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No. 680 Spring 1995

## The Mississippi River Ties Minnesota Agriculture to the World

**Jerry Fruin and Daniel W. Halbach**

A well-maintained inland waterway system and a healthy shallow draft barge industry are vital to the well-being of midwestern agriculture. This part of the country is the world's most efficient producer of corn, soybeans, and other crops because of the quality of its land, its favorable climate, and its well-developed production technology.

To get a bushel of grain from its production site (a wheat field in Grant County, say) to its ultimate destination (a bakery in Paris, say), three different transport modes are usually employed: a truck to the Twin Cities, barge or rail to New Orleans, and a ship to Europe. Each of these links, even though they vary greatly in length, costs about the same amount—roughly 20¢/bushel. In this report, we focus on the second link, the use of inland waterways to move Upper Midwest grain to ocean ports.

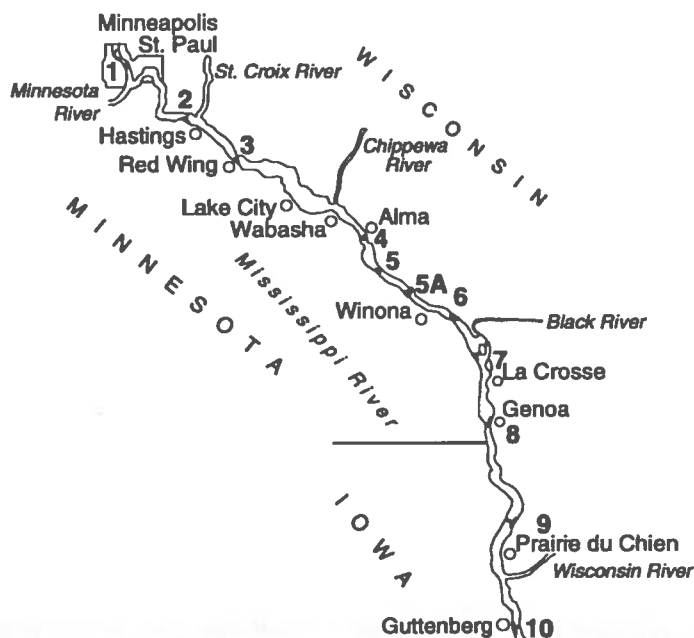
### Barge Transport

Eighty-two percent of the nation's corn, 77 percent of its soybeans, and 32 percent of its wheat were produced in 10 Upper Midwest states that rely on barge transportation along the Mississippi, Illinois, Ohio, and Missouri Rivers. The inland waterway system formed by these rivers is the major transportation route from the Midwest's grain production area to the Gulf of Mexico. Approximately 60 percent of the nation's grain and

(See *Mississippi River* page 2)

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**Figure 1. The Upper Mississippi River Navigation System**



## Federal Spending: Where Does the Money Go?

**Thomas F. Stinson**

Plans for slowing the growth in federal spending fill the news. A balanced budget amendment passed the House of Representatives and was only narrowly defeated in the Senate. Now, both leaderships have committed to

plans that seek to balance the budget by 2002. Federal spending patterns clearly are going to change over the next few years, affecting every household, farm, and business in Minnesota. The

(See *Expenditures* page 4)

*Thomas F. Stinson is an assistant professor in the Department of Applied Economics.*

oilseed exports leave from Mississippi River terminals. Since the United States provides about 40 percent of the grain and oilseeds moving in international trade each year, this means that more than 25 percent of the entire world's total grain and oilseed trade depends on this low-cost waterway system.

We also rely on this system for low-cost transportation of farm inputs. Each year, for example, a quarter of all the fertilizer used in the United States is shipped on the Mississippi and its tributaries. Barge transportation is also important for other major farm inputs such as petroleum, petroleum products, and chemicals.

Minnesota lies more than 1,200 miles from the Gulf, three to five times the distance to ocean ports of any of the competing agricultural production areas around the world. For example, the prime soybean-growing areas of Brazil are all within 200 to 600 miles of the ports of Paranaguá and Porto Alegre. All of Australia's major wheat-growing areas lie within 80 to 300 miles of the ocean. The grain-growing areas of the European Economic Community are virtually all within 300 miles of a deep water port.

Of the world's major grain exporting countries, only Canada has to move grain as far to its export ports as does the United States. Canada's solution initially was to subsidize its farm exports with the very low "Crow" rail rates. More recently, the Western Grain Transportation Act ensures that Canadian shippers have paid only about one-third of the actual cost of moving products to export points.

The United States has an excellent land transportation infrastructure of railroads and interstate highways and port facilities as good or better than its competitors, but the vast distances

between the U.S. heartland and ocean ports would pose a major transportation disadvantage for American agriculture if not for the low cost and efficiency of our shallow draft barge system.

## Transportation Costs

Waterway shipping costs are low because barges carry large amounts of cargo. A typical nine-foot-draft barge holds from 1,400 to 1,600 tons, more than 50,000 bushels of grain. Tows leaving Minnesota typically consist of 15 barges carrying some 750,000 bushels of grain. At St. Louis, below the last locks on the Upper Mississippi, barges are typically placed into tows of 30 or more for the rest of the trip to the Gulf.

Although the circuitous course of the waterways means that barged grain has to move more miles than rail, per-ton barge costs, and therefore barge rates, are generally much lower than rail rates between similar destinations.

Table 1 shows the relative costs of shipping grain from the Twin Cities by both barge and rail to Lower Mississippi ports. Barge rates are quoted as a percent of an historic tariff price: they traditionally fluctuate between 135 percent and 175 percent. Because of the large 1994 crops and current strong export demand, rates for this year are projected to be as high as 250 percent.

Rail rates are traditionally quoted in cents per ton-mile. The rate level of 1.2¢ per ton-mile approximates rail unit train variable costs for grain on long hauls. The 1.7¢ rate level approximates the fully allocated rail unit train costs to haul grain for long distances. Actual rail rates typically will be between these levels. The rate level of 2.2¢ per ton-mile is for nonunit trains, low volume, or short distance grain movements.

We have converted both barge and rail rates into total Twin Cities-to-New Orleans per-ton shipping charges. The cost advantage of barge shipments is readily apparent; barge rates at

175 percent of tariff are less than rail rates at the variable cost level of 1.2¢ per ton-mile. Only at the 250 percent level do barge rates exceed variable cost rail rates, and even then barge rates are substantially less than the fully allocated unit train cost level of 1.7¢ per ton-mile.

Even if rail shipment were to become more competitive at the margin, it is unlikely that a complete switch from barge transport would occur. Each barge moves nearly 1,500 tons of grain, as much as 15 rail cars, so a 15-barge tow carries more grain than two 100-car unit trains. If the rail system had to move all the grain and oilseeds that now move on the Mississippi River system, an additional 44,000 rail cars would be required.

Even this large number actually understates the increase in equipment that would be required. Covered hopper barges that carry grain downstream are also used for hauling products like fertilizer, salt, coal, and similar products upstream. The use of rail grain hopper cars for such "backhauls" has been insignificant in recent years.

The volume of commodities moved by barge on the Upper Mississippi River showed almost 50 years of nearly uninterrupted growth after the completion of the locks and dams and the nine-foot channel system in the 1930s. This upward trend accelerated when towboats were switched from steam to diesel electric power in the 1950s. Figure 2 shows the yearly total tonnage of barge shipments and receipts in the Twin Cities area over the past 30 years. (None of the shipping data reported here covers such downstream ports as Red Wing or Winona. Consequently, these data understate the total volume of "Minnesota" barge shipments.)

Shipments peaked in the early 1980s, then began an unprecedented decline. This raises a number of important questions about the future of commercial waterway navigation on the Upper Mississippi River. Is the decline permanent or an aberration? Has commercial waterway navigation in the region lost its competitive edge? Have there been structural changes in the economy that reduce the need for the commodities commonly shipped by barge?

**Table 1. Comparative Rates for Barge and Rail**

Minneapolis/St. Paul to New Orleans	Barge—Percent of Tariff			Rail—Cents Per Ton-Mile		
	135%	175%	250%	1.2¢	1.7¢	2.2¢
Dollars/Ton	\$8.36	\$10.83	\$15.48	\$15.28	\$21.64	\$28.01

## Unbalanced Movement of Receipt and Shipment Numbers

Note the different trends in figure 2 for receipts and shipments. Receipts have been much more stable than shipments. Shipments dropped to a 13-year low in 1986, but have generally been increasing since then.

The ratio of shipments to receipts of dry cargo is important in navigation economics, because backhauls allow higher utilization of equipment. Moving empty barges costs nearly as much as moving cargo because of nonvolume-related costs such as fuel and labor. Historically, commodities such as coal, fertilizer, and salt have been transported upstream to the Twin Cities. Shipments and receipts were much more balanced before the rapid expansion of U.S. grain exports in the 1970s. The present imbalance means that a substantial number of barges must be towed upstream empty, a costly maneuver. But this imbalance has existed for some time, as figure 2 shows, so it alone can't explain the drop in total volume after 1984.

## Major Commodity Movements

If we can explain the volume changes in individual commodities, perhaps we can explain most of the changes in total barge volume noted in figure 2.

Changes in barge movement volumes tend to be "lumpy." Once a major commodity flow is committed to water, it tends to remain so, year after year. If for some reason the flow should stop, it probably will not be restarted. For example, a power plant or refinery located on the river requires approximately the same amount of coal or crude oil year after year. If the plant is either expanded or retired, the volume of traffic to that location would permanently change.

Coal movement (figure 3) increased from less than 2 million tons in 1963 to more than 5 million tons in 1975, when it accounted for over 38 percent of total Twin Cities barge movements. However, since 1987, coal has averaged well under 1 million tons a year, less than 5 percent of total volume.

Figure 2. Barge Shipments and Receipts (Twin Cities)

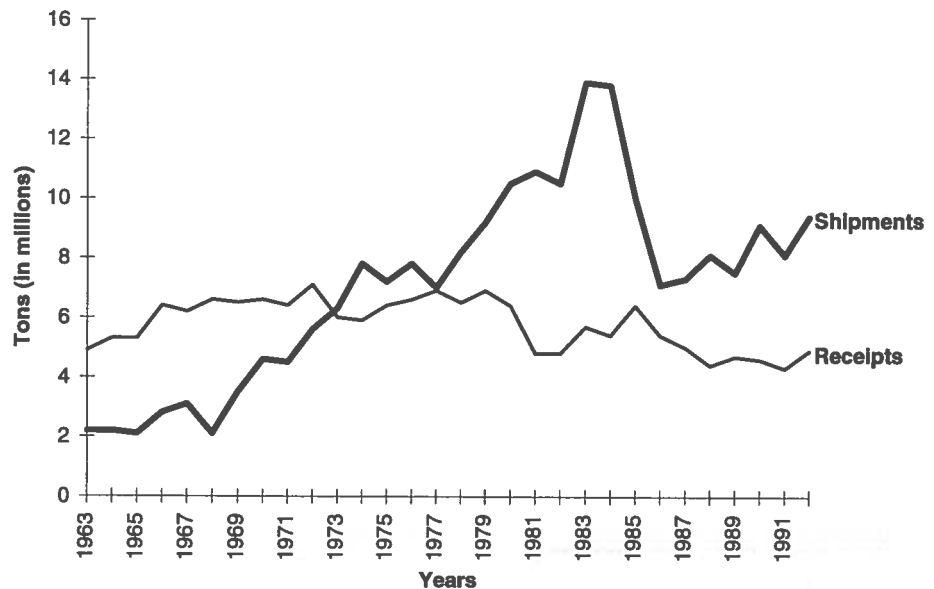
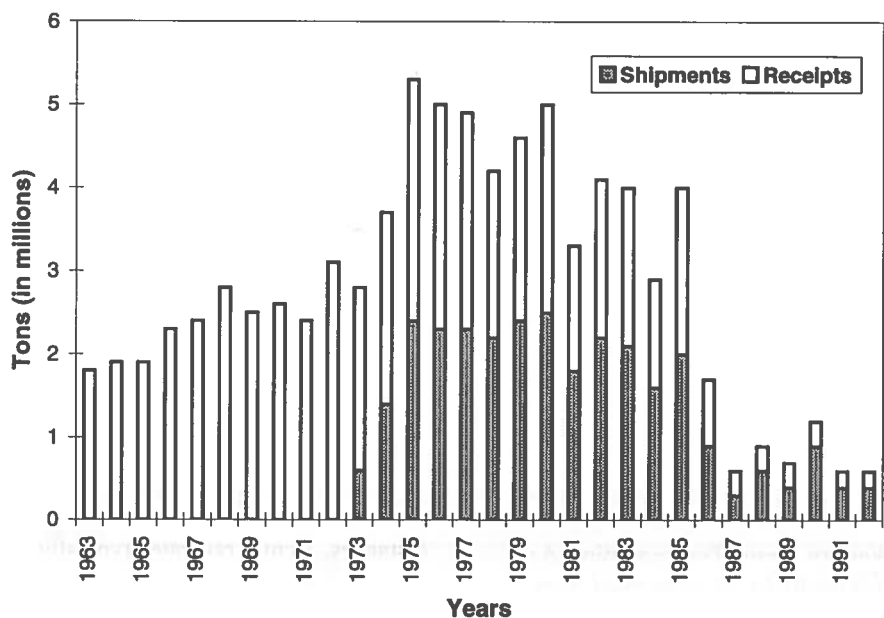


Figure 3. Waterborne Coal Movement (Twin Cities)



Is this drop evidence of a structural change in our economy? Most definitely! The coal receipts in the 1960s were primarily shipments of relatively high sulfur coal from southern Illinois. In response to environmental concerns over sulfur emissions and the associated high costs of burning southern Illinois coal, Northern States Power switched over to western coal in the 1970s. This coal comes by unit train to the Twin Cities. Initially it was transferred to barges for delivery to power plants that could not unload unit trains.

The drop in coal traffic after 1985 is almost entirely explained by the completion of unit train handling equipment at Twin Cities NSP plants. Western coal was no longer transshipped locally by barge, and so it no longer appears in our shipping statistics. (The local coal movement actually showed up twice in the official volume statistics summarized in figure 3, once as a shipment and once as a receipt.) The only coal that has been shipped by barge in recent years is western coal for one down-river

power plant that does not have adequate unit train handling facilities. Remaining Twin Cities receipts are of types of eastern coal that meet specific requirements of a handful of users.

The decline of 3 to 4 million tons of annual coal traffic is permanent. Future volumes will not return to their pre-1985 levels.

Figure 4 shows the movements of three other commodities (corn, wheat, and soybeans) from 1963 to 1992.

The volume of corn increased to an all-time high in 1992. The decline in the late 1970s was linked to a severe drought, but decline in the 1980s corresponded to an overall decline in U.S. corn exports.

The volume of wheat shipments peaked in 1984 before the drop in U.S. farm exports, and volumes did not recover in the 1990s. Wheat volumes been relatively constant at 1 million tons a year, only about one-third that of 1984. Soybean shipments have not recovered to all-time highs, but their shipping volume movements resemble corn more than wheat.

Why a different trend for wheat than for corn or soybeans? Has there been a permanent change? Again, Yes. The soybean pattern is the result of rail deregulation and associated adjustments in the rail industry structure and rate making. To learn more about these, we invite you to read the documents cited at the end of this report.

## Conclusion

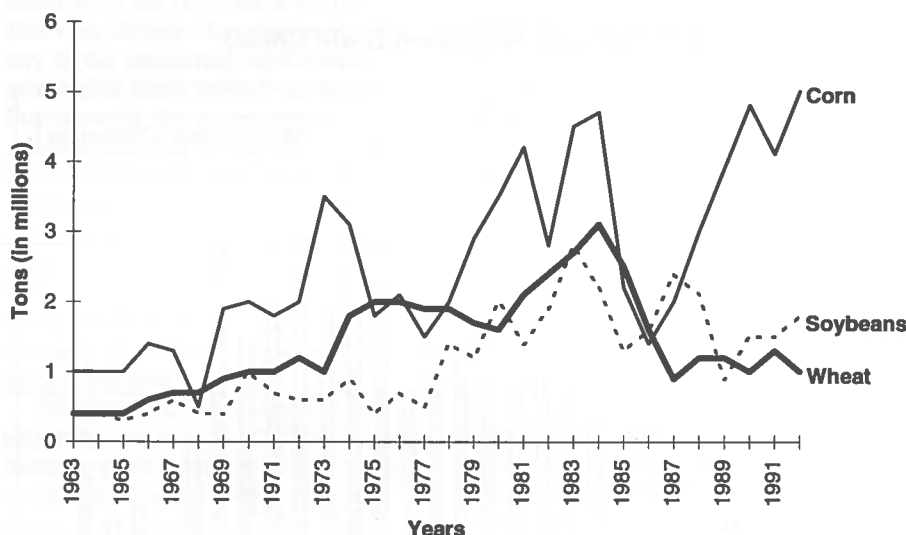
The volume of commodities moved to and from the Twin Cities area on the Upper Mississippi River has permanently changed. These reductions are due both to changes in the source of supply (coal) and to increased competition from railroads after deregulation (wheat). However, other commodities show continued growth, and many reached new highs in the 1990s (corn, cement, chemicals, and fertilizer). In addition, shipments measured in ton-miles (as opposed to tons) and the volume of long-distance shipments reached an all-time high in 1992.

Rail deregulation and other changes in the economy have had little effect on the relative competitiveness of the barge industry for the movement of bulk commodities. Commercial navigation on the Mississippi River remains important to the economy of Minnesota. It will remain so into the foreseeable future.

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**Figure 4. Waterborne Movement of Wheat, Corn, and Soybeans (Twin Cities)**



*(Expenditures continued from page 1)*

finances of our state and local governments will also be affected.

Even though spending issues have been highlighted recently, most Americans have only a passing familiarity with the contents of the federal budget and its impact on everyday life. This article examines several dimensions of current federal spending in Minnesota and neighboring states. Unless otherwise noted, all numbers are for the 1993 federal fiscal year (October 1-September 30), the most recent available.

## Most Federal Spending Goes to People, Not Governments

For most of us, talking about cutting government spending is more palatable in the abstract than in the particular. Former Council of Economic Advisors head Herbert Stein reminds us that all the federal budget originally comes from people through taxes, and that cutting government

spending means cutting payments to people—taxpayers and voters—who have come to rely on those payments. Only about 1 percent of the budget goes to people and governments outside the United States. Everything else, Stein notes, in various ways, is returned to the American people and businesses. Changes in the federal budget are really changes in the payments that people and businesses receive.

In 1993, federal expenditures amounted to \$1.5 trillion, while revenues were \$1.3 trillion. The

resulting deficit (revenues minus expenditures) was \$241 billion. Nearly \$200 billion was paid in interest on money borrowed by our government in the past. More than one-third of federal spending, \$550 billion, went for transfers to people in just one program, Social Security.

Shifting these numbers to a per capita basis makes them easier to relate to. Spending per capita was \$5,757 in fiscal 1993, while per capita revenues, including Social Security taxes, were \$4,836.

If we had tried to balance the 1993 budget with no increase in taxes, spending cuts averaging more than \$920 for everyone in the United States would have been necessary.

Making such changes, even phasing them in during a period of economic growth, would change money flows throughout the economy. The ultimate impact on households, businesses, and state and local governments would depend on how much individual programs were cut, but cuts of the size needed to balance the budget would clearly reach into everyone's life.

The Census Bureau separates federal spending into five categories: direct payments to individuals, procurements, grants to state and local governments, salaries and wages, and "all other" (figure 1). More than one-half of all federal spending is classified as direct payments to individuals. Social Security and Medicare are the two largest components of this group. Salaries to federal civilian and military employees accounted for 13 percent of the total. Farm subsidies and crop insurance, included in the "all other" category, totaled \$13.8 billion in 1993, less than 1 percent of the federal budget.

## Federal Spending in Minnesota

Federal payments to Minnesotans and their governments totaled more than \$18 billion, about 1.4 percent of all 1993 federal spending. That puts us right in the middle in the state-by-state rankings. California, New York, and Texas received the most, \$147 billion, \$87 billion, and \$75 billion respectively.

On a per capita basis, however, Minnesota's \$3,989 ranked 45th. Minnesotans paid \$20.5 billion, about \$4,583 per capita, in federal taxes,

including Social Security. The state was 15th in per capita federal taxes paid.

North Dakota and South Dakota ranked 6th and 13th, respectively, in per capita federal receipts. Iowa ranked 36th and Wisconsin 49th.

Where did this money go? Figure 2 shows the recipient categories for federal spending in Minnesota and surrounding states. Minnesota has proportionately fewer federal employees than most states, so federal wage and salary payments were well below the national average of \$634 per capita. Approximately \$1.5 billion in federal salaries and wages placed Minnesota 47th in wage and salary receipts per capita. Only Wisconsin, Michigan, and

Iowa received lower federal wages and salaries on a per capita basis. North Dakota and South Dakota were much higher in this category.

Minnesota businesses were also less reliant on federal procurement contracts than the national average. In 1993 defense-related purchases from Minnesota firms totaled slightly more than \$1.5 billion, ranking the state 20th in dollar value of defense contracts. This, coupled with contracts to supply goods and services to other federal agencies, led to just over \$2 billion in federal purchases, slightly more than 2 percent of gross state product. Federal contracts were smaller in absolute value in Iowa, North Dakota, South Dakota, and Wisconsin,

Figure 1. Total Federal Spending in the United States

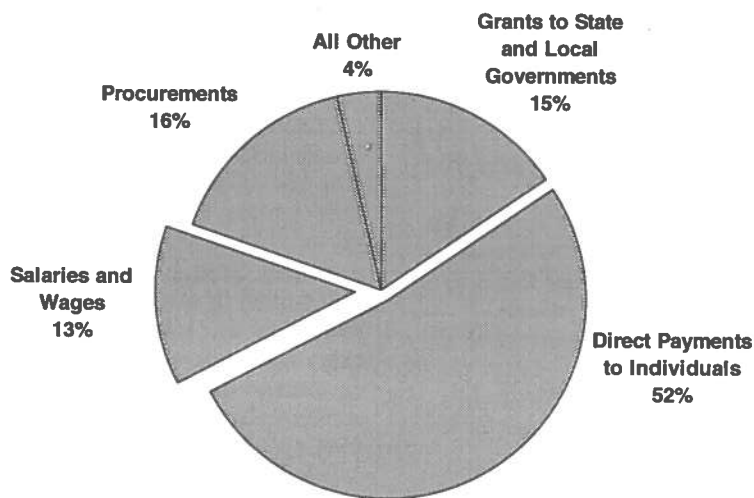
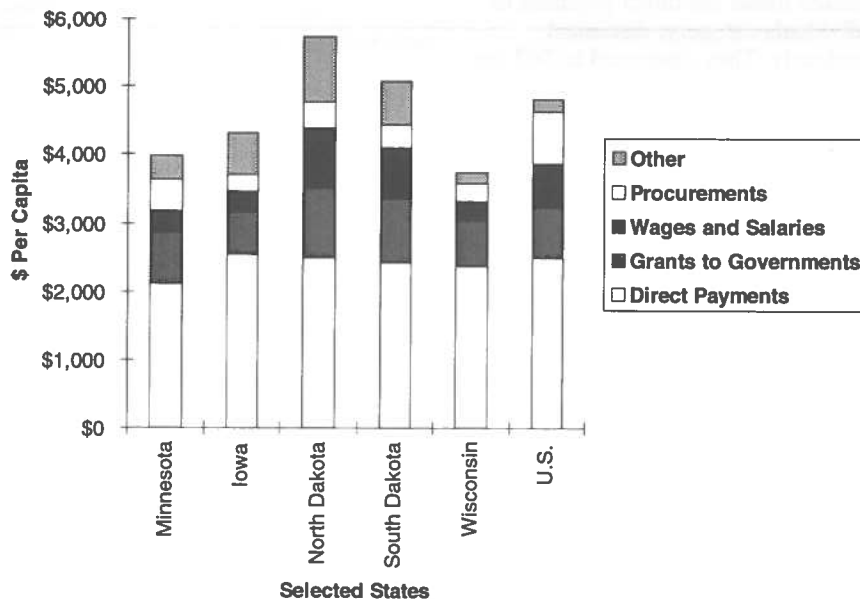


Figure 2. Per Capita Federal Expenditures in Upper Midwest



but in North Dakota and South Dakota they were a larger percentage of the state economy.

More than half of all federal expenditures in Minnesota (and nationwide) go directly to individuals and households. These payments include federal retirement, veterans benefits, federal unemployment compensation, food stamps, housing assistance, and interest subsidies on student loans for higher education. Spending on these programs, however, is dwarfed by the two largest programs in this category, Social Security and Medicare. These two accounted for nearly 70 percent of total federal spending in this category, about one-fifth of all federal spending nationwide.

Most midwestern states clustered relatively near the U.S. average of \$2,487 per capita. Minnesota ranked 46th, receiving only \$2,114 per capita.

Nearly \$3.3 billion in grants were made to state and local governments in Minnesota in 1993. On a per capita basis Minnesota ranked 20th, receiving \$730 per capita, just slightly less than the national average of \$745.

This category includes some of the best known and most controversial federal programs. In dollar terms, it is dominated by Medicaid, which accounted for nearly 40 percent of all such grants.

In Minnesota, federal Medicaid reimbursements were \$269 per capita. The federal share of the Aid for Dependent Children program (AFDC) was \$64 per capita, and payments for food aid other than food stamps were \$52 per person. (Food stamps are counted under the direct payment to individuals category, discussed previously. They amounted to \$65 per capita in Minnesota.) Low income housing programs totaled \$52 per capita, and federal highway funding was about \$82 per capita. Corporation for Public Broadcasting payments to public radio and television averaged \$3 per capita in Minnesota.

The remaining category, "other" expenditures, was roughly one-third farm program payments, one-third federal employee benefits, and one-third research grants. While this category accounts for only 4 percent of the federal budget, it is a much larger proportion in states where farm commodity program payments are more important.

Farm program payments in Minnesota, including those for the conservation reserve, totaled \$822 million, or about \$180 per capita, three times the average per capita expenditure in the United States on this item. More than \$200 million in research funding, the equivalent of about \$45 for each resident of the state, went directly to the University of Minnesota.

## USDA Payments to Minnesota

In fiscal 1993, the U.S. Department of Agriculture spent over \$1.6 billion in Minnesota. Nationally USDA's largest expenditures are for nutrition programs—food stamps, child nutrition programs, and the Women, Infants and Children (WIC) program. In Minnesota, however, those programs accounted for only about one-third of USDA spending (figure 3). Minnesota's total for all commodity programs including the conservation reserve and federal crop insurance reached more than \$800 million. USDA also purchased goods and services amounting to more than \$130 million, and paid \$79 million in salaries to their employees living in this state. The extension service and the agricultural experiment station in Minnesota each received about \$9 million in federal funding.

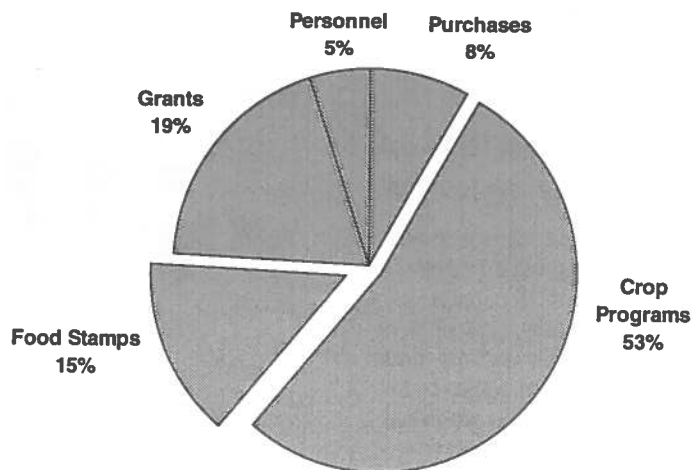
## Payments to Greater Minnesota

Federal spending shares going to the seven-county Twin Cities metropolitan area and to Greater Minnesota are almost identical to their shares of state population. The metro area contains about 52 percent of the state's population and received about 52 percent (\$9.4 billion) of those federal payments that could be allocated to specific locations in the state (figure 4).

There is a substantial difference in the proportion of spending in particular categories going to Greater Minnesota. Metro counties received proportionately more federal salaries, purchases, and grants to local governments, while non-metro counties received greater proportions of direct federal payments to individuals and households and of "all other" expenditures.

More than \$600 million, or about 40 percent of all wages and salaries paid to federal employees living in Minnesota, went to individuals living in Hennepin County, and nearly two-thirds of all federal procurement was with firms headquartered there. This may be a misleading statistic, however, since the data reflect only the headquarters of the prime contractor, and not where the work was actually done. To the extent that these contracts were actually filled by individuals working in branch plants located outside the

Figure 3. USDA Expenditures in Minnesota (\$1.6 Billion Total)



Twin Cities, these figures would overstate the amount going to the metro area.

Similarly the data on aid to governments are not fully representative because aid that goes first to state government and then is spent according to state formulas was not allocated to particular regions in this analysis.

Greater Minnesota received a larger share of direct payments to individuals, principally Social Security and Medicare. Other expenditures, primarily agricultural commodity program payments, were heavily concentrated

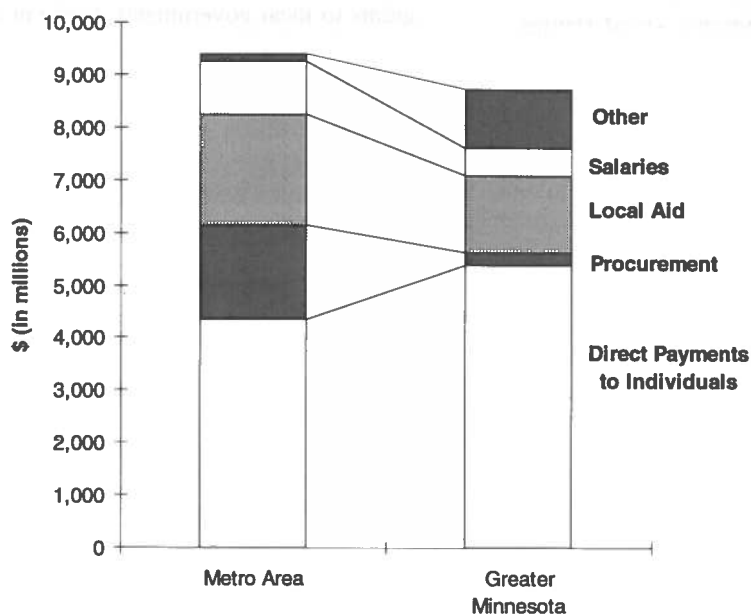
in Greater Minnesota, as would be expected.

## Conclusion

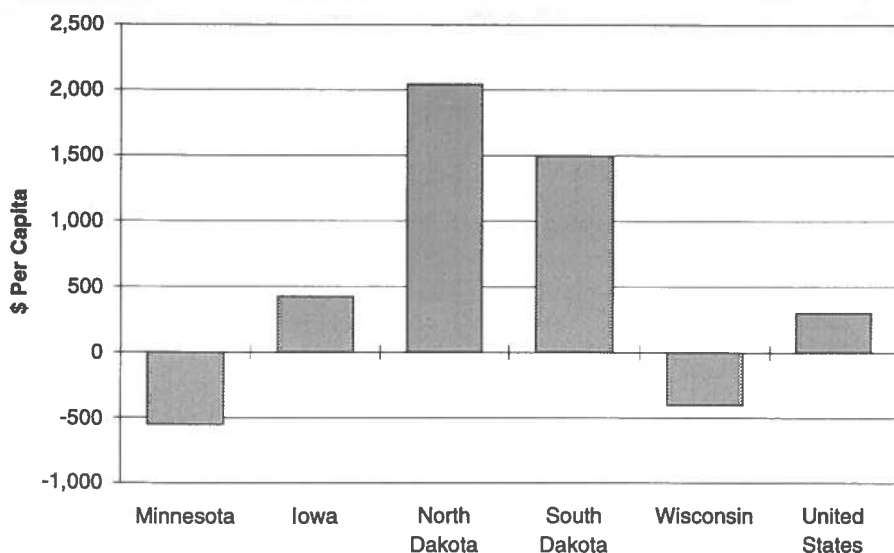
Minnesota currently receives less in federal spending than it sends to the federal government in taxes (figure 5). There is no reason to expect that any future federal budget changes will reduce that imbalance. Nor is it likely that cuts in the federal budget will fall less severely on Minnesota than elsewhere.

Had we tried to balance the budget in 1993, we would have had to trim nearly 25 percent of the money households, farmers, businesses, and state and local governments in Minnesota received from the federal government that year. Such cuts in the future years, by themselves, would not create a recession, but they would certainly check future economic growth, until the expected benefits from the lower interest rates accompanying deficit reduction could begin to take effect.

**Figure 4. Federal Spending by Spending Class, Twin Cities Metro Area and Greater Minnesota**



**Figure 5. Net Federal Spending Flows in Upper Midwest**





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