Corn Milling
Other Meat Animal Products	Dog, Cat, and Other Pet Food
Miscellaneous Livestock	Prepared Feeds (not included elsewhere)
Cotton	Bread, Cake, and Related Products
Food Grains	Cookies and Crackers
Feed Grains	Sugar
Hay and Pasture	Confectionery Products
Grass Seeds	Chocolate and Cocoa Products
Tobacco	Chewing Gum
Fruits	Salted and Roasted Nuts & Seeds
Tree Nuts	Cottonseed Oil Mills
Vegetables	Soybean Oil Mills
Sugar Crops	Vegetable Oil Mills (not included elsewhere)
Miscellaneous Crops	Animal and Marine Fats and Oils
Oil Bearing Crops	Shortening and Cooking Oils
<u>Agricultural and Food Processing</u>	Malt Beverages
Meat Packing Plants	Malt
Sausages and Other Prepared Meats	Wines, Brandy, and Brandy Spirits
Poultry Processing	Distilled Liquor, Except Brandy
Creamery Butter	Bottled and Canned Soft Drinks & Water
Cheese, Natural and Processed	Flavoring Extracts and Syrups (not included elsewhere)
Condensed and Evaporated Milk	Canned and Cured Sea Foods
Ice Cream and Frozen Desserts	Prepared Fresh Or Frozen Fish Or Seafood
Fluid Milk	Roasted Coffee
Canned Specialties	Potato Chips & Similar Snacks
Canned Fruits and Vegetables	Manufactured Ice
Dehydrated Food Products	Macaroni and Spaghetti
Pickles, Sauces, and Salad Dressings	Food Preparations (not included elsewhere)

SOURCE: 1999 IMPLAN database, Minnesota IMPLAN Group, Inc.

Table 3. Sales to and Purchases from Minnesota's Food and Agricultural Industry in 1999

	Sales to Industry (\$ billion)	Purchases from Industry (\$ billion)
<i>Within State</i>		
Food & Ag Production & Processing	\$ 7.7	\$ 7.7
Other Manufacturing (Non-food)	\$ 0.1	\$ 1.5
Wholesale/retail Trade	\$ 0.7	\$ 2.2
Financial/insurance	\$ 0.0	\$ 0.4
Other industries	\$ 0.2	\$ 2.1
Total Inter-Industry	\$ 8.7	\$ 15.2
Households and Other	\$ 6.0	\$ 7.1
<i>Out-of-State</i>	\$ 10.5	\$ 2.9
Total	\$ 25.2	\$ 25.2

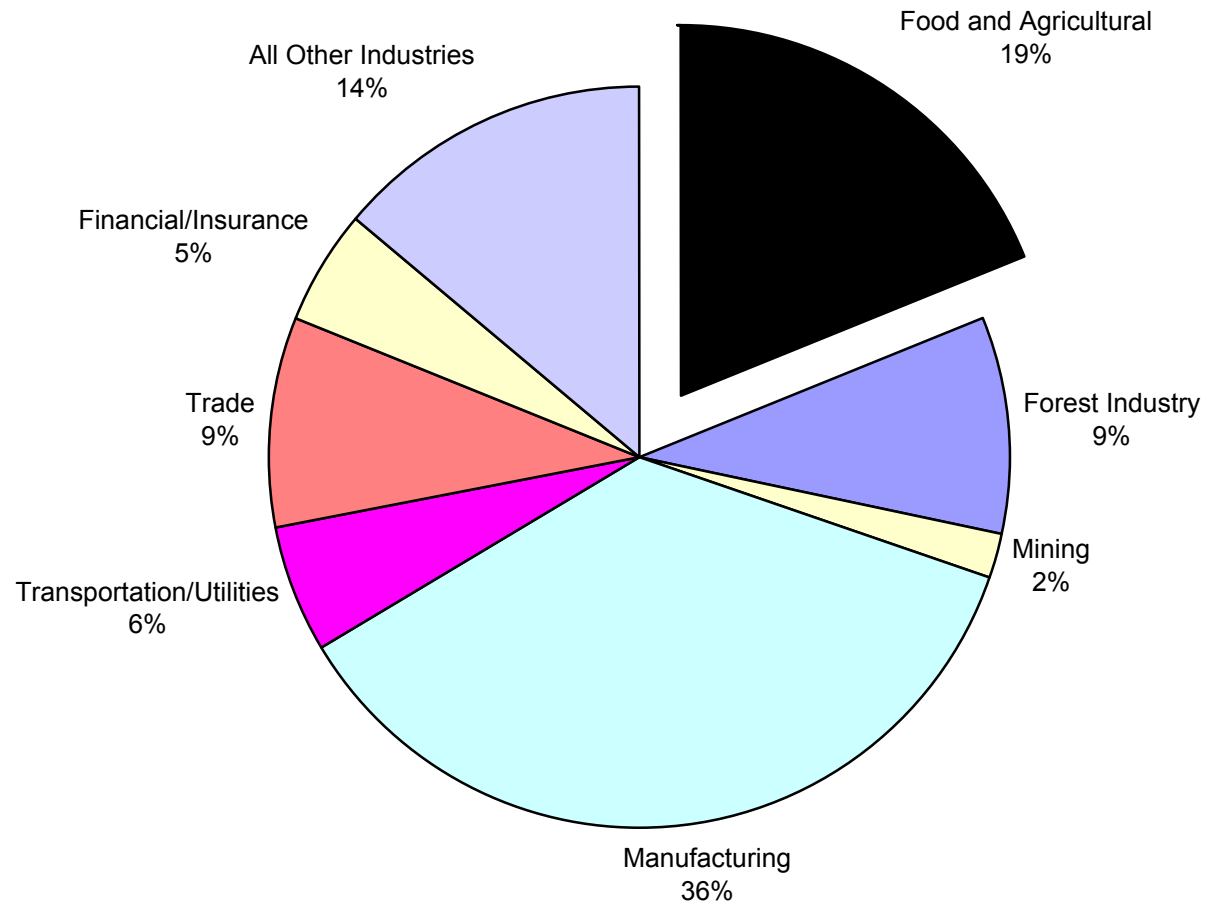
Table 4. Output Impacts of The Food & Agricultural Industry by Sub-state Region Compared to the Overall Economy, 1999

	Total Output of the Overall Economy (\$ billion)	All Final Sales of Ag & Food (Direct Impacts) (\$ billion)	Total Impact of of All Final Sales (Direct & Secondary) (\$ billion)	Total Impact of Ag as % of Overall Economy (percent)
Total Minnesota Economy (from state analysis in Table 1)	\$311	\$17	\$45	14%
By Sub-state Region:				
West	23	5	9	40%
Southeast	\$40	\$6	\$11	28%
Central	34	3	5	15%
Northeast	<u>14</u>	<u>0</u>	<u>0</u>	2%
Total Non-metro	\$110	\$14	\$25	23%
Metro Region	<u>\$201</u>	<u>\$7</u>	<u>\$11</u>	5%
Total Minnesota Economy Based on Regional Totals	\$311	\$21	\$36	12%

Table 5. Employment Impacts of the Food and Agricultural Industry by Sub-state Region Compared to the Overall Economy, 1999

	Total Employment in the Overall Economy (000 jobs)	All Final Sales of Ag & Food (Direct Impacts) (000 jobs)	Total Impact of of All Final Sales (Direct & Secondary) (000 jobs)	Total Impact of Ag as % of Overall Economy (percent)
Total Minnesota Economy (from state analysis in Table 1)	3,294	88	350	11%
By Sub-state Region:				
West	292	38	81	28%
Southeast	439	32	89	20%
Central	437	28	60	14%
Northeast	<u>182</u>	<u>3</u>	<u>4</u>	2%
Total Non-metro	1,350	101	234	17%
Metro Region	<u>1,945</u>	<u>23</u>	<u>68</u>	3%
Total Minnesota Economy Based on Regional Totals	3,294	124	302	9%

Figure 1. Sales to Out-of-State Purchasers in 1999 (\$55.8 billion total, all Minnesota Industries)



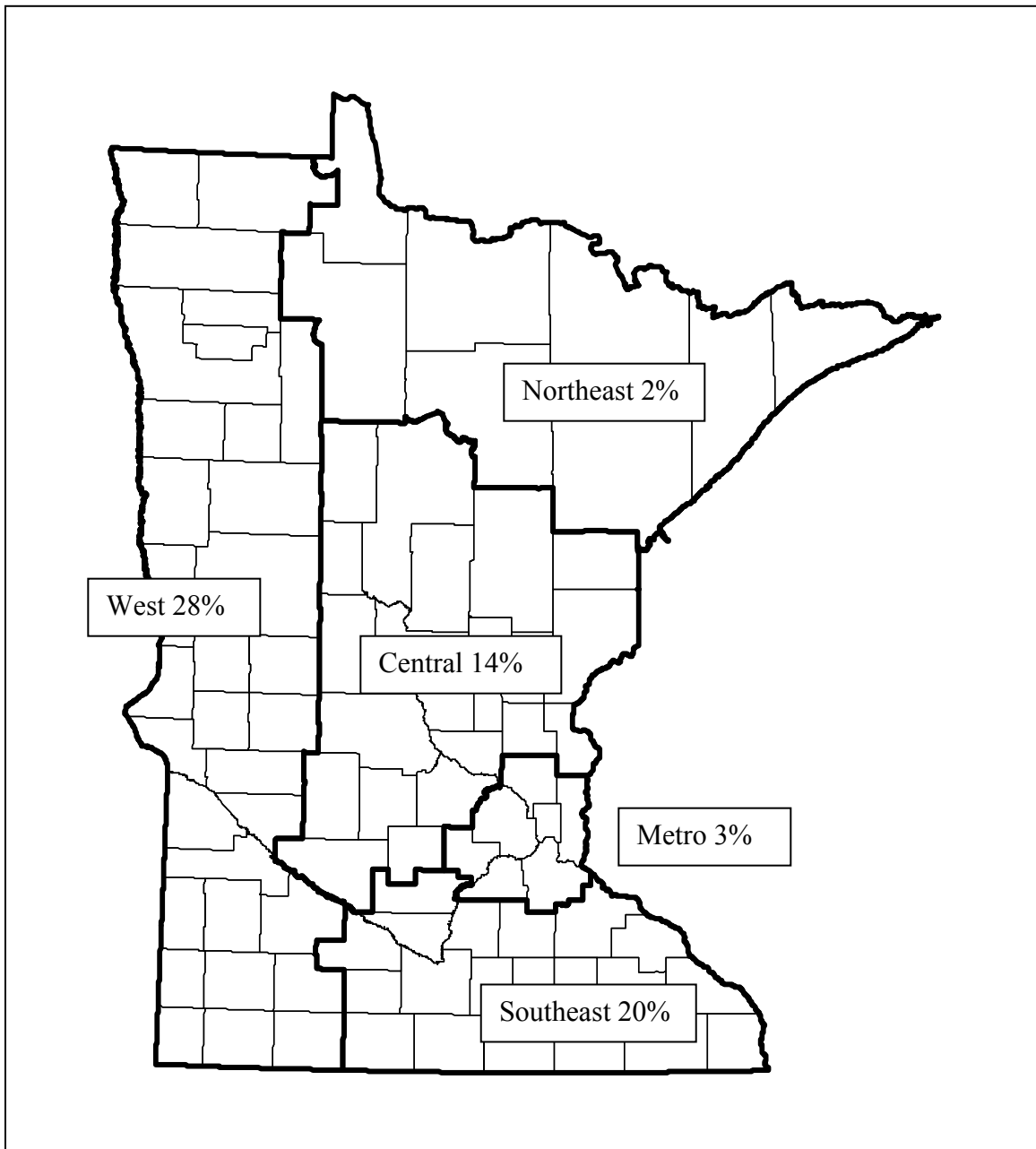


Figure 2. Regional Employment Related to the Food and Agricultural Industry, 1999

Figure 3. Sales to and from Minnesota in 1999

