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Economic Contribution of the Wheat Industry to the North Dakota Economy

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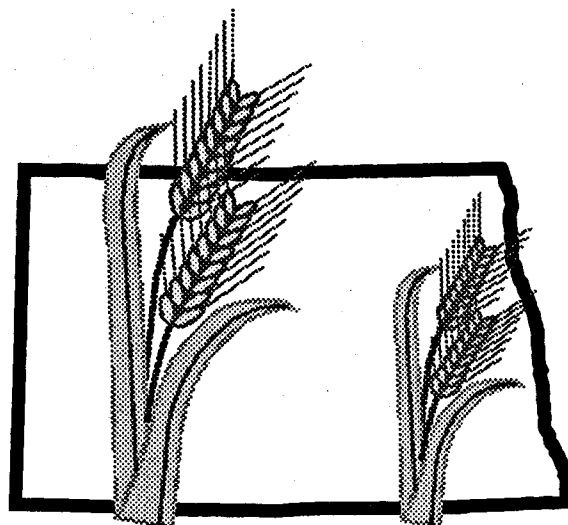
North Dakota, like other Great Plains states, relies heavily upon agriculture for much of its economic activity. The contribution of agriculture to the state's economy has been well documented (Leistritz et al. 1993; Coon and Leistritz 1994). The importance of agriculture can be measured by examining the amount of money that the activity brings into the state, sometimes called the economic base or basic income. From 1990 through 1992, agriculture accounted for 37 percent of North Dakota's economic base. If measured by gross state product (the value of goods/services attributable to labor and property), North Dakota is the fourth most agriculturally dependent state in the nation.

Agriculture does play a major role in North Dakota's economy and most people familiar with the state realize the importance of agriculture to the state's economy. However, the economic significance of the various activities within the agriculture industry are less understood. North Dakota has been dependent upon cash crop receipts (including government program payments) for nearly 70 percent of the state's total farm receipts since 1985 (North Dakota Agricultural Statistics Service 1994). Even more dramatic than the dominance of crop activities to the agriculture industry is the dominance of wheat to North Dakota's crop production. Wheat production (excluding government payments) has accounted for over 52 percent of all crop receipts from 1991 through 1993 (North Dakota Agricultural

Statistics Service 1994). Cash wheat sales and government payments for wheat production have accounted for nearly 41 percent of all farm revenue from 1991 through 1993 (North Dakota Agricultural Statistics Service 1994). Wheat activities, measured in terms of cash receipts, clearly overshadow any other agricultural activity in the state.

OBJECTIVE

The purpose of the study was to estimate the economic contribution (direct and secondary effects) of the wheat industry to the economy of North Dakota. Specifically, economic impacts from the wheat industry were estimated for crop production, grain handling, transportation, and processing activities.



DISCUSSION

A general discussion of the procedures and methods used in the study is divided into (1) wheat production, (2) grain movement, (3) transportation, (4) processing, and (5) input-output analysis.

Wheat Production

North Dakota has a well-earned reputation as being a major producer of wheat in the United States. Since 1980, North Dakota has led the nation in total wheat production 3 times and been second to Kansas 10 times. Wheat production in Kansas is dominated by winter wheat, whereas, in North Dakota, durum and spring wheat dominate production.

Historically, North Dakota has been the nation's top producer of durum and spring wheat, averaging 78 and 42 percent of all U.S. production the last 15 years, respectively. Recently, North Dakota has produced over 80 percent of U.S. durum production and half of the country's spring wheat production. North Dakota has accounted for over 12 percent of all wheat produced in the U.S. since 1980.

Wheat is produced in all areas of the state; however, production is concentrated in the Red River Valley and in the northern third of the state (Figure 1). Spring wheat and durum have historically dominated North Dakota wheat production, accounting for about 78 and 21 percent of all wheat production, respectively (North Dakota Agricultural Statistics Service *various years*).

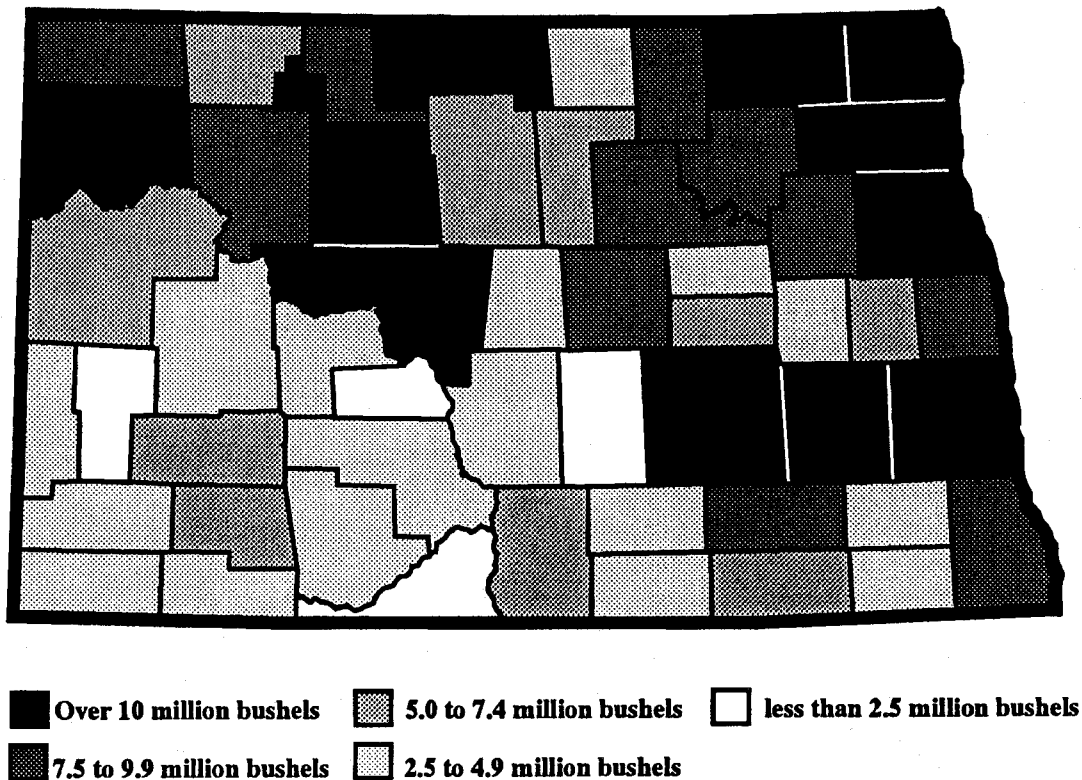


Figure 1. Average Wheat Production in North Dakota, by County, 1991 to 1993

Wheat production in North Dakota averaged about 11.1 million planted acres and 368.3 million bushels from 1991 through 1993 (North Dakota Agricultural Statistics Service 1994). County wheat yields during that period varied from 23 to 41 bushels per planted acre, with an overall state average of 33.2 bushels per acre (Figure 2). Wheat yields were generally highest in the Red River Valley and in the northern counties of North Dakota.

Crop budgets were developed to estimate expenditures and returns for various production regions in North Dakota.

Production expenditures were based on estimated 1993 production costs, while revenues were based on average yields and prices, wheat deficiency payments, and disaster payments.

Grain Movement

Grain movement was defined as including grain flow (i.e., logistics of grain movement from production to final markets) and grain handling (i.e., cleaning, mixing, storing, loading, and unloading).

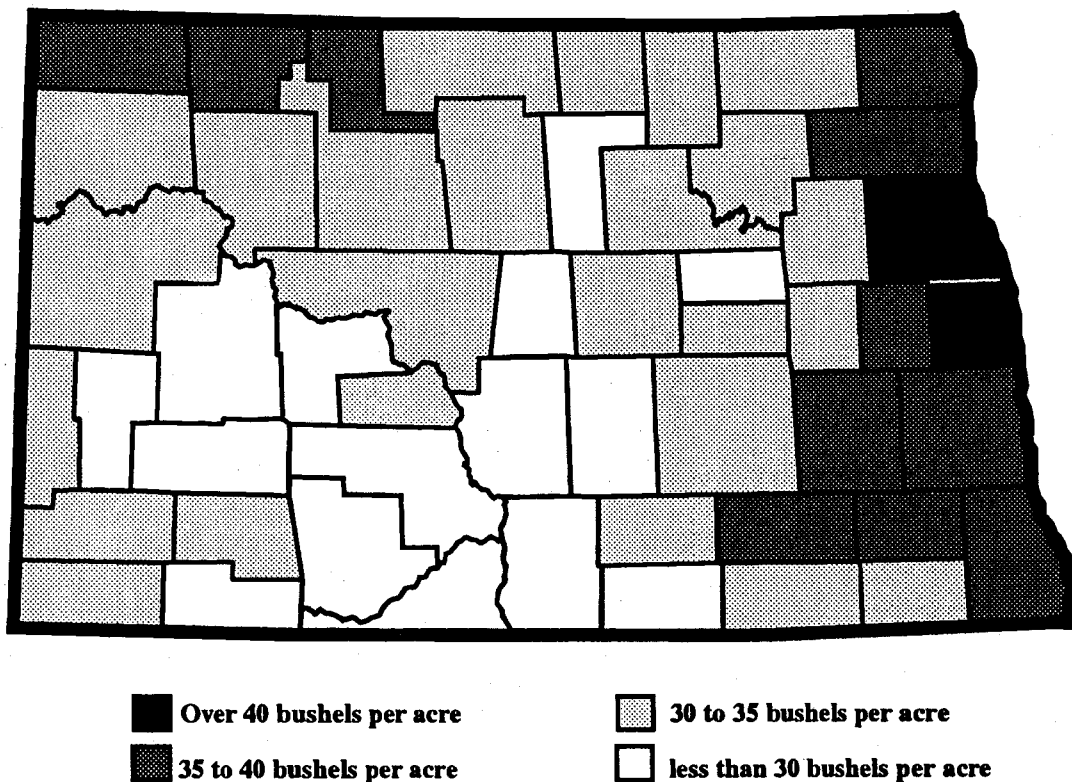


Figure 2. Average Wheat Yields in North Dakota, by County, 1991 to 1993

Grain Flow

Grain flow is complex, involving several modes of transportation (e.g., truck, railroad, barge, vessel) and several possible destinations and handlers. For this study, grain movements were limited to shipments from (1) farms to country elevators and (2) country elevators to out-of-state destinations (i.e., river port, terminal elevator, subterminal elevator, another country elevator, processor) and (3) country elevators to in-state processors or final destinations.

Estimates of grain flow from various regions in North Dakota to in-state and out-of-state destinations were obtained from Andreson (1994b). Grain flow, including the amount shipped by truck and railroad, was estimated for various production regions to six possible destinations (Andreson 1994a). Destinations in Minnesota received about half of all North Dakota wheat shipments, followed by destinations in the pacific northwest (18 percent), and southwest/midland destinations (13 percent). Nearly 80 percent of all North Dakota wheat shipped from local elevators to market destinations was moved by rail.

Grain Handling

Grain handling impacts were estimated for handling activities of local (country) elevators. A grain handling budget combined with a gross handling margin was used to estimate returns and expenses from wheat handling activities. Country elevators handled approximately 356 million bushels of North Dakota wheat annually from 1991 through 1993.

Transportation

Shipping and hauling costs (i.e., money spent on transporting wheat to market

destinations) were included to measure the economic impact of wheat transportation on the North Dakota economy. Transportation costs were limited to truck and rail movements from country elevators to in-state and out-of-state destinations.

Transportation costs of shipping wheat from local elevators to market destinations were estimated from (1) the amount of wheat transported from counties to market destinations by mode of transport, (2) per unit expenses for truck and rail transportation, and (3) hauling distances from county locations to market destinations.

Trucking rates were obtained from the Upper Great Plains Transportation Institute (1995). A truck operating budget was developed to estimate hauling expenses. Railroad companies' expenses incurred in rail transport were estimated using a microcomputer model developed by the Interstate Commerce Commission. A railroad budget was developed to allocate the costs obtained from the model to various economic sectors. Shipping rates (tariffs) charged elevators for rail shipments were obtained from the Upper Great Plains Transportation Institute (1995) and used to estimate returns from rail shipments.

Processing

Economic impacts associated with the processing of North Dakota wheat were limited to in-state milling activities. Economic activity from wheat milling was estimated from a combination of industry information and information obtained from a survey of processors. Only expenditures made to North Dakota entities by in-state processors were obtained from the survey. In addition to wheat milling expenditures and revenues, information on wheat-related employment and bushels of wheat milled was also solicited.

Input-Output Analysis

Economic activity from a project, program, or policy can be categorized into direct and secondary impacts. Direct impacts are those changes in output, employment, or income that represent the initial or direct effects of the project, program, or policy. Secondary impacts (sometimes further categorized into indirect and induced effects) result from subsequent rounds of spending and respending within the economy. Input-output (I-O) analysis traces linkages (i.e., the amount of spending and respending) among sectors of an economy and calculates the total business activity resulting from a direct impact in a basic sector (Coon et al. 1985).

This process of spending and respending can be explained by using an example. A single dollar from a North Dakota wheat producer (*Households* sector) may be spent for a loaf of bread at the local store (*Retail Trade* sector); the store uses part of that dollar to pay for the next shipment of bread (*Transportation* and *Agricultural Processing* sectors) and part to pay the store employee (*Households* sector) who shelved or sold the bread; the bread supplier uses part of that dollar to pay for the grain used to make the bread (*Agriculture-Crops* sector) ... and so on (Hamm et al. 1993).

RESULTS

The economic contribution from the wheat industry was estimated from production, grain handling, transportation, and processing activities. Expenditures and returns from these activities represent the direct economic impacts from the wheat industry. Subsequently, the direct impacts were used

with an input-output model to estimate the secondary impacts.

Direct Economic Impacts

The direct impacts from the wheat industry on the economy of North Dakota include (1) expenditures and returns from the production of wheat, (2) expenditures and returns from handling wheat at local elevators, (3) economic activity generated from transportation of wheat from local collection points to in-state and out-of-state markets, and (4) expenses and returns from wheat milling activities.

Wheat production in North Dakota averaged 11.1 million acres from 1991 to 1993. The 11.1 million acres of wheat generated about \$845.8 million in production expenditures and \$546.1 million in returns to unpaid labor, management, and equity annually during that period. Direct impacts (expenditures and returns) from wheat production averaged \$135 per acre or \$1.5 billion annually (Table 1).

Local elevators in North Dakota handled approximately 356 million bushels of wheat or about 97 percent of state production annually from 1991 through 1993. With a gross margin of about \$0.12 per bushel, grain handling at local elevators generated about \$43 million in annual direct impacts to the economy of North Dakota (Table 1).

Direct economic impacts from shipping activity were estimated for truck and rail transportation by developing budgets for each mode and estimating quantities and distances of wheat shipped by each mode. Country

Table 1. Direct Impacts from the Wheat Industry to the North Dakota Economy, by Economic Sector and Industry Activity, 1991 through 1993

Economic Sector	Total Direct Impacts by Industry Activity				Total Direct
	Wheat Production	Transportation	Grain Handling	Processing	
	----- 000s \$ -----				
Agriculture-Livestock	0	0	0	0	0
Agriculture-Crops	0	0	0	0	0
Nonmetal Mining	0	0	0	0	0
Construction	0	0	0	705	705
Transportation	0	16,509	0	10,906	27,416
Comm and Pub Util	19,749	601	2,018	1,498	23,865
Ag Proc and Misc Mfg	0	0	9,799	7,241	17,041
Retail Trade	630,865	49,956	9,754	231	690,807
Fin, Ins, and R Estate	233,871	2,737	6,391	910	243,908
Bus and Pers Service	25,511	0	1,345	141	26,997
Prof and Soc Service	0	0	0	64	64
Households	540,299	30,310	11,772	14,732	597,113
Government	47,448	1,778	1,682	62	50,970
Total Direct Impacts	1,497,743	101,891	42,761	36,490	1,678,886

elevators spent about \$41 million on truck transportation; however, only 81 percent of that expense was allocated as direct impacts (some of the expense occurred out of the state). Direct economic impacts from truck transportation were about \$34 million. Country elevators spent about \$220 million on rail transportation to ship North Dakota wheat to market destinations. About 30 percent or \$68 million of the total amount spent was allocated as direct economic impacts. Rail shipments accounted for two-thirds of the transportation impacts.

Expenditures and returns from wheat processing were obtained from a survey of in-state milling firms. Milling firms in the state processed about 18 million bushels of wheat annually from 1991 through 1993. In-state expenditures and returns from processing

wheat were estimated at \$36 million annually (Table 1).

Total direct impacts from wheat industry expenditures and returns in North Dakota were estimated at \$1.68 billion annually from 1991 through 1993. Wheat production accounted for about 89 percent of all direct impacts, transportation activities accounted for 6 percent, and grain handling and processing activities accounting for 5 percent of all direct impacts. The economic areas of the state economy with the greatest total direct impact included the *Retail Trade* (\$234.6 million), *Households* (\$189.3 million), *Finance, Insurance, and Real Estate* (\$44.2 million), and *Government* (\$21 million) sectors (Table 1).

Secondary Economic Impacts

Secondary economic impacts were estimated separately for wheat production, grain handling, transportation, and processing. The direct impacts from each industry activity were allocated to various economic sectors of the North Dakota Input-Output Model. Total direct impacts of \$1.5 billion from wheat production in North Dakota generated about \$2.5 billion in secondary impacts. Total direct impacts of \$43 million from wheat handling activities generated about \$92 million in secondary impacts. Total direct impacts of \$102 million from wheat transportation generated about \$160 million in secondary impacts. Total direct impacts of \$36 million from processing North Dakota wheat generated about \$85 million in secondary impacts. Total direct impacts of \$1.68 billion from the wheat industry generated another \$2.85 billion in secondary impacts in North Dakota.

The economic areas of the state economy with the greatest *secondary* impacts included the *Households* (\$975 million), *Retail Trade* (\$847 million), *Finance, Insurance, and Real Estate* (\$186 million), *Communication and Public Utilities* (\$141 million), and *Government* (\$131 million) sectors. Overall, each dollar of direct impacts from the wheat industry generated about \$1.70 in secondary impacts.

Total Economic Impacts

Total annual impacts from wheat production expenditures and returns in North Dakota were estimated at \$4 billion. Grain handling, transportation, and processing activities generated an additional \$517 million in total annual impacts. All wheat industry activities combined generated a total economic impact of \$4.5 billion annually in the state from 1991 through 1993 (Table 2).

The economic sectors with the greatest *total* impacts included *Households* (\$1.57

billion), *Retail Trade* (\$1.54 billion), *Finance, Insurance, and Real Estate* (\$430 million), *Government* (\$182 million), and *Communication and Public Utilities* (\$165 million).

Employment

Approximately 22,900 farms raised wheat in North Dakota in 1992 (U.S. Department of Commerce 1994); however, direct employment (full-time equivalent jobs) in wheat production is difficult to quantify. Direct employment in the grain handling and transportation industries is also extremely difficult to quantify. Direct employment in wheat processing activities was estimated at 520 full-time equivalent jobs. Many of the positions (employment) affiliated with wheat activities (i.e., those outside of production) exist in larger/other industries. Employment at local elevators is part of the grain handling business and jobs in shipping and hauling wheat are part of the transportation industry. Most of the jobs outside of wheat production are within industries that are supported only in part by the wheat industry, making employment estimates difficult to generate.

The wheat industry does directly affect jobs in grain handling and transportation; however, actual quantification of those jobs was not estimated.

Secondary employment was estimated for wheat production, grain handling, transportation, and processing activities. Secondary employment estimates represent the number of full-time jobs generated based on the volume of business activity created by the industry. Wheat production indirectly supported about 43,710 full-time equivalent jobs. Transportation activities indirectly supported roughly 3,750 full-time equivalent jobs. Wheat handling and processing activities combined indirectly supported another 3,520 full-time equivalent jobs. All wheat industry activities combined indirectly supported about

Table 2. Total Impacts from the Wheat Industry to the North Dakota Economy, by Economic Sector and Industry Activity, 1991 through 1993

Economic Sector	Total Economic Impacts by Industry Activity				Total Impacts
	Wheat Production	Transportation	Grain Handling	Processing	
	----- 000s \$ -----				
Agriculture-Livestock	108,658	7,427	4,056	3,040	123,181
Agriculture-Crops	43,663	2,794	7,266	5,360	59,083
Nonmetal Mining	5,934	461	198	264	6,857
Construction	90,615	5,528	2,684	3,243	102,070
Transportation	14,960	17,482	456	11,265	44,163
Comm and Pub Util	145,820	8,249	5,722	4,871	164,662
Ag Proc and Misc Mfg	68,587	4,186	18,513	13,647	104,933
Retail Trade	1,383,965	97,335	32,980	23,320	1,537,600
Fin, Ins, and R Estate	399,393	13,160	11,512	6,052	430,117
Bus and Pers Service	90,336	3,794	3,378	2,064	99,572
Prof and Soc Service	91,860	5,467	2,639	2,662	102,628
Households	1,408,287	83,975	40,159	40,125	1,572,546
Government	159,651	11,637	5,108	5,356	181,752
Total Economic Impacts	4,011,729	261,495	134,671	121,269	4,529,164
Secondary Employment	43,712	3,745	1,553	1,968	50,980

50,980 full-time equivalent jobs annually in North Dakota.

Tax Collections

Tax collections are another important measure of the economic impact of an industry on an economy. Tax implications are an increasingly important measure of local and state-level impacts. Some of the interest in estimating tax revenue generated by an industry stems from public awareness of the importance of tax revenue to local and state governments. In an era of reduced federal funding, revenue shortfalls, and growing public demand on governments to balance their budgets while providing constant or increased levels of services and benefits, tax

collections are an important factor in assessing economic impacts.

Tax collections were estimated collectively for all areas of wheat impacts in North Dakota. Direct economic impacts from production, handling, transportation, and processing were summed. I-O analysis was used to estimate personal income, retail trade, and other business activity, which was used to estimate tax revenue. Annual tax revenue generated by the wheat industry in North Dakota included \$72 million in sales and use taxes, \$20 million in personal income taxes, and \$8 million in corporate income taxes. Total collections from sales and use, personal income, and corporate income taxes were about \$100 million. The wheat industry also was estimated to be directly responsible for about \$47 million in property taxes. Total annual taxes generated

by the wheat industry in North Dakota, including property taxes, were estimated at \$147 million.

SUMMARY AND CONCLUSIONS

North Dakota, like other Great Plains states, relies heavily upon agriculture for much of its economic activity. Agriculture in the state is heavily dominated by farm-level production activities and North Dakota's reliance on agriculture is based largely on crop sales, which account for about 70 percent of the total value of all farm receipts. Wheat is arguably the single most important agricultural activity in the state, accounting for over 40 percent of all farm receipts (crop and livestock sales) and generating over \$1 billion in cash receipts annually. The importance of wheat to the state's economy becomes clear when the magnitude of wheat sales is combined with the state's dependence upon agricultural activities.

An analysis of the economic impacts from the wheat industry was limited to wheat produced in North Dakota and included in-state expenditures and returns from wheat transportation, handling, and processing. Wheat acreage and yields and production expenses and returns were used to estimate the economic activity from wheat production. Commodity flow information was used to determine the amount of wheat shipped to various market destinations. Wheat flow information was combined with truck and rail transportation costs and returns to estimate the economic impacts from wheat shipments. Grain handling costs and returns were estimated to determine impacts from wheat handling activities. Wheat processing impacts were limited to in-state flour/semolina production and were based on a survey of processors in the state.

Wheat production in North Dakota averaged 11.1 million acres and 368 million

bushels from 1991 through 1993. Total direct impacts (in-state expenditures and returns) from wheat production were estimated at \$1.5 billion or about \$135 per acre. The \$1.5 billion in direct impacts from wheat production generated another \$2.5 billion in secondary economic impacts.

Direct impacts from handling wheat at country (local) elevators in North Dakota were estimated at about \$43 million. Secondary impacts resulting from grain handling activities were estimated at \$92 million dollars.

In-state expenditures and returns from transporting wheat from country elevators to market destinations were estimated at \$102 million. The direct economic impacts from transportation activities generated another \$160 million in secondary impacts. Truck and rail shipments of wheat accounted for one-third and two-thirds of all wheat transportation impacts, respectively.

Direct economic impacts generated by wheat milling activities were estimated at about \$36 million. Flour milling activity generated another \$85 million in secondary impacts.

Annual economic impacts from all wheat activities in North Dakota were estimated at \$4.5 billion. Wheat production accounted for 88 percent, grain handling accounted for 6 percent, transportation accounted for about 3 percent, and processing activities accounted for 3 percent of all economic impacts.

The wheat industry, through economic activity created by wheat production, handling, transportation, and processing, indirectly supported about 50,980 full-time equivalent secondary jobs. Secondary jobs represent employment outside the wheat industry, but employment that is dependent on the existence of the wheat industry. Wheat processing activities directly support about 520 full-time equivalent jobs annually.

In addition to secondary employment, economic activity associated with the wheat industry in North Dakota generated about \$71 million, \$20 million, and \$8 million in sales and use, personal income, and corporate income taxes, respectively. The wheat industry also was estimated to be directly responsible for about \$47 million in property taxes. Total taxes generated by the wheat industry in North Dakota, including property taxes, were estimated at \$147 million annually.

Wheat production is undoubtedly the most important agricultural activity in North Dakota. The importance of wheat to North Dakota is not a recent phenomenon; historical acreage and production would suggest this crop has been the single most important agricultural activity in the state for several decades. The importance of wheat not only comes from the magnitude of the crop's impacts, but from the distribution of those impacts as well. Wheat is produced abundantly throughout North Dakota, which correspondingly implies the impacts are distributed in all areas of the state. Also, much of the impacts from wheat production are generated in local and rural economies through the purchase of production inputs, which are not concentrated in any particular region or city.

The enormous influence of wheat production on North Dakota's economy also makes the economy sensitive to factors affecting overall crop value. Because of the magnitude of wheat production, small changes in wheat acreage, yields, or prices can have dramatic effects on the state's economy. Examples of the effects of these changes have been recently felt with yield reductions from overly wet growing/harvest conditions and the effects of wheat diseases on crop values. The actual effects of recent adverse weather impacts were not evaluated in this study; however, the effect of changes in price or crop production can be demonstrated. For example, a \$0.10 to \$0.15 per bushel drop in the average yearly market value for wheat, based on production figures from 1991 through 1993, would cost the state \$37 to \$55 million in lost revenues. Alternatively, if crop prices remain unchanged but yield drops by 10 percent statewide, the state could experience a reduction in farm revenues of nearly \$124 million. Decreases in crop quantities also affect transportation and grain handling impacts, further adding to the effect of reduced crop quantities. The potential consequences of policies or actions which could affect crop prices and/or acreage planted should be evaluated carefully since small changes in wheat production or values translate into substantial impacts within the state.

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