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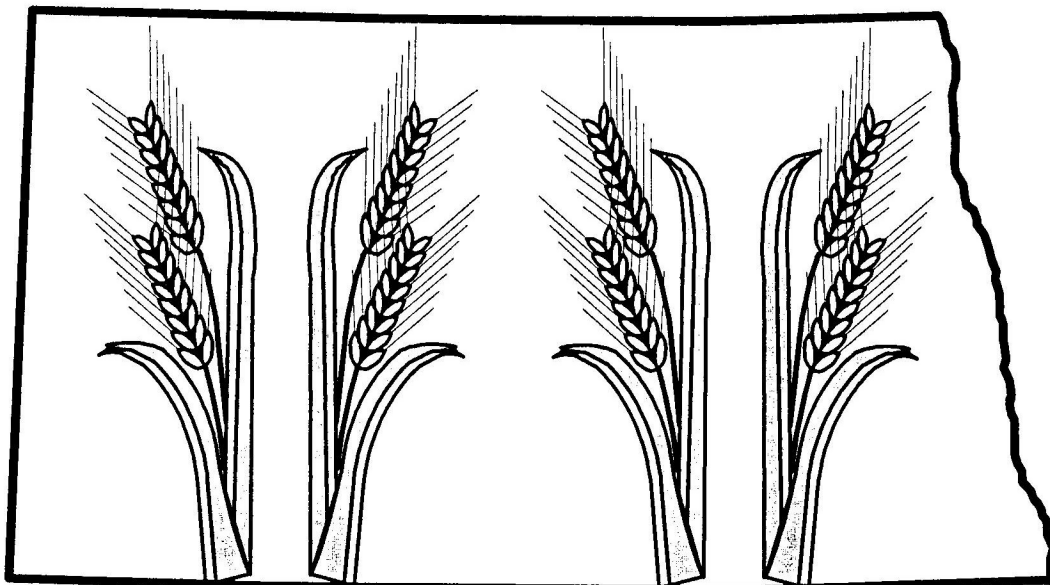
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Economic Contribution of the Wheat Industry to North Dakota



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ACKNOWLEDGMENTS

Several people were helpful in providing data and information used in this study. Our appreciation and thanks are extended to

Dale Ihry (Farm Service Agency)
Mark Berwick (Upper Great Plains Transportation Institute)
Debbie Reinig and Darrin Elliott (Horizon Milling)
Vance Taylor and Ed Barchenger (North Dakota State Mill)
Carl Schoenfelder (Conta Luna Foods)
Tim Dodd (Dakota Growers Pasta Co.)
Kevin Schultz (Minot Milling)
Stephen Sebesta (North Dakota State Seed Department)

Special thanks are extended to Leland “Judge” Barth, North Dakota Wheat Commission, for his assistance and support throughout the project.

Thanks are given to Carol Jensen for document preparation and to our colleagues for reviewing this manuscript.

Financial support was provided by the North Dakota Wheat Commission. We express our appreciation for their support.

The authors assume responsibility for any errors of omission, logic, or otherwise. Any opinions, findings, or conclusions expressed in this publication are those of the authors and do not necessarily reflect the views of the North Dakota Wheat Commission or the NDSU Department of Agribusiness and Applied Economics.

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HIGHLIGHTS

North Dakota has a well-earned reputation as being a major producer of wheat in the United States. Historically, North Dakota has been the nation's number one producer of durum and spring wheat. North Dakota has accounted for 14 percent of all wheat produced in the U.S. since 1989.

The importance of wheat production to the North Dakota economy may not be clearly understood. Wheat production is likely the single most important agricultural activity in the state, considering (1) agriculture is among the largest economic base sectors (activities that bring money into the state) in the state, (2) crop revenues account for nearly 76 percent of all farm receipts, and (3) wheat alone accounts for 34 percent of all crop revenue.

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. Wheat production (spring, durum, and winter wheat) in North Dakota averaged about 9.1 million acres and 275 million bushels annually from 2001 through 2003.

Direct economic impacts from the wheat industry were estimated for crop production, grain handling, transportation, and processing activities. Farmers and producers generate direct impacts to the state's economy through (1) expenditures for production inputs and (2) returns to unpaid labor, management, and equity. Grain handling, transportation, and processing activities similarly impact the economy through (1) expenditures for operating inputs and (2) net returns from operations.

Crop production budgets were used with estimates of wheat acreage and yields to determine the economic impacts from wheat production. Annual direct economic impacts from wheat production were estimated at \$1.14 billion or about \$126.50 per acre.

Grain handling impacts were estimated for country elevators using a grain handling budget, typical handling margin, and estimates of the amount of wheat handled. Annual direct economic impacts from grain handling were estimated at \$32 million.

The amount of grain shipped from counties to various market destinations by mode of transport was used in conjunction with truck and rail shipping rates to estimate the direct economic impacts from wheat transportation. Annual direct economic impacts were \$17 million and \$55 million for truck and rail transportation, respectively. Collectively, of the \$199 million spent annually on wheat transportation, an estimated \$73 million were retained within the North Dakota economy.

Economic impacts from wheat processing were determined from surveying wheat processors in the state. Total direct economic impacts from wheat processing (milling activities) were \$100 million annually.

Total annual direct economic impacts from all wheat activities in North Dakota were estimated at \$1.35 billion. Direct impacts were allocated to various sectors of the North Dakota Input-output Model to estimate secondary economic impacts. The \$1.35 billion in direct economic impacts were estimated to generate another \$2.21 billion in secondary economic impacts. Total annual economic activity (direct and secondary impacts), also termed gross business volume, was estimated at about \$3.56 billion. Each acre of wheat planted was estimated to generate about \$394 in gross business volume annually. The wheat industry was responsible for an annual average of \$1.2 billion in retail trade activity and \$1.1 billion in economy-wide personal income.

Annual tax collections, based on the gross business volume from the wheat industry, were about \$76.4 million, which included \$55 million in sales and use, \$14.9 million in personal income, and \$6.5 million in corporate income taxes. Another \$50 million in property taxes were paid by producers. Other tax revenues to the state were included in the direct impacts for handling, transportation, and processing activities. Wheat processing activities in the state were directly responsible for about 471 full-time jobs. Secondary employment supported by wheat production, grain handling, transportation, and processing activities was estimated at about 35,000 full-time equivalent jobs annually.

Previous estimates of the economic contribution of the wheat industry were based on activity levels from 1991 through 1993. Average wheat production in North Dakota decreased by 93 million bushels between the two periods (1991 through 1993 and 2001 through 2003). Wheat prices and per-acre government payments were similar between the two periods. As a result, most of the change in the value of wheat production between the studies was attributable to changes in production levels. In real terms (i.e., effects of inflation removed), the value of wheat production decreased by 37 percent. Due to reduced grain volume, impacts from grain handling and transportation also decreased between the periods. Wheat processing showed real growth, increasing by nearly 121 percent between the two periods. Overall, the economic size of the wheat industry in North Dakota declined 33 percent from 1991 through 1993 to 2001 through 2003.

The importance of wheat to North Dakota is not a recent phenomenon; historical acreage and production suggest this crop has been an extremely important agricultural activity in the state for many decades. Wheat is still produced abundantly throughout North Dakota, implying the economic impacts are distributed in all areas of the state. Recent decreases in wheat production have reduced the economic importance of wheat; however, wheat is still a multi-billion dollar industry in the state. When measured in terms of secondary employment, economy-wide personal income, retail sales, tax revenues, and overall economic activity, the wheat industry in North Dakota remains one of the most important economic activities in the state, agricultural or otherwise.

Economic Contribution of the Wheat Industry to North Dakota

Dean A. Bangsund and F. Larry Leistritz*

INTRODUCTION

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 repeatedly documented (Coon et al. 1986; Coon and Leistritz 1989, 1995, 1998, 2004; Leistritz et al. 2002). 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 1998 through 2002, agriculture accounted for 26 percent of North Dakota's economic base (Coon and Leistritz 2004). Agriculture's importance in the North Dakota economy also can be demonstrated by examining the state's gross state product. Gross state product is the value of all goods and services attributable to labor and property located within the state. In 2000, agriculture accounted for 8 percent of the state's gross state product, making North Dakota the second most agriculturally dependent state in the nation (Leistritz et al. 2002).

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 agriculture are less understood. North Dakota has been dependent upon cash crop receipts (excluding government program payments) for nearly 76 percent of the state's total farm receipts since 2000. If cash crop receipts and government program payments are included over the same time period, crop activities account for nearly 81 percent of all farm receipts (North Dakota Agricultural Statistics Service various years). Alternatively, excluding government payments, crop sales have outnumbered livestock sales by a margin of 3.1-to-1.

Considering the importance of crop sales to the North Dakota economy, the leading crops in the state should represent a substantial contribution to the economy. 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 34 percent of all crop receipts from 2001 through 2003 (North Dakota Agricultural Statistics Service various years). Since farm receipts are an important measure of farm level impacts on local economies, wheat is the single most important enterprise for farmers and agriculturally-based rural economies in North Dakota. Wheat production, measured in terms of cash receipts, is nearly double that of any other crop activity in the state.

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Information from an economic impact or contribution study can be valuable for industry, educational, and public relations efforts. Determining the economic contribution of a given industry provides information about its importance to local economies. Not only can the impacts to local economies be measured, but the impacts on specific economic sectors and industries also can be identified. Providing economic information on how an industry impacts related industries can be valuable to policymakers and business leaders.

Wheat production affects the entire state; wheat is abundantly produced in all areas of the state and the economic consequences of production are felt throughout the state and local economies. In the case of the wheat industry in North Dakota, an impact study is especially beneficial for identifying specific economic impacts to various economic sectors and quantifying impacts to local economies. Also, economic studies can demonstrate the susceptibility of the North Dakota economy to fluctuations in wheat sales, demonstrate the economic dependence of the state on wheat production, and indicate the economic impacts that could result from potential changes in policies which affect the wheat industry.

OBJECTIVES

The purpose of this report is to estimate the economic contribution (direct and secondary effects) of the wheat industry to the economy of North Dakota. Specific objectives relating to wheat produced in North Dakota include:

- 1) estimating the direct and secondary impacts to the North Dakota economy from producing wheat,
- 2) estimating the direct and secondary impacts to the North Dakota economy from grain handling of wheat,
- 3) estimating the direct and secondary impacts to the North Dakota economy from transporting wheat, and
- 4) estimating the direct and secondary impacts to the North Dakota economy from processing (milling) North Dakota wheat.

PROCEDURES

An economic contribution analysis, as defined in this study, represents an estimate of all local expenditures and returns associated with an industry (i.e., economic activity from producing, handling, transporting, and processing wheat). The economic contribution approach to estimating economic activity has been used for several similar studies (Bangsund and Leistriz 1995a, 1995b, 1998, 1999, 2004).

Analysis of the impacts associated with the wheat industry¹ required several steps. Discussion of the procedures used in the study was divided into the following sections: (1) wheat production, (2) grain movement, (3) transportation, (4) processing, and (5) application of input-output analysis to generate secondary impacts.

Wheat Production

North Dakota has a well-earned reputation as being a major producer of wheat in the United States. North Dakota and Kansas have traditionally been the nation's largest wheat producers. Over the last 15 years, North Dakota has led the nation in total wheat production 4 times and been second to Kansas 11 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 73 and 43 percent of all U.S. production the last 15 years, respectively. From 2001 through 2003, North Dakota has produced 62 percent of U.S. durum production and 45 percent of the country's spring wheat production. North Dakota has accounted for 14 percent of all wheat produced in the U.S. since 1989.

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 has historically dominated North Dakota wheat production, accounting for about 78 percent of all wheat production (North Dakota Agricultural Statistics Service *various years*). Durum and winter wheat typically have accounted for about 21 and 1 percent of all wheat produced in the state, respectively.

All wheat production in North Dakota averaged about 9.1 million planted acres and 275 million bushels from 2001 through 2003 (North Dakota Agricultural Statistics Service *various years*) (Appendix A). County wheat yields from 2001 through 2003 varied from 16 to 46 bushels per planted acre, with an overall state average of 30.4 bushels per acre (Figure 2). Wheat yields are generally highest in the eastern third of the state. Considering the effects of adverse weather on the general growing conditions in many parts of the state during recent years, average yields may reflect differences in weather-related yield losses as much as any geographic advantages in wheat production.

¹The wheat industry, as described and analyzed in this report, is limited to activities associated with wheat produced in North Dakota. Wheat from other states generates economic activity within the state through expenditures for transportation and processing, but was not included in this study.

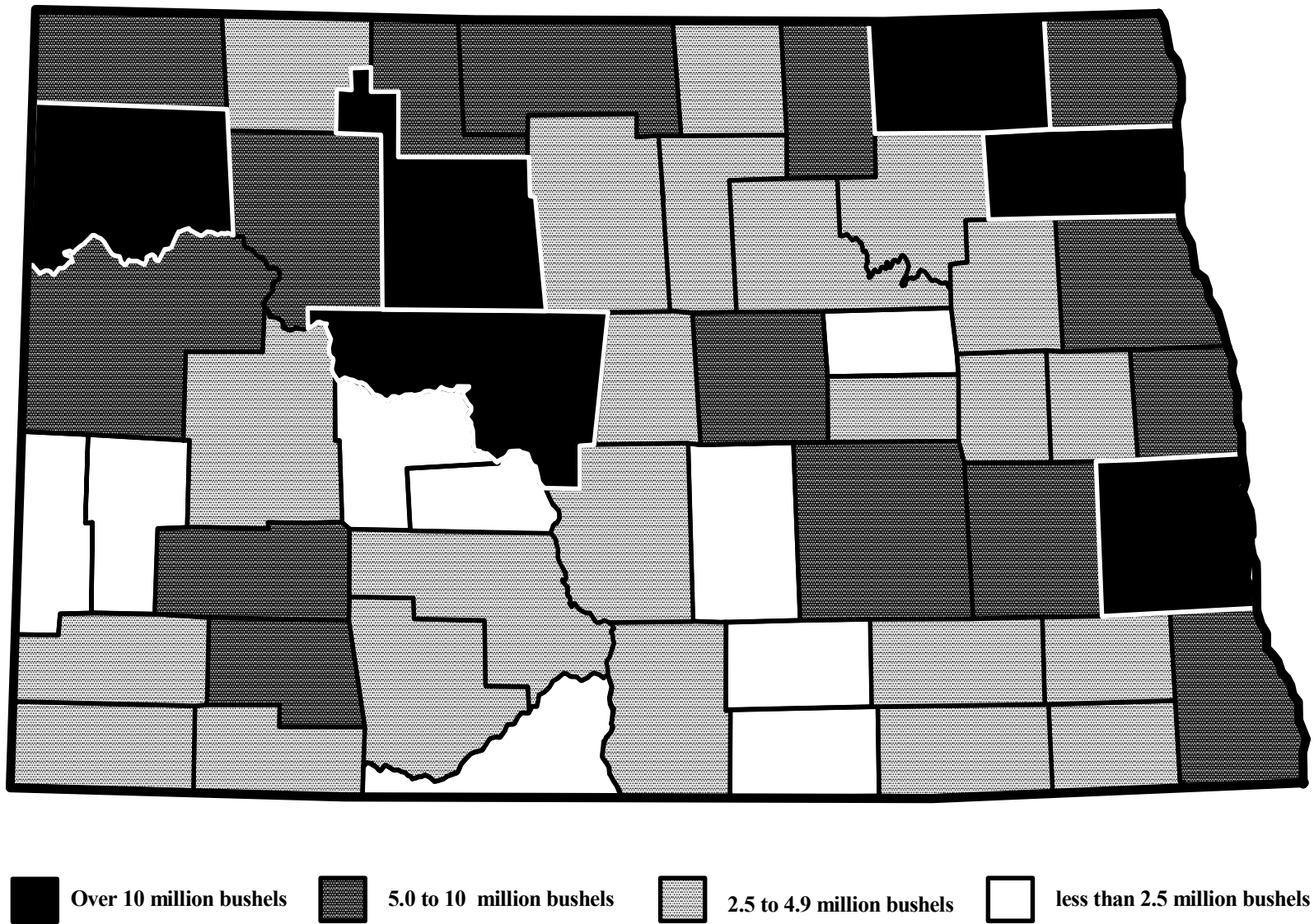


Figure 1. Average Wheat Production in North Dakota, by County, 2001 to 2003

Wheat production used in this report was averaged to eliminate fluctuations in yearly production levels, thus providing a better indication of year-to-year impacts generated by the wheat industry. A three-year average (2001-2003) was used as a proxy to estimate the economic impacts.

Production budgets were developed for spring wheat, durum, and winter wheat production in North Dakota (Appendix B). Production expenditures were estimated based on wheat production costs obtained from the North Dakota Farm and Ranch Business Management Education Program. Wheat revenue was a combination of yields and prices, government payments, disaster payments, and insurance indemnities, all averaged from 2001 through 2003 (Appendix B).

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). The following section is divided into 1) grain flow and 2) grain handling.

Grain Flow

Tracking grain flow is usually complex, involving several modes of transportation (e.g., truck, railroad, barge, vessel) and several possible destinations and handlers (Figure 3). 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 in-state processors or final destinations (Figure 4).

All wheat produced² was assumed to be transported by the farmer to a country elevator. Spring and durum wheat shipments from elevators in North Dakota were nearly equal to total production from 2001 through 2003 (Vachal and VanWechel 2003b, Vachal 2002). Collectively, North Dakota farmers transport relatively minor amounts of their own wheat to processors and out-of-state destinations.

²Wheat produced for commercial seed was subtracted from county wheat production when estimating the amount of wheat entering the marketing system (see Appendix A for explanation).

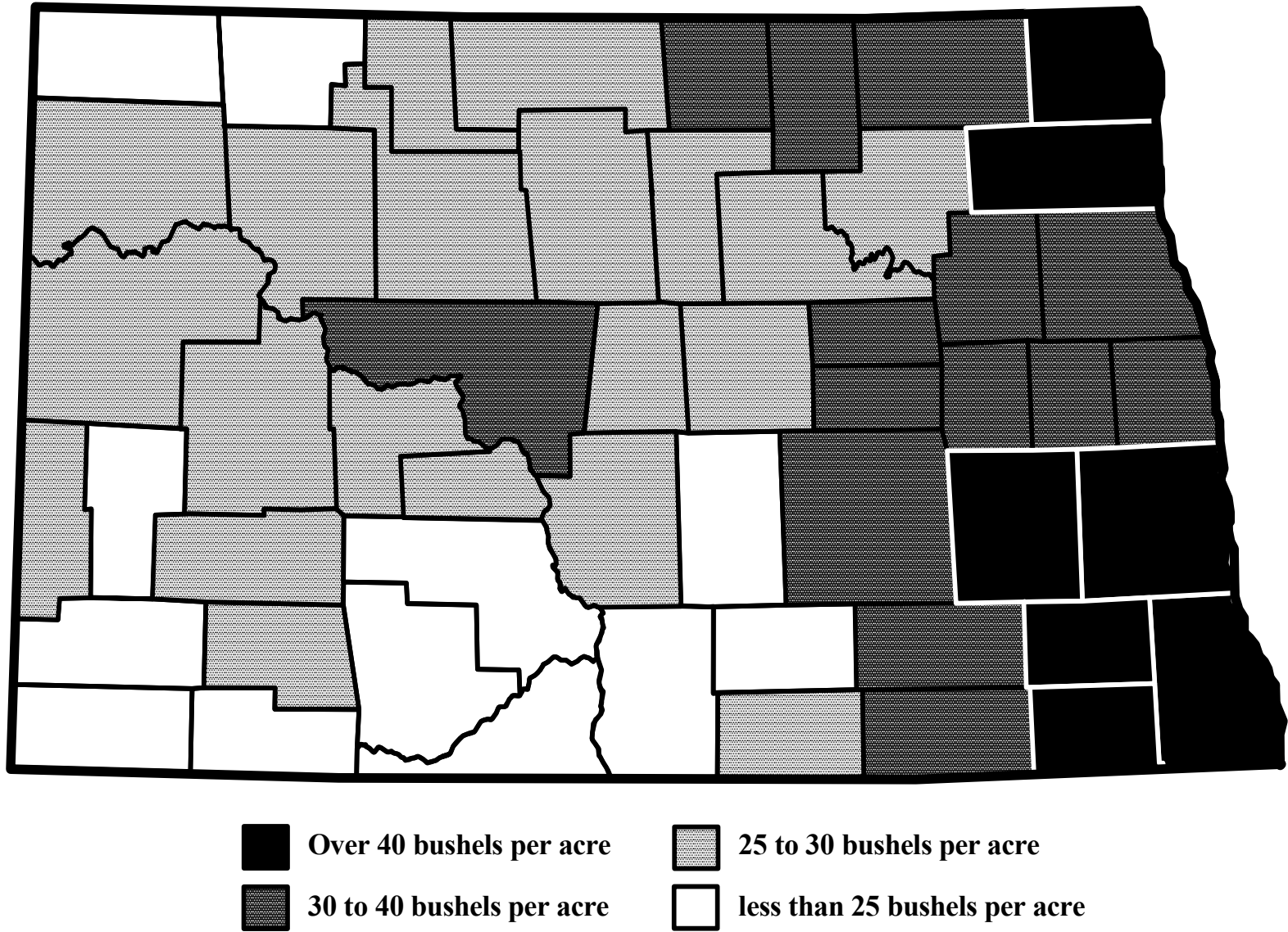


Figure 2. Average Wheat Yields in North Dakota, by County, 2001 to 2003

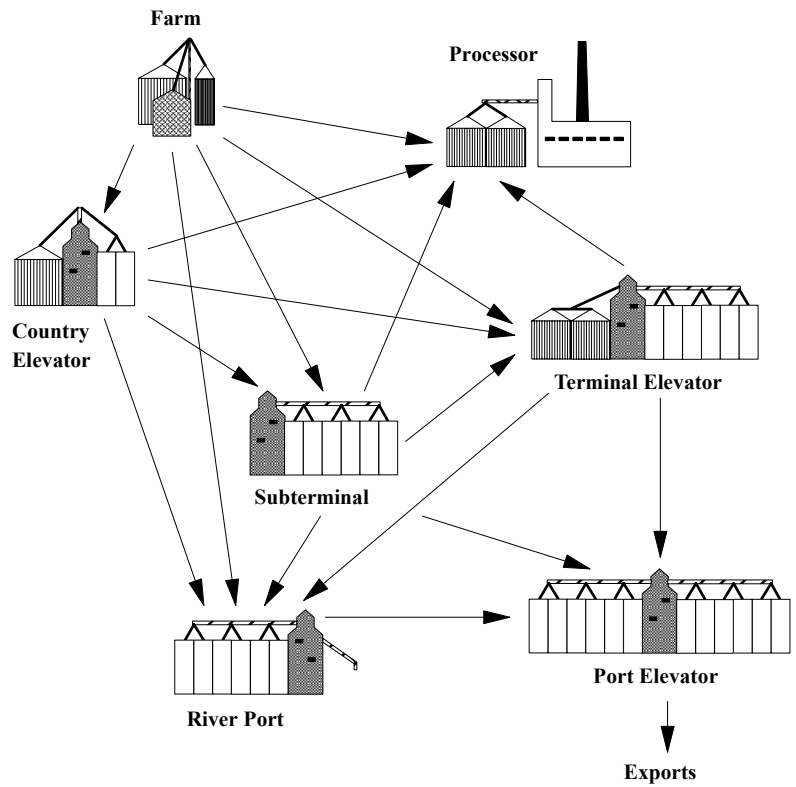


Figure 3. Typical Grain Movements in the United States Grain Marketing System
 Source: U.S. Department of Agriculture (1990).

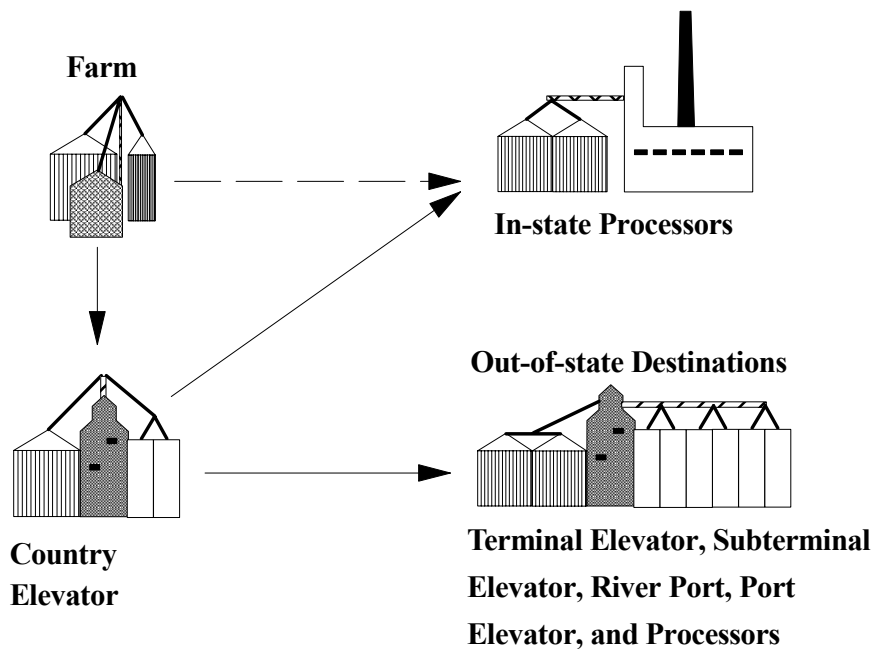


Figure 4. Assumed Wheat Movements for Wheat Produced in North Dakota

After delivery to a country elevator, wheat was assumed to be delivered by the country elevator to either in-state processors or out-of-state destinations. Grain flow statistics for spring and durum wheat were used to identify the percentage of wheat shipped to various destinations from crop reporting districts in the state (Vachal and VanWechel 2003b, Vachal 2002). Estimates of average wheat production were used with the grain flow statistics to identify the volumes of wheat shipped from crop reporting districts to various destinations. The amount of wheat shipped by mode of transportation (i.e., truck and rail), estimated separately for each destination, was obtained from Vachal and VanWechel (2003a). Shipping characteristics (i.e., amount shipped by truck and rail to each destination) for each crop reporting district were applied to county-level durum and spring wheat production to estimate grain flow from each county.

Wheat produced in North Dakota is eventually shipped all over the nation; however, Duluth and Minneapolis/St. Paul destinations collectively received about 51 percent of all North Dakota wheat (Table 1). Substantial amounts of wheat were also shipped to the Pacific Northwest and Southwest/Midland destinations. Destinations outside of North Dakota that received the greatest amount of durum were Minneapolis/St. Paul, Duluth, and Southwest/Midland markets. Destinations for North Dakota spring wheat that received the greatest amount were Minneapolis/St. Paul, Pacific Northwest, and miscellaneous markets (Appendix C).

Grain Handling

Grain handling impacts were estimated by determining (1) a typical handling margin for local elevators in North Dakota and (2) the amount of wheat typically handled by country elevators. A grain handling budget was used to allocate the local elevator returns and expenses for handling wheat (Appendix B). All wheat produced³ in North Dakota, except wheat delivered directly to processors by producers, was assumed to be handled through country elevators. Country elevators handled, after accounting for direct delivery of wheat by producers to processors, approximately 264 million bushels annually. Wheat handled by elevators and processors at destinations outside of North Dakota was not included.

³Wheat raised for commercial seed was included in grain handling charges with country elevators; however, commercial wheat seed was excluded from grain flow calculations.

Table 1. Wheat Movements From Crop Reporting Regions in North Dakota to Various Destinations, 2001 Through 2003

Region	Unit	Market Destinations						Total	Percent of All Wheat
		Duluth	Minn/ St. Paul	Pacific Northwest	Southwest/ Midland	North Dakota	Other		
Central	Bu	2,192,000	8,592,000	1,811,000	3,924,000	743,000	4,110,000	21,372,000	8.2%
	%	10.3	40.2	8.5	18.4	3.5	19.2		
East Central	Bu	6,642,000	8,361,000	1,566,000	7,149,000	1,118,000	8,847,000	33,683,000	12.9%
	%	19.7	24.8	4.7	21.2	3.3	26.3		
North Central	Bu	3,416,000	6,324,000	7,948,000	1,801,000	1,501,000	745,000	21,735,000	8.3%
	%	15.7	29.1	36.6	8.3	6.9	3.4		
Northeast	Bu	10,354,000	18,521,000	1,043,000	3,503,000	9,502,000	10,541,000	53,464,000	20.5%
	%	19.4	34.6	2.0	6.6	17.8	19.7		
Northwest	Bu	6,707,000	9,821,000	12,056,000	6,222,000	7,916,000	1,782,000	44,505,000	17.0%
	%	15.1	22.1	27.1	14.0	17.8	4.0		
South Central	Bu	301,000	11,253,000	280,000	641,000	80,000	326,000	12,882,000	4.9%
	%	2.3	87.4	2.2	5.0	0.6	2.5		
Southeast	Bu	2,169,000	15,268,000	0	1,238,000	829,000	5,365,000	24,869,000	9.5%
	%	8.7	61.4	0.0	5.0	3.3	21.6		
Southwest	Bu	703,000	8,346,000	9,841,000	3,825,000	700,000	1,476,000	24,891,000	9.5%
	%	2.8	33.5	39.5	15.4	2.8	5.9		
West Central	Bu	981,000	12,914,000	2,033,000	1,660,000	1,526,000	4,821,000	23,934,000	9.2%
	%	4.1	54.0	8.5	6.9	6.4	20.1		
All Regions	Bu	33,466,000	99,399,000	36,578,000	29,963,000	23,915,000	38,013,000	261,334,000	
	%	12.8	38.0	14.0	11.5	9.2	14.5		

Transportation

Shipping and hauling costs (i.e., money spent on transporting wheat to market destinations) were included in the study to measure the economic impact transportation of wheat has on the North Dakota economy. To realistically approach the problem of estimating transportation costs for wheat in North Dakota, transportation costs were limited to 1) truck and rail movements from country elevators to in-state and out-of-state destinations and 2) shipments of wheat from farms to in-state destinations. Any other possible combinations of shipments and destinations were not included in the study. The remaining section is divided into transportation by country elevators and brief discussions of truck and railroad transportation.

Transportation from Country Elevators

Transportation costs of shipping wheat from local elevators to market destinations required estimating 1) the amount of wheat transported from counties to market destinations by mode of transport, 2) per unit expense for truck and rail transportation to move wheat to various destinations, and (3) the distance from a central location within the county to market destinations. The amount of wheat shipped from each county to market destinations (i.e., Duluth, Minneapolis/St. Paul, in-state processors, etc.) was determined by applying grain flow information to county production (Appendix C).

The percentages of grain shipments to market destinations by truck and railroad transportation were obtained from Vachal and VanWechel (2003a). The percentages of grain hauled by truck and railroad were applied to county grain movements to estimate the amount of grain shipped by each mode of transportation (Appendix C).

Shipping points (i.e., a central town or location) within each county were selected to calculate transportation costs for the entire county. Shipping points for each county were selected based on location within the county and on whether they contained an elevator with access to a major railroad. Shipping points were used to determine transportation distances to market destinations for both truck (highway miles) and rail (rail line miles). All wheat entering the market system within a county was assumed to be transported from that county's shipping point.

Truck Transportation

Trucking costs for wheat were based on information obtained from the Upper Great Plains Transportation Institute (2004). Grain flow information was used with various truck rates. The truck rate used was a combination of survey data and a truck operating budget to estimate operational expenses and returns. These expenses and returns were then allocated to various economic sectors of the North Dakota Input-Output Model (Appendix B). Total

trucking costs for each county to each destination were estimated by multiplying mileage by cost per mile by the number of shipments.

Railroad Transportation

Railroad transportation costs required estimating the railroad companies' costs of rail shipments, developing a railroad expense budget to allocate shipment costs to expense categories, and estimating charges levied by the railroad companies on elevators for railcar shipments (shipping tariffs). Railroad companies' expenses incurred in rail transport were estimated using the Uniform Railroad Costing System (URCS), a microcomputer model developed by the Interstate Commerce Commission (1990).

URCS estimates variable and total costs (i.e., expenses incurred by the railroad companies, not to be mistaken for the cost incurred by elevators) of railroad transportation based on a current data base of financial and rail shipment information obtained from major railroad companies. The proportions of wheat shipped by single car, multiple car, and unit train rates in the state were obtained from Vachal and VanWechel (2003b) and Vachal (2002) and were used with URCS and grain flow information to estimate an overall cost structure of rail shipments in North Dakota.

URCS provides an estimate of the total variable costs and total allocated costs for rail shipments; however, the model does not provide an adequate breakdown of the costs. Thus, a railroad budget was used to allocate the variable and fixed costs obtained from URCS to various expense categories which were subsequently allocated to economic sectors of the North Dakota Input-Output Model (Appendix B).

After estimating the expenses incurred by the railroad companies, the rates charged elevators for rail shipments were determined. Shipping tariffs are rates charged elevators per rail car to ship grain. Tariffs for rail shipments from North Dakota origins to various destinations were obtained from the Burlington Northern-Santa Fe Corporation (2004). Total railroad costs were subtracted from shipping tariffs to estimate railroad net returns.

Railroad net returns generated from shipments of wheat were assumed to leave the state and were not considered part of the economic impact. However, not all of the economic activity of rail transportation leaves the state (e.g., fuel, repairs, track maintenance, property tax, some labor, etc.). About 60 percent of the variable and fixed costs was assumed to remain within the state's economy (Tolliver et al. 1987; Bangsund et al. 1994; Bangsund and Leistriz 1995).

Processing

Milling wheat into flour and semolina is the only major wheat processing activity in North Dakota, with no significant amount of wheat used in commercial feed formulations,

ethanol production, or other processing activities. Thus, processing impacts were limited to flour milling activities. Any economic activity generated by the flour industry beyond the milling process was not included in this study (e.g., the value of flour to the baking industry, the value of miller's feed grains to the livestock industry). 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 survey of industry processors and other secondary sources (U.S. Department of Commerce 2004). 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 also were solicited (Appendix D).

Input-Output Analysis

Economic activity from a project, program, policy, or activity can be categorized into direct and secondary impacts. Direct impacts are those changes in output, employment, or income that represent the initial or first-round effects of the project, program, policy, or activity. Secondary impacts (sometimes further categorized into indirect and induced effects) result from subsequent rounds of spending and respending within the economy. This process of spending and respending is sometimes termed the multiplier process, and the resultant secondary effects are sometimes referred to as multiplier effects (Leistritz and Murdock 1981).

Input-output (I-O) analysis is a mathematical tool that traces linkages among sectors of an economy and calculates the total business activity resulting from a direct impact in a basic sector (Coon et al. 1985). The North Dakota I-O Model has 17 economic sectors, is closed with respect to households (households are included in the model), and was developed from primary (survey) data from firms and households in North Dakota. Empirical testing has shown the North Dakota Input-Output Model is sufficiently accurate in estimating gross business volume, personal income, retail activity, and gross receipts in major economic sectors in North Dakota (Coon and Leistritz 2004).

ECONOMIC IMPACTS

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 applied to the North Dakota Input-Output Model to estimate the secondary impacts. Secondary impacts result from the turnover or respending of direct impacts within the economy. The following section is divided into six major parts: (1) direct impacts, (2) secondary impacts, (3) employment, (4) tax revenue, (5) total economic impacts, and (6) previous industry impacts.

Direct Impacts

From an economic perspective, direct impacts are those changes in output, employment, or income that represent the initial or first-round effects of a project, program, or activity. 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/country 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. The following sections describe these direct economic impacts.

Wheat Production

Farmers and producers generate direct economic impacts to the area economy through (1) expenditures for production outlays and (2) returns to unpaid labor, management, and equity. Direct economic impacts from wheat production (i.e., production outlays and producer returns) were estimated by developing crop production budgets. The wheat production budgets contained estimated revenue, variable and fixed costs, and returns to unpaid labor, management, and equity (Appendix B).

Total direct impacts per acre from wheat production should be equal to the gross revenue per acre, providing all economic activity (production expenses and returns) remains in the North Dakota economy. All expenses and returns associated with wheat production were assumed to remain within the state economy (i.e., there were no economic leakages associated with the production of wheat), even though minor amounts of some inputs, such as fertilizer, seed, and machinery, may be purchased in neighboring states.

Wheat production in North Dakota averaged 9.1 million acres from 2001 to 2003. The 9.1 million acres of wheat generated about \$1 billion in production expenditures and \$134 million in returns to unpaid labor, management, and equity annually from 2001 through 2003. Direct impacts (expenditures and returns) from wheat production averaged about \$126.50 per acre or \$1.145 billion annually (Table 2).

Table 2. Average Direct Economic Impacts From Wheat Production in North Dakota, 2001 Through 2003

Expenses/Returns	Direct Impacts from Wheat Production
	----- \$ -----
Gross Revenue	
Grain Sales	915,615,000
Government Payments ^a	229,382,000
Total Revenue	1,144,998,000
Expenses	
Fertilizer	157,891,000
Herbicide, Fungicide, etc.	115,161,000
Seed and Seed Treatment	73,109,000
Fuel and Lubrication	57,267,000
Repairs and Maintenance	89,350,000
Crop Insurance	37,512,000
Operating Interest	20,388,000
Land Rent	158,741,000
Land Interest Payments	50,062,000
Equipment/Buildings Depreciation & Lease	88,783,000
Hired Labor	29,613,000
Custom Hire	25,621,000
Miscellaneous ^b	57,418,000
Property Taxes	49,810,000
Total Expenses	1,010,726,000
Returns to Unpaid Labor, Management, and Equity	134,271,000
Total Direct Impacts	1,144,998,000

^a Government payments included farm program payments, disaster payments, and Federal Crop Insurance indemnities (see Appendix B).

^b Miscellaneous expenditures included general farm insurance, license fees, farm utilities (e.g., electricity, phone), machinery storage, and other general farm expenses (e.g., tax preparations, subscriptions, dues).

Grain Handling

Country (local) elevators generate direct economic impacts to the area economy through (1) expenditures for grain handling inputs and (2) returns on grain handling. Direct economic impacts from grain handling were estimated by developing a country elevator budget and from information obtained from industry contacts.

Local elevators in North Dakota handled approximately 264 million bushels (96 percent of production) of wheat annually from 2001 through 2003. With a gross margin of about \$0.12 per bushel (Wilson 2004), grain handling at local elevators generated about \$32 million in annual direct impacts to the economy of North Dakota (Table 3).

Table 3. Average Direct Economic Impacts to the North Dakota Economy From Wheat Handling by Country Elevators, 2001 Through 2003

Categories	Annual Direct Impacts from Grain Handling
	----- \$ -----
Labor	10,367,000
Utilities	1,777,000
Interest	2,962,000
Equip. Depr. and Repairs	4,147,000
Taxes and Licenses	1,481,000
Insurance	2,666,000
General Expenses	4,443,000
Services	1,185,000
Net Returns	2,639,000
Total Direct Impacts	31,667,000

Transportation

Truck and rail transportation generates direct economic impacts in the North Dakota economy through (1) expenditures for operating inputs and (2) operating returns. Direct economic impacts from transportation were estimated separately for truck and rail transportation.

Truck Transportation

Trucking rates were used in conjunction with hauling distances and number of loads to develop an estimate of the economic impacts from truck transportation. Economic activity from intrastate (e.g., a local elevator to Grand Forks State Mill) and interstate (e.g., a local elevator to Duluth) truck shipments was allocated differently. All trucking costs associated with intrastate shipments were assumed to remain within the state. Fuel is a major portion of the expense in trucking, some of which on interstate shipments would be purchased in other states. Also, some repairs are incurred on out-of-state trips. Furthermore, some trucking is conducted by out-of-state trucking firms, which incur most of their expenses in other states. Thus, about 20 percent of the interstate trucking expenses were assumed to occur in other states (Dooley et al. 1988; Bangsund et al. 1994; Bangsund and Leistriz 1995).

Country/local elevators spent about \$20.8 million on truck transportation; however, only 83 percent of that expense was allocated as direct impacts. Total direct economic impacts from truck transportation were about \$17.2 million (Table 4). About 16 percent of all North Dakota wheat was shipped by truck to market destinations. Trucking expenditures and returns accounted for about 24 percent of the direct impacts from wheat transportation.

Table 4. Annual Direct Economic Impacts From Truck Transportation of North Dakota Wheat to Market Destinations, 2001 Through 2003

Categories	Annual Direct Impacts from Truck Transportation
	----- \$ -----
Fuel and Lubrication	3,974,000
Labor	5,740,000
Tires	589,000
Repairs and Maintenance	1,178,000
Equipment	3,827,000
License and Taxes	589,000
Insurance	883,000
Mngt., Admin., and Comm.	147,000
Net Returns	294,000
Total Direct Impacts	17,221,000

Railroad Transportation

Railroads and rail transportation have played major roles in the economy of most western states since statehood; North Dakota is no exception. The availability and use of railroads are important to most industries, especially agriculture. Their impacts can be felt by the service they provide (i.e., the complex movement of production inputs and shipment of commodities to and from all areas of the United States) and by the economic activity they incur in operation. The economic impacts of railroad transportation were estimated by determining expenses and returns generated in the transportation process.

Country elevators spent about \$199 million on rail transportation to ship North Dakota wheat to market destinations. About 28 percent or \$55.4 million of the total amount spent remained as direct economic impacts (Table 5), the remaining amount was either incurred in other states or removed from the state. About 84 percent of all North Dakota wheat was shipped by rail to market destinations. Expenditures for rail shipments retained within the North Dakota economy accounted for 76 percent of the direct economic impacts from wheat transportation.

Table 5. Annual Direct Economic Impacts From Rail Transportation of North Dakota Wheat to Market Destinations, 2001 Through 2003

Categories	Annual Direct Impacts from Rail Transportation
	----- \$ -----
Crew and Labor	17,447,000
Locomotive Operation	9,332,000
Car Expenses	8,542,000
Transportation	4,576,000
Maintenance-of-Way	7,026,000
Depr./Car and Locomotive	7,026,000
Central Administration	314,000
Insurance	186,000
Property Tax	911,000
Total Direct Impacts	55,360,000

Processing

Agricultural processing is a key component of the farm-to-consumer food chain. Agricultural processing, to some extent, includes almost all agricultural commodities and

generates a host of different products. In the case of wheat, the processing chain generally starts with the milling industry⁴, which grinds wheat into flour and semolina.

Economic impacts to the North Dakota economy from processing wheat were limited to in-state milling activities. Expenditures, returns, and employment information was obtained through a survey of in-state milling firms. Milling firms in the state processed about 46 million bushels of wheat in 2003. About 40.5 million bushels were obtained from North Dakota sources. In-state expenditures and returns from processing North Dakota wheat were estimated at \$100 million annually (Table 6).

Table 6. Annual Direct Economic Impacts From Wheat Processing Activities in North Dakota, 2001 Through 2003

Economic Sectors	Direct Impacts from Wheat Processing
	----- \$ -----
Construction	2,564,000
Transportation	27,324,000
Comm and Public Utilities	5,485,000
Ag Processing and Misc Mfg.	30,945,000
Retail Trade	5,397,000
Finance, Insurance, and Real Estate	3,226,000
Business and Personal Service	2,623,000
Professional and Social Service	512,000
Households	21,405,000
Government	545,000
Total Direct Impacts	100,025,000

Secondary Impacts

Secondary economic impacts result from subsequent rounds of spending and respending within an 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). An economic sector is a group of similar economic units (e.g., communications and public utilities, retail trade, construction).

⁴Some wheat in the United States is processed into breakfast foods and miscellaneous feeds; however, impacts from in-state processing of North Dakota wheat was limited entirely to flour milling.

This process of spending and respending can be explained by using an example. A single dollar from an area 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).

Secondary economic impacts were estimated separately for wheat production, grain handling, transportation, and processing. The following sections discuss the allocation of direct impacts to various economic sectors of the North Dakota Input-Output Model and the amount of secondary impacts generated in those economic sectors.

Wheat Production

Wheat production expenditures and returns were allocated to various economic sectors of the North Dakota Input-Output Model. Seed, herbicide, fungicide, insecticide, fertilizer, fuel, lubrication, machinery and building depreciation and lease, two-thirds of miscellaneous expenses, and one-third of miscellaneous overhead costs were allocated to the *Retail Trade* sector. Insurance, operating interest, and land interest payments were allocated to the *Finance, Insurance, and Real Estate* (FIRE) sector. Repairs, custom hire, one-third of miscellaneous expenses, and two-thirds of miscellaneous overhead costs were allocated to the *Business and Personal Services* sector. The *Communication and Public Utilities* sector included farm utility expenses. Property taxes were allocated to the *Government* sector. Hired labor and net returns to unpaid labor, management, and equity were allocated to the *Households* sector.

Total direct impacts of \$1.14 billion from wheat production in North Dakota generated about \$1.8 billion in secondary impacts (Table 7). Secondary impacts were greatest in the *Households* sector (\$635 million), which represents economy-wide personal income. Other sectors with substantial secondary impacts were the *Retail Trade* (\$527 million), *Finance, Insurance, and Real Estate* (\$117 million), and *Communication and Public Utilities* (\$93 million) sectors. Secondary impacts occurred in seven economic sectors that did not have direct impacts. For every dollar in direct economic activity from wheat production, another \$1.57 was generated in secondary economic activity. Total economic impacts from wheat production were about \$2.9 billion and included about 27,519 secondary jobs. Secondary jobs represent employment outside of the wheat industry, but employment that is dependent on the existence of the wheat industry.

Table 7. Annual Direct, Secondary, and Total Economic Impacts of Wheat Production in North Dakota, by Economic Sector, 2001 Through 2003

Economic Sectors	Economic Impacts from Wheat Production		
	Direct	Secondary	Total
	----- 000s \$ -----		
Agriculture-Livestock	0	79,717	79,717
Agriculture-Crops	0	31,302	31,302
Nonmetal Mining	0	4,278	4,278
Construction	0	63,785	63,785
Transportation	0	11,456	11,456
Comm and Public Utilities	11,813	92,937	104,750
Ag Proc and Misc Mfg	0	48,364	48,364
Retail Trade	503,597	527,074	1,030,671
Fin, Ins, and Real Estate	123,586	116,701	240,287
Bus and Pers Service	133,566	45,964	179,530
Prof and Social Service	0	62,925	62,925
Households	322,625	634,921	957,546
Government	49,810	79,439	129,249
Total Impacts	1,144,998	1,798,862	2,943,860
Secondary Employment (full-time equivalent jobs)			27,519

Grain Handling

Grain handling expenditures and returns were allocated to various economic sectors. Supplies, equipment depreciation and repairs, and general expenses were allocated to the *Retail Trade* sector. Taxes and licenses were allocated to the *Government* sector. Insurance and interest expenses were allocated to the *Finance, Insurance, and Real Estate* sector. Utilities and communication expenses were allocated to the *Communications and Public Utilities* sector. Labor expenses were allocated to the *Households* sector.

Total direct impacts of \$32 million from handling activities generated about \$60 million in secondary impacts (Table 8). Secondary impacts were greatest in the *Households* (economy-wide personal income) sector (\$20 million) and the *Retail Trade* sector (\$17 million). Secondary impacts from wheat handling also affected the *Agriculture-Crops*, *Agriculture-Livestock*, and *Construction* sectors, three sectors that had no direct impacts, but had substantial secondary impacts. For every dollar in direct economic activity from grain handling, another \$1.90 was generated in secondary economic activity. Total economic impacts from grain handling were about \$92 million annually and included about 824 secondary jobs.

Table 8. Annual Direct, Secondary, and Total Economic Impacts of Grain Handling Activities in North Dakota, by Economic Sector, 2001 Through 2003

Economic Sector	Economic Impacts from Grain Handling		
	Direct	Secondary	Total
	----- 000s \$ -----		
Agriculture-Livestock	0	2,427	2,427
Agriculture-Crops	0	2,512	2,512
Nonmetal Mining	0	137	137
Construction	0	1,993	1,993
Transportation	0	325	325
Comm and Public Utilities	1,777	2,803	4,580
Ag Proc and Misc Mfg	2,639	3,240	5,879
Retail Trade	8,589	16,792	25,381
Fin, Ins, and Real Estate	5,628	3,717	9,345
Bus and Pers Service	1,185	1,483	2,668
Prof and Social Service	0	2,007	2,007
Households	10,367	20,291	30,658
Government	1,481	2,540	4,021
Total Impacts	31,665	60,268	91,933
Secondary Employment (full-time equivalent jobs)			824

Transportation

Expenditures and returns associated with wheat transportation were allocated to various economic sectors. Fuel, lubrication, tires, repairs and maintenance, equipment, locomotive operation, rail car expenses, rail car and locomotive depreciation, food, supplies, and other expenses were allocated to the *Retail Trade* sector. Labor and central administration expenses were allocated to the *Households* sector. Property taxes and licenses were allocated to the *Government* sector. Insurance and housing expenses were allocated to the *Finance, Insurance, and Real Estate* sector. Communication expenses were allocated to the *Communications and Public Utilities* sector. General transportation expenses, maintenance-of-way costs, and net returns from truck transportation were allocated to the *Transportation* sector.

Total direct impacts of \$73 million from wheat transportation generated about \$114 million in secondary impacts (Table 9). Secondary impacts were greatest in the *Households*

sector (\$38 million in economy-wide personal income) and the *Retail Trade* sector (\$34 million). Secondary impacts from transportation also affected the *Agriculture-Livestock*, *Construction*, and *Professional and Social Service* sectors, three sectors that had no direct impacts, but had substantial secondary impacts. For every dollar in direct economic activity from transportation activities, another \$1.57 was generated in secondary economic activity. Total economic impacts from wheat transportation were about \$186 million annually and included about 2,171 secondary jobs.

Table 9. Annual Direct, Secondary, and Total Economic Impacts of Wheat Transportation in North Dakota, by Economic Sector, 2001 Through 2003

Economic Sector	Economic Impacts from Transportation		
	Direct	Secondary	Total
	----- 000s \$ -----		
Agriculture-Livestock	0	5,264	5,264
Agriculture-Crops	0	1,972	1,972
Nonmetal Mining	0	332	332
Construction	0	3,997	3,997
Transportation	11,896	685	12,581
Comm and Public Utilities	49	5,457	5,506
Ag Proc and Misc Mfg	0	2,948	2,948
Retail Trade	34,466	34,254	68,720
Fin, Ins, and Real Estate	1,069	7,546	8,615
Bus and Pers Service	0	2,728	2,728
Prof and Social Service	0	3,976	3,976
Households	23,599	37,633	61,232
Government	1,499	7,099	8,598
Total Impacts	72,579	113,891	186,469
Secondary Employment (full-time equivalent jobs)			2,171

Processing

Expenditures and returns obtained from a survey of wheat processors in the state were allocated to various economic sectors. Construction expenditures were allocated to the *Construction* sector. Transportation expenses were allocated to the *Transportation* sector. Miscellaneous manufacturing and wholesale trade expenses and net returns were allocated to the *Agricultural Processing and Miscellaneous Manufacturing* sector. Half of plant maintenance and overhaul expenses was allocated to *Business and Personal Services* sector,

and the remaining half was allocated to the *Retail Trade* sector. Other items allocated to the *Retail Trade* sector included expenses for petroleum, natural gas, supplies, maintenance, and miscellaneous items. Communication, public utility, and electricity expenses were allocated to the *Communications and Public Utilities* sector. Interest and insurance expenses were allocated to the *Finance, Insurance, and Real Estate* sector. Employee benefits and salary and wages were allocated to the *Households* sector. All taxes were allocated to the *Government* sector.

Total direct impacts of \$100 million from wheat processing activities generated about \$241 million in secondary impacts (Table 10). Secondary impacts were greatest in the *Households* sector (\$72 million in economy-wide personal income) and the *Retail Trade* sector (\$58 million). For every dollar in direct economic activity from wheat processing, another \$2.41 was generated in secondary economic activity. Total economic impacts from wheat processing were about \$341 million and included about 4,527 secondary jobs.

Table 10. Annual Direct, Secondary, and Total Economic Impacts of Wheat Processing Activities in North Dakota, by Economic Sector, 2001 Through 2003

Economic Sector	Economic Impacts from Wheat Processing		
	Direct	Secondary	Total
	----- 000s \$ -----		
Agriculture-Livestock	0	9,704	9,704
Agriculture-Crops	0	21,591	21,591
Nonmetal Mining	0	712	712
Construction	2,564	6,295	8,859
Transportation	27,324	1,043	28,367
Comm and Public Utilities	5,485	8,690	14,175
Ag Proc and Misc Mfg	30,945	25,288	56,233
Retail Trade	5,397	58,422	63,819
Fin, Ins, and Real Estate	3,226	12,939	16,165
Bus and Pers Service	2,623	4,918	7,541
Prof and Social Service	512	6,147	6,659
Households	21,405	72,053	93,458
Government	545	13,320	13,865
Total Impacts	100,025	241,123	341,148
Secondary Employment (full-time equivalent jobs)			4,527

Employment

The wheat industry benefits the economy by creating and supporting direct and secondary employment. Direct employment is a measure of the number of full-time jobs within an industry. Secondary jobs are an estimate of employment outside of an industry, but employment that is created from the industry's economy-wide economic activity.

Direct Employment

Direct employment in the wheat industry is extremely difficult to quantify. Many of the positions (employment) affiliated with the wheat industry (i.e., those outside of production) exist in 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. In each case, some jobs might disappear without the wheat industry, while others may not be affected. For example, an elevator that relies on wheat for a major portion of its grain handling activities may reduce its work force if it no longer handled wheat, providing it could not make up for the loss in grain handling with other commodities or agricultural activities.

However, the issue is not that simple. If wheat was no longer produced, some alternative commodity likely would be raised in its place and likely would be marketed and handled by grain elevators. Thus, local elevators would change from handling and shipping wheat to handling and shipping the alternative commodity. The effects on employment are unclear.

Employment-related questions in transportation are similar. For example, independently employed truck drivers who haul farm commodities, in the absence of any wheat to haul, likely would remain employed, but seek alternative hauling opportunities with other commodities. Even in the case where wheat is the only commodity hauled, alternative commodities raised in the place of wheat likely would provide similar shipping opportunities. Thus, most of the jobs outside of wheat production are within industries that are supported only in part by the wheat industry. This makes estimating direct employment extremely difficult. The wheat industry does directly affect jobs in grain handling and transportation; however, actual quantification of those jobs is not clear.

Direct employment (full-time equivalent jobs) in wheat production is also difficult to quantify. Approximately 12,900 farms raised wheat in North Dakota in 2002 (U.S. Department of Agriculture 2004c). The number of full-time equivalent (FTE) positions that could be attributable to wheat production from those 12,900 farms is nearly impossible to estimate, given the scope of this study. Unless those farms raised only wheat each year, the time spent raising wheat usually would be less than a full-time job. The degree of time or fraction of employment for any particular farmer raising wheat varies nearly every year. An estimate of the number of full-time jobs would require knowing the number of people

employed by those farms, and the fraction of employment devoted to wheat production for each worker. Also, many farmers, even in the absence of wheat, likely would remain employed raising other crops.

Employment in wheat processing activities was obtained from a survey of processors. Wheat processors were estimated to employ 471 FTE positions in North Dakota.

Secondary Employment

Secondary employment estimates represent the number of full-time jobs generated based on the volume of business activity created by an industry. Productivity ratios⁵ were used with estimates of business activity to obtain secondary employment. Wheat production indirectly supported about 27,519 full-time equivalent jobs in North Dakota. Grain handling activities indirectly supported about 824 FTE jobs. Transportation of wheat to in-state and out-of-state markets generated about 2,171 FTE jobs. Wheat processing in the state indirectly supported about 4,527 FTE jobs. All wheat activities combined supported about 35,041 FTE jobs in the state.

Tax Revenue

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.

Business activity alone does not directly support local government functions; however, taxes on personal income, retail trade, real estate property, and corporate income are important revenue sources for local and state governments. Total economic impacts in the *Retail Trade* sector were used to estimate revenue from sales and use taxes. Economic activity in the *Households* sector was used to estimate personal income tax collections. Similarly, corporate income tax revenue was estimated from the economic activity in all business sectors (excluding the *Households*, *Government*, and *Agriculture* sectors).

Input-output 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 \$55 million in sales and use taxes, \$14.9 million in personal income taxes, and \$6.5 million in corporate income taxes from 2001 through

⁵A measure of the amount of economic activity needed in an economic sector to support one full-time job.

2003 (Table 11). Total collections from sales and use, personal income, and corporate income taxes were about \$76.4 million annually. Wheat production also was directly responsible for about \$49.8 million in property taxes annually from 2001 through 2003. Property taxes were included in the direct impacts.

Table 11. Estimated Annual Tax Collections
Generated From Wheat Industry Activities,
North Dakota, 2001 Through 2003

Tax	Estimated Tax Collections
	-- 000s \$ --
Sales and Use	55,032
Personal Income	14,858
Corporate Income	6,542
Total Collections	76,432

Total Economic Impacts

Total annual direct impacts from wheat production expenditures and returns in North Dakota were estimated at \$1.14 billion. Grain handling, transportation, and processing activities generated an additional \$204 million in annual direct impacts. All wheat industry activities generated about \$1.35 billion in annual direct impacts from 2001 through 2003. Business activity was greatest in the *Retail Trade* (\$552 million), *Households* (\$378 million in economy-wide personal income), *Business and Personal Services* (\$137 million), and *Finance, Insurance, and Real Estate* (\$134 million) sectors (Table 12).

Annual secondary impacts from wheat production in North Dakota were estimated at \$1.8 billion. Grain handling, transportation, and processing activities generated an additional \$415 million in annual secondary impacts. All wheat industry activities generated about \$2.2 billion in annual secondary impacts from 2001 through 2003. The economic areas of the state economy with the greatest secondary impacts included the *Households* (\$765 million), *Retail Trade* (\$637 million), *Finance, Insurance, and Real Estate* (\$141 million), *Communication and Public Utilities* (\$110 million), and *Government* (\$102 million) sectors. Overall, each dollar of direct impacts from the wheat industry generated about \$1.64 in secondary impacts.

Table 12. Direct Impacts From the Wheat Industry to the North Dakota Economy, by Economic Sector and Industry Activity, 2001 Through 2003

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	2,564	2,564
Transportation	0	11,896	0	27,324	39,220
Comm and Pub Util	11,813	49	1,777	5,485	19,124
Ag Proc and Misc Mfg	0	0	2,639	30,945	33,583
Retail Trade	503,597	34,466	8,589	5,397	552,050
Fin, Ins, and R Estate	123,586	1,069	5,628	3,226	133,509
Bus and Pers Service	133,566	0	1,185	2,623	137,373
Prof and Social Service	0	0	0	512	512
Households	322,625	23,599	10,367	21,405	377,995
Government	49,810	1,499	1,481	545	53,336
Total Direct Impacts	1,144,998	72,579	31,665	100,025	1,349,267

Secondary employment estimates represent the number of full-time jobs generated based on the volume of business activity created by an industry. Wheat activities in the state supported about 35,041 FTE secondary jobs. In addition to wheat processing employment and secondary jobs, the wheat industry directly influences employment in grain handling and transportation. Direct employment from wheat processing was estimated at 471 FTE jobs.

Annual economic impacts from wheat production expenditures and returns in North Dakota were estimated at \$2.9 billion. Grain handling, transportation, and processing activities generated an additional \$620 million in annual economic impacts. All wheat industry activities generated a total economic impact of \$3.6 billion annually in the state from 2001 through 2003 (Table 13).

The economic sectors with the greatest total (direct and secondary) impacts included *Retail Trade* (\$1.19 billion), *Households* (\$1.14 billion in economy-wide personal income), *Finance, Insurance, and Real Estate* (\$274 million), *Business and Personal Services* (\$192 million), *Government* (\$156 million), and *Communication and Public Utilities* (\$129 million) (Table 13).

Table 13. Total Impacts From the Wheat Industry to the North Dakota Economy, by Economic Sector and Industry Activity, 2001 Through 2003

Economic Sector	Total Economic Impacts by Industry Activity				Total Impacts
	Wheat Production	Transportation	Grain Handling	Processing	
----- 000s \$ -----					
Agriculture-Livestock	79,717	5,264	2,427	9,704	97,112
Agriculture-Crops	31,302	1,972	2,512	21,591	57,377
Nonmetal Mining	4,278	332	137	712	5,459
Construction	63,785	3,997	1,993	8,859	78,634
Transportation	11,456	12,581	325	28,367	52,729
Comm and Pub Util	104,750	5,506	4,580	14,175	129,011
Ag Proc and Misc Mfg	48,364	2,948	5,879	56,233	113,424
Retail Trade	1,030,671	68,720	25,381	63,819	1,188,591
Fin, Ins, and R Estate	240,287	8,615	9,345	16,165	274,412
Bus and Pers Service	179,530	2,728	2,668	7,541	192,467
Prof and Social Service	62,925	3,976	2,007	6,659	75,567
Households	957,546	61,232	30,658	93,458	1,142,894
Government	129,249	8,598	4,021	13,865	155,733
Total Economic Impacts	2,943,860	186,469	91,933	341,148	3,563,410
Secondary Employment	27,519	2,171	824	4,527	35,041

Each acre of wheat planted in North Dakota (2001 through 2003) averaged about \$394 in total economic activity (direct and secondary economic impacts) or, expressed alternatively, each bushel of wheat produced resulted in \$12.95 in total business activity. For every 258 acres of wheat planted or 7,854 bushels of wheat harvested, one secondary FTE job in North Dakota was supported. On average, each acre of wheat planted in North Dakota generated about \$13.94 in tax revenue (\$5.50 in property tax and \$8.44 in combined sales and use, personal income, and corporate income taxes).

Previous Industry Impacts

The economic contribution of commodity-based industries (e.g., wheat) is largely a function of quantity (bushels) and value (crop prices). In the case of the wheat industry in North Dakota, changes in production and crop prices directly affect the level of economic activity attributable to the industry. However, changes in production have the added effect of

changing the volume of commodity transported and handled within the state. Thus, changes in production will also influence the economic activity associated with other aspects of a commodity-based industry. Primary in-state processing is another area typically included in economic assessments of commodity-based industries in North Dakota. However, in the case of the wheat industry, historically, minor amounts of wheat, relative to overall production, have been processed in the state. As a result, the economic size of the wheat industry in North Dakota has largely paralleled changes in crop production.

The general approach to estimating the economic contribution of commodity-based industries in the state has been to average production over a three- or five-year period to avoid placing too much emphasis on a single year (Bangsund and Leistritz 1999, 1998, 1995a, 1995b). Bangsund and Leistritz (1995b) used a three-year average (1991 through 1993) of production to estimate the economic contribution of the wheat industry. In this study, wheat production was averaged from 2001 through 2003. Even though both studies use the same length of time to account for annual variations in acreage and production, wheat production has generally been decreasing in North Dakota since 1992, despite a 15-year high in acreage in 1996 (Figure 5). Over the past 15 years, the value of wheat production peaked in 1996, only to decrease substantially in the late 1990s. However, the value of wheat production has rebounded somewhat in recent years (Figure 6).

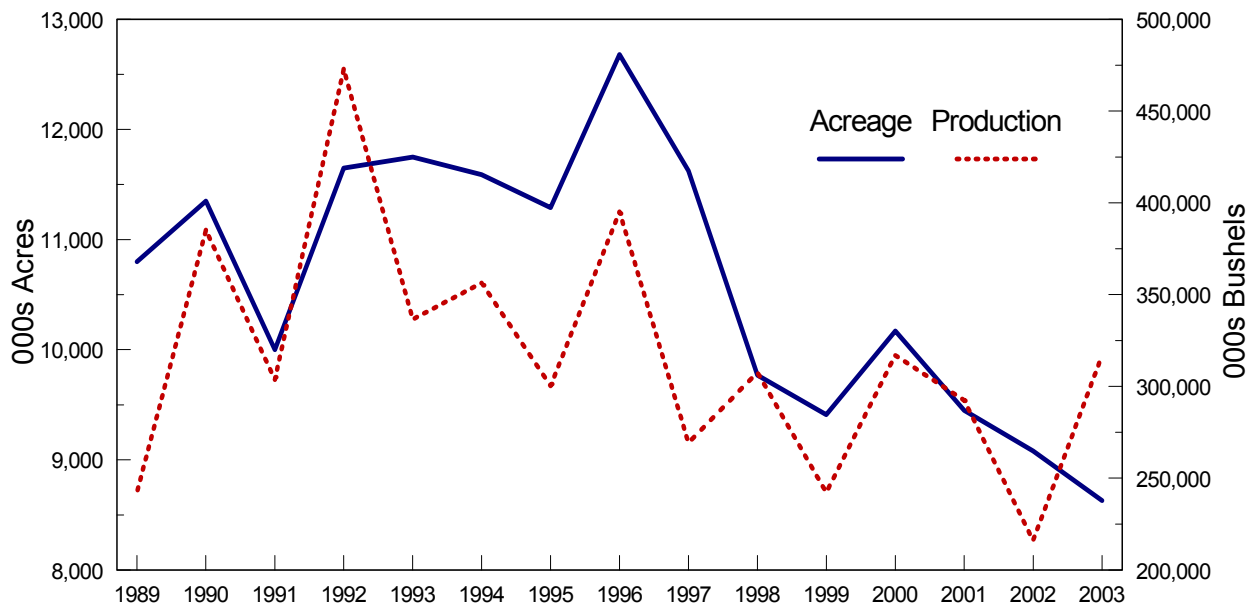


Figure 5. Wheat Acreage and Production, North Dakota, 1989 to 2003

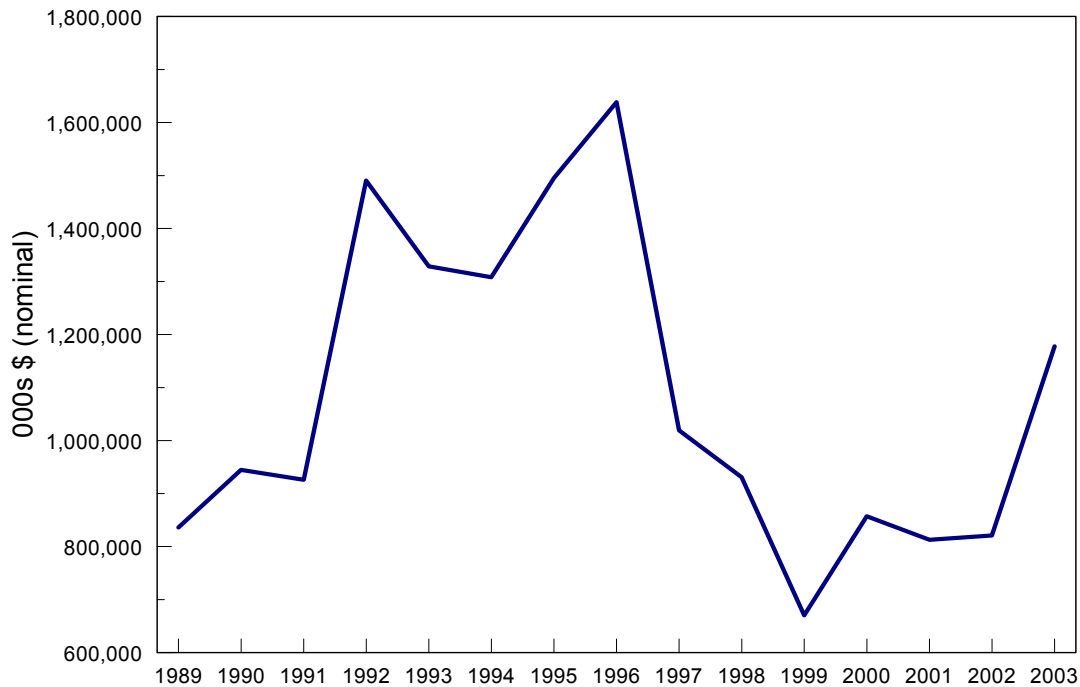


Figure 6. Value of Wheat Production, North Dakota, 1989 to 2003

Estimates of the economic contribution of the wheat industry published in 1995 were compared to estimates in this study. Scope and methodology in the two studies are nearly identical. Thus, direct comparisons can be made by adjusting previous industry estimates to reflect real dollars (effects of inflation removed). Previous estimates from Bangsund and Leistriz (1995b) were adjusted using the Consumer Price Index (U.S. Department of Labor 2004) to reflect 2003 equivalent dollars.

From 1991 through 1993, North Dakota averaged 11,078,000 planted acres of wheat compared to 9,053,000 planted acres from 2001 through 2003; a decrease of over 2 million acres or 18 percent. Wheat production averaged over 368 million bushels annually from 1991 through 1993 compared to just over 275 million bushels annually from 2001 through 2003. Average production between the two periods decreased by 93 million bushels or by 25 percent. Average annual wheat prices in North Dakota over the 1991 to 1993 period (\$3.36/bu) were similar to prices received during the 2001 to 2003 period (\$3.33/bu) (Figure 7). Thus, most of the change in the value of wheat production between the periods was attributable to changes in production levels.

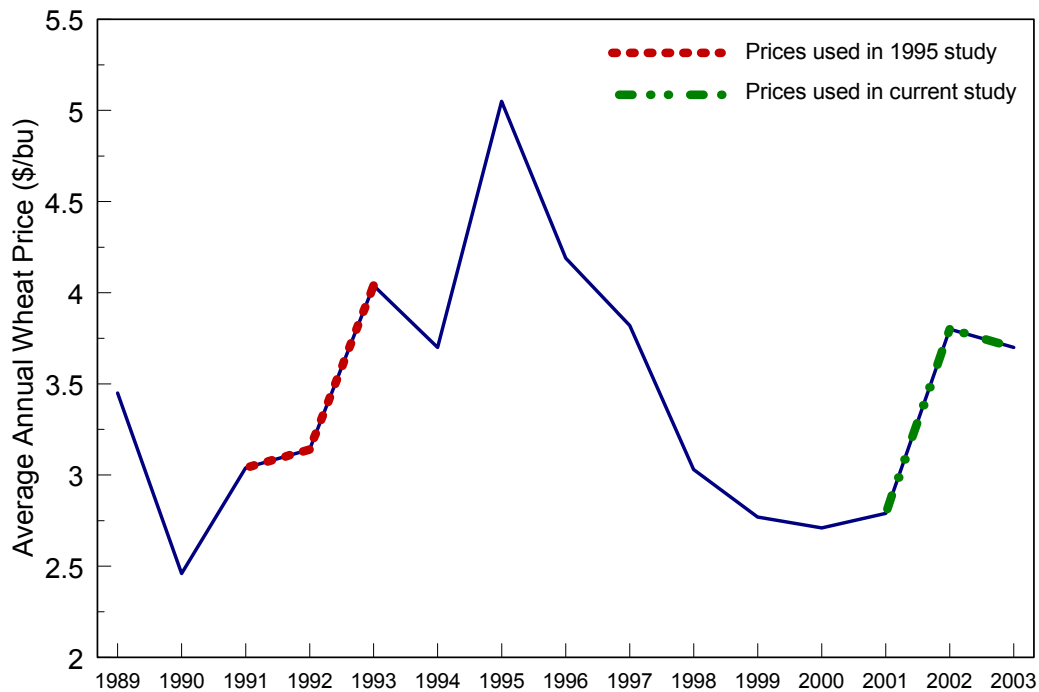


Figure 7. Average Annual Wheat Prices, North Dakota, 1989 to 2003

Average yield from 1991 through 1993 was estimated at 33.25 bushels per planted acre compared to 30.40 bushels from 2001 through 2003. Gross revenue per acre, which includes government payments, insurance indemnities, and disaster payments, was estimated at \$135.20 per planted acre from 1991 through 1993 and \$126.47 from 2001 through 2003. Less economic activity was produced on each acre of wheat from 2001-2003 than was generated from 1991-1993 due mostly to changes in yields, as prices and government payments were similar in both periods. Gross revenue per planted acre decreased by \$8.73 or by 6.5 percent (Table 14). Crop prices were not adjusted for inflation since commodity values are not correlated with changes in consumer prices (U.S. Department of Labor 2005).

The direct impacts from wheat production were estimated at \$1.498 billion annually from 1991 through 1993. Wheat production was estimated to generate \$1.143 billion annually from 2001 through 2003. Due primarily to an estimated 2,024,434 fewer planted acres and a 8.6 percent lower yield per acre from 1991-1993 to 2001-2003, the value of wheat production in the state decreased by \$355 million or by 23.7 percent between the two periods (Table 14). Government payments were estimated at about \$23.55 per acre from 1991 through 1993 versus \$25.34 per acre from 2001 through 2003. Secondary impacts from wheat production were adjusted for inflation (i.e., expressed in 2003 dollar equivalents) and added to direct impacts. The total annual economic effects of wheat production from 1991 through 1993 was \$4.7 billion (2003 dollars) versus a total annual impact of \$2.9 billion from 2001 through 2003. The economic impact of wheat production decreased by about \$1.76 billion or by 37 percent in real terms between the two periods (Table 14).

Table 14. Comparison of Economic Size of the Wheat Industry in North Dakota, Averages from 1991 Through 1993 and 2001 Through 2003

Economic Indicators	1991 to 1993 ^a	2001 to 2003	Percentage Change
<u>Production Statistics</u>			
Planted Acres	11,077,767	9,053,333	-18.3
Production (bushels)	368,289,600	275,195,000	-25.3
Bushels per planted acre	33.25	30.40	-8.6
<u>Wheat Production</u>			
Grain sales (nominal \$)	1,236,853,000	915,615,000	-26.0
Government payments (nominal \$)	260,890,000	229,382,000	-12.1
Gross revenue per acre (nominal \$)	135.20	126.47	-6.5
Direct impacts (nominal \$)	1,497,743,000	1,144,998,000	-23.6
Secondary impacts (2003 \$) ^b	3,201,199,000	1,798,862,000	-43.8
Total (direct and secondary)	4,698,942,000	2,943,860,000	-37.4
<u>Grain Handling</u>			
Total impacts (2003 \$)	171,484,000	91,933,000	-46.4
<u>Transportation</u>			
Total impacts (2003 \$)	332,976,000	186,469,000	-44.0
<u>Processing</u>			
Total impacts (2003 \$)	154,419,000	341,148,000	120.9
<u>Wheat Industry</u>			
Gross Business Volume (2003 \$)	5,357,821,000	3,563,410,000	-33.5
<u>Employment</u>			
Direct employment (processing only) ^c	350	471	34.6
Secondary employment	50,980	35,041	-31.3
<u>Tax Revenues</u>			
State tax collections (2003 \$)	127,081,000	76,432,000	-39.9

^a Source of data obtained from Bangsund and Leistritz (1995b).

^b Adjusted for inflation using the Consumer Price Index (U.S. Department of Labor 2004).

^c Employment in wheat processing in 1993, obtained from Bangsund and Leistritz (1995b), was revised.

Transportation and grain handling impacts are predominantly influenced by the volume of grain produced. Transportation rates and grain handling margins were similar between the two study periods. Thus, most of the change in economic activity generated from wheat handling and transportation was due to a reduction in the volume of wheat. Total annual impacts from wheat transportation were estimated at \$333 million (2003 dollars) from 1991 through 1993 compared to an annual impact (direct and secondary) of \$186 million from 2001 through 2003. The economic impact from wheat transportation decreased by \$147 million in real terms between the two periods. Total annual impacts from wheat handling were estimated at \$171 million (2003 dollars) from 1991 through 1993 compared to an annual impact (direct and secondary) of \$92 million from 2001 through 2003. The economic impact from wheat handling decreased by nearly \$80 million in real terms between the two periods.

Economic impacts from wheat processing are not directly tied to production levels. In 1993, in-state processing of North Dakota wheat was estimated at 17.9 million bushels annually. By comparison, in-state processing of North Dakota wheat in 2003 was estimated at 40.5 million bushels annually. The change in economic activity associated with in-state processing of wheat raised in North Dakota was due to both the addition of new processing plants in the state and expansion of processing capacities at existing plants. The total economic effect of wheat processing was estimated at \$154.4 million (2003 dollars) in 1993 compared to \$341.1 million in 2003. The processing sector of the wheat industry exhibited real (effects of inflation removed) growth between the two periods. The economic activity associated with in-state processing of North Dakota wheat was estimated to increase by \$186.7 million or by nearly 121 percent.

The combined economic activity from wheat production, transportation, handling, and processing was estimated at \$5.4 billion (2003 dollars) annually from 1991 through 1993. The economic impact from the wheat industry was estimated at \$3.6 billion annually from 2001 through 2003. Overall, the wheat industry, in real terms, decreased by nearly \$1.8 billion or by 33 percent between the two periods.

Secondary employment supported by the economic activity generated by the wheat industry was estimated at 50,980 full-time equivalent jobs from 1991 through 1993. Secondary employment tied to the wheat industry from 2001 through 2003 was estimated at 35,041. Overall, secondary employment supported by the industry decreased by 15,939 jobs between the two periods. The only measure of direct employment was tied to wheat processing. Direct employment by wheat processors in the state was estimated at over 500 jobs in 1991 through 1993; however, data collected in this study would suggest the estimates generated in the previous study were overly optimistic. Revised estimates would place direct employment in 1993 closer to 350 full-time jobs. Survey data of wheat processors in the state in 2004 placed direct employment at 471 jobs. Based on updated information, the wheat processing sector of the industry would have added about 120 jobs or increased by 34 percent from 1993 to 2003.

A comparison of tax revenues generated by the wheat industry shows a similar pattern of decreased economic activity. From 1991 through 1993, about \$127 million (2003 dollars) in sales and use, corporate income, and personal income tax collections were generated by the wheat industry. By comparison, about \$76 million in estimated annual tax collections were attributable to the wheat industry during the 2001 through 2003 period. The decrease in tax revenues was directly tied to lower estimates of gross business volume.

SUMMARY

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 repeatedly documented; however, the economic significance of the various activities within the agriculture sector are less understood. Agriculture in the state is heavily dominated by farm-level production activities. North Dakota's reliance on agriculture is based largely on crop sales, which when combined with government payments, account for about 81 percent of the total value of all farm receipts.

North Dakota has traditionally been a leading state in the production of several crops in the United States; however, the most important, in terms of acreage and farm sales, is wheat. Wheat is arguably the single most important agricultural activity in the state, accounting for over 20 percent of all farm receipts (crop and livestock sales) and generating over \$1 billion in farm revenues 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. Thus, an economic impact study of the wheat industry benefits the state by (1) documenting the size of the industry, (2) highlighting the susceptibility of the state's economy to changes in wheat activities, and (3) identifying the economic consequences of policy changes affecting the industry.

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, combined with crop prices, government payments, production expenses, and net returns were used to estimate the economic activity from wheat production. Grain flow statistics were used to determine the amount of wheat shipped to various market destinations. The volume of wheat moved 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 the economic activity from wheat handling. Economic impacts from wheat processing were limited to in-state flour milling and were based on a survey of wheat processors in the state.

Wheat production in North Dakota averaged about 9.1 million acres and 275 million bushels from 2001 through 2003. Average yield during that time was 30.40 bushels per planted acre. Wheat industry impacts were estimated based on a three-year average of wheat acreage and production. Total direct impacts (in-state expenditures and returns) from wheat

production were estimated at \$1.1 billion or about \$126 per acre. The \$1.1 billion in direct impacts from wheat production generated another \$1.8 billion in secondary economic impacts.

Direct impacts from handling wheat at country (local) elevators in North Dakota were estimated at about \$32 million. Secondary impacts resulting from grain handling activities were estimated at \$60 million.

In-state expenditures and returns from transporting wheat from country elevators to market destinations were estimated at \$73 million. The direct economic impacts from transportation activities generated another \$114 million in secondary impacts. Truck and rail shipments of wheat accounted for 24 percent and 76 percent of all wheat transportation impacts, respectively.

Direct economic impacts generated by wheat milling activities were estimated at about \$100 million. Flour milling activity generated another \$241 million in secondary impacts.

Annual gross business volume (direct and secondary impacts) from all wheat activities in North Dakota were estimated at \$3.6 billion from 2001 through 2003. Wheat production accounted for 83 percent, grain handling accounted for 2 percent, transportation accounted for about 5 percent, and processing activities accounted for 10 percent of all economic impacts.

The wheat industry, through economic activity created by wheat production, handling, transportation, and processing, indirectly supported about 35,041 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 471 full-time equivalent jobs annually.

In addition to secondary employment, economic activity associated with the wheat industry in North Dakota generated about \$55 million, \$14.9 million, and \$6.5 million in sales and use, personal income, and corporate income taxes, respectively. Wheat production also was estimated to be directly responsible for about \$49.8 million in property taxes. Total taxes generated by the wheat industry in North Dakota, including property taxes, were estimated at \$126 million annually.

The economic size of the wheat industry was compared to previous estimates conducted in 1995. North Dakota averaged 11,078,000 planted acres of wheat from 1991 through 1993, compared to 9,053,000 planted acres from 2001 through 2003; a decrease of over 2 million acres or 18 percent. Wheat production averaged over 368 million bushels annually from 1991 through 1993 compared to just over 275 million annually from 2001 through 2003. Average production between the two periods decreased by 93 million bushels

or by 25 percent. Wheat prices in North Dakota over the 1991 to 1993 period (\$3.36/bu) were similar to prices received during the 2001 to 2003 period (\$3.33/bu). Also, per acre government payments were relatively similar in size between the two periods. Thus, most of the change in the value of wheat production between the periods was attributable to changes in production levels.

Transportation and grain handling impacts are predominantly influenced by the volume of grain produced. Transportation rates and grain handling margins were similar between the two study periods. Thus, most of the change in economic activity generated from wheat handling and transportation was due to a reduction in the volume of wheat.

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The combined economic activity from wheat production, transportation, handling, and processing was estimated at \$5.4 billion (2003 dollars) annually from 1991 through 1993. The economic impact from the wheat industry was estimated at \$3.6 billion annually from 2001 through 2003. Overall, the wheat industry, in real terms, decreased by nearly \$1.8 billion or by 33 percent between the two periods.

Secondary employment supported by the economic activity generated by the wheat industry was estimated at 50,980 full-time equivalent jobs from 1991 through 1993. Secondary employment tied to the wheat industry from 2001 through 2003 was estimated at 35,041. Overall, secondary jobs supported by the industry decreased by 15,939 jobs between the two periods. Revised estimates would place direct employment in wheat processing activities in 1993 close to 350 full-time jobs. Survey data of wheat processors in the state in 2004 placed direct employment at 471 jobs. The wheat processing sector of the industry has added about 120 jobs or increased by 34 percent from 1993 to 2003.

CONCLUSIONS

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. Wheat is produced abundantly throughout North Dakota, which correspondingly implies the impacts are distributed in all areas of North Dakota. 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 poor 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 2001 through 2003, would cost the state \$28 to \$41 million in lost revenues, not including secondary economic effects. Alternatively, if crop prices remain unchanged but yield drops by 10 percent statewide, the state could experience a reduction in farm revenues of nearly \$92 million. Decreases in crop quantities also affect transportation and grain handling impacts, further adding to the economic losses associated with reduced crop quantities. The potential consequences of policies or actions which could affect crop prices and/or acreage should be evaluated carefully since small changes in wheat production or values translate into substantial impacts within the state.

North Dakota has experienced a decrease in wheat acreage over the last decade due to a host of factors. Decreases in wheat acreage have reduced the economic importance of wheat to the state economy. However, substantial gains in wheat processing are an encouraging trend within the industry. Despite a reduction in wheat production, which has translated into reduced levels of economic activity associated with wheat handling and transportation, wheat is still a multi-billion dollar industry in the state. When measured in terms of secondary employment, economy-wide personal income, retail sales, tax revenues, and overall economic activity, the wheat industry in North Dakota remains one of the most important economic activities in the state, agricultural or otherwise.

REFERENCES

- Bangsund, Dean A. and F. Larry Leistritz. 2004. *Economic Contribution of the Sugarbeet Industry in Minnesota, North Dakota, and Eastern Montana*. Agribusiness and Applied Economics Report No. 532, Department of Agribusiness and Applied Economics, North Dakota State University, Fargo.
- Bangsund, Dean A. and F. Larry Leistritz. 1999. *Economic Contribution of the Soybean Industry in North Dakota*. Agricultural Economics Report No. 416, Department of Agricultural Economics, North Dakota State University, Fargo.
- Bangsund, Dean A. and F. Larry Leistritz. 1998. *Economic Contribution of the Barley Industry in North Dakota, South Dakota, and Minnesota*. Agricultural Economics Report No. 391, Department of Agricultural Economics, North Dakota State University, Fargo.
- Bangsund, Dean A. and F. Larry Leistritz. 1995a. *Economic Contribution of the United States Sunflower Industry*. Agricultural Economics Report No. 327, Department of Agricultural Economics, North Dakota State University, Fargo.
- Bangsund, Dean A. and F. Larry Leistritz. 1995b. *Economic Contribution of the Wheat Industry to the North Dakota Economy*. Agricultural Economics Report No. 332, Department of Agricultural Economics, North Dakota State University, Fargo.
- Bangsund, Dean A., Randall S. Sell, and F. Larry Leistritz. 1994. *Economic Contribution of the Wheat Industry to the Minnesota Economy*. Agricultural Economics Report No. 312, Department of Agricultural Economics, North Dakota State University, Fargo.
- Burlington Northern Santa Fe Corporation. 2004. BNSF Rate Book 4, various sections. [Http://www.bnsf.com](http://www.bnsf.com). Burlington Northern Santa Fe Corporation, Forth Worth, TX.
- Coon, Randal C. and F. Larry Leistritz. 2004. *The North Dakota Input-Output Model Data Base*. Department of Agribusiness and Applied Economics, North Dakota State University, Fargo.
- Coon, Randal C. and F. Larry Leistritz. 1998. *The State of North Dakota: Economic, Demographic, Public Service, and Fiscal Conditions*. Department of Agricultural Economics, North Dakota State University, Fargo.
- Coon, Randal C. and F. Larry Leistritz. 1995. *An Updated Economic Base Data Set for North Dakota*. Agricultural Economics Statistical Series No. 55, Department of Agricultural Economics, North Dakota State University, Fargo.

- Coon, Randal C. and F. Larry Leistritz. 1989. *The North Dakota Economy in 1988: Historic Economic Base, Recent Changes, and Projected Future Trends*. Agricultural Economics Statistical Series No. 45, Department of Agricultural Economics, North Dakota State University, Fargo.
- Coon, Randal C., F. Larry Leistritz, and Thor A. Hertsgaard. 1986. *Composition of North Dakota's Economic Base: A Regional Analysis*. Agricultural Economics Report No. 209, Department of Agricultural Economics, North Dakota State University, Fargo.
- Coon, Randal C., F. Larry Leistritz, Thor A. Hertsgaard, and Arlen G. Leholm. 1985. *The North Dakota Input-Output Model: A Tool for Analyzing Economic Linkages*. Agricultural Economics Report No. 187, Department of Agricultural Economics, North Dakota State University, Fargo.
- Dooley, Frank J., Leslie M. Bertram, and Wesley W. Wilson. 1988. *Operating Costs and Characteristics of North Dakota Grain Trucking Firms*. UGPTI Publication No. 67, Upper Great Plains Transportation Institute, North Dakota State University, Fargo.
- Hamm, Rita R., JoAnn M. Thompson, Randal C. Coon, and F. Larry Leistritz. 1993. *The Economic Impact of North Dakota's Health Care Industry on the State's Economy in 1991*. Agricultural Economics Report No. 296, Institute for Business and Industry Development and Department of Agricultural Economics, North Dakota State University, Fargo.
- Interstate Commerce Commission. 1990. *Uniform Railroad Costing System--Movement Costing Program*. Bureau of Accounts, Interstate Commerce Commission, Washington, D.C.
- Leistritz, F. Larry, David K. Lambert, and Randal C. Coon. 2002. *The Role of Agriculture in the North Dakota Economy*. Agribusiness and Applied Economics Statistical Series Report No. 57, Department of Agribusiness and Applied Economics, North Dakota State University, Fargo.
- Leistritz, F. Larry and Steve H. Murdock. 1981. *Socioeconomic Impact of Resource Development: Methods for Assessment*. Westview Press, Boulder, Colorado.
- North Dakota Agricultural Statistics Service. Various Years. *North Dakota Agricultural Statistics*. North Dakota Agricultural Statistics Service, U.S. Department of Agriculture, North Dakota Department of Agriculture, and North Dakota State University, Fargo.

- North Dakota Farm and Ranch Business Management Education. 2004. *FINBIN Farm Financial Database*. Minnesota State Colleges and University Farm Business Management Education, Center for Farm Financial Management, University of Minnesota, St. Paul, MN and North Dakota Vocational and Technical Education Adult Farm Business Management, Bismarck, ND.
- Sebesta, Stephen. 2004. Unpublished estimates of seed wheat acreage in North Dakota. North Dakota State Seed Department, North Dakota State University, Fargo.
- Tolliver, D.D., F.J. Dooley, and D.L. Zink. 1987. "Short Line Operation of Light Density Rail Networks: Economics and Public Policy." *Journal of the Transportation Research Forum* 29(1):277-282.
- U.S. Department of Agriculture. 2004a. Unpublished data on government payments. Farm Services Agency, U.S. Department of Agriculture, Fargo, ND.
- U.S. Department of Agriculture. 2004b. *Federal Crop Insurance Corporation annual statistics*. <http://www3.rma.usda.gov/apps/sob/stateCrop.cfm> Risk Management Agency, U.S. Department of Agriculture, Washington, D.C.
- U.S. Department of Agriculture. 2004c. *2002 Census of Agriculture: Volume 1, Geographic Area Series*. National Agricultural Statistics Service, U.S. Department of Agriculture, Washington, D.C.
- U.S. Department of Agriculture. 1990. *The Physical Distribution System for Grain*. Agricultural Information Bulletin No. 457, Office of Transportation, U.S. Department of Agriculture, Washington, D.C.
- U.S. Department of Commerce. 2004. *Flour Milling: 2002*. Report No. EC02-311-311211. U.S. Census Bureau, Economics and Statistics Administration, U.S. Department of Commerce, Washington, D.C.
- U.S. Department of Labor. 2005. *Producer Price Index, Commodities, Series ID WPU0121*. <http://data.bls.gov/cgi-bin/dsrv> Bureau of Labor Statistics, U.S. Department of Labor, Washington, D.C.
- U.S. Department of Labor. 2004. *Consumer Price Index* (extracted from BEA web site). Bureau of Economic Analysis, U.S. Department of Labor, Washington, D.C.
- Upper Great Plains Transportation Institute. 2004. Unpublished truck transportation costs using the *TruckCost Spreadsheet Model*. Upper Great Plains Transportation Institute, North Dakota State University, Fargo.

Vachal, Kimberly and Tamara VanWechel. 2003a. *North Dakota Grain and Oilseed Transportation Statistics 2002-03*. UGPTI Publication No. 154, Upper Great Plains Transportation Institute, North Dakota State University, Fargo.

Vachal, Kimberly and Tamara VanWechel. 2003b. *Annual North Dakota Elevator Marketing Report 2002-03*. UGPTI Publication No. 155, Upper Great Plains Transportation Institute, North Dakota State University, Fargo.

Vachal, Kimberly. 2002. *Annual North Dakota Elevator Marketing Report 2001-02*. UGPTI Publication No. 148, Upper Great Plains Transportation Institute, North Dakota State University, Fargo.

Wilson, W.W. 2004. Personal Communication. Department of Agribusiness and Applied Economics, North Dakota State University, Fargo.

APPENDIX A

**Wheat Production, Yield, and Acreage
by County, North Dakota, 2001-2003**

Certified seed production was obtained from the North Dakota State Seed Department (Sebesta 2004). Total seed use was estimated by multiplying planting seed rates and average planted acres. Wheat entering the marketing system was estimated as total production less total seed use, adjusted for 1 percent shrink. Wheat handled by local elevators was estimated as total wheat production less the difference between total seed use and certified seed production.

Appendix Table A1. Spring Wheat and Durum, by County and Production Region, North Dakota, Average 2001 Through 2003

County and Production Region	Spring Wheat				Durum			
	Acres Planted	Acres Harvested	Yield Per Pltd Acre	Production bu	Acres Planted	Acres Harvested	Yield per Pltd Acre	Production bu
Burke	81,000	77,500	23.2	1,878,333	135,000	129,500	22.5	3,040,000
Divide	9,500	9,167	24.0	228,333	258,333	252,000	24.7	6,376,667
Mountrail	71,667	70,167	26.5	1,898,333	228,333	223,500	25.1	5,728,333
Renville	135,333	128,000	26.8	3,623,333	73,333	71,333	23.7	1,735,000
Ward	245,667	239,000	29.6	7,270,000	138,333	134,333	26.2	3,628,333
Williams	73,500	71,167	25.8	1,898,333	333,333	328,667	27.6	9,208,333
NORTHWEST	616,667	595,000	27.2	16,796,667	1,166,667	1,139,333	25.5	29,716,667
Benson	136,000	130,000	28.8	3,918,333	26,667	25,833	20.8	555,000
Bottineau	185,333	181,000	30.7	5,696,667	55,000	52,500	27.0	1,485,667
McHenry	151,333	145,167	25.7	3,888,333	12,500	11,167	25.9	324,000
Pierce	113,667	108,167	29.7	3,373,333	15,833	14,667	22.8	361,333
Rolette	63,667	62,000	32.6	2,076,667	18,333	17,667	31.3	574,000
NORTH CENTRAL	650,000	626,333	29.2	18,953,333	128,333	121,833	25.7	3,300,000
Cavalier	337,000	324,333	35.6	11,988,333	26,833	25,367	34.7	931,000
Grand Forks	233,667	220,000	38.7	9,038,333	1,833	1,700	29.1	53,333
Nelson	110,000	106,000	33.7	3,706,667	6,033	5,667	21.2	127,667
Pembina	245,667	231,167	40.3	9,901,667	833	833	39.2	32,667
Ramsey	120,667	114,000	28.7	3,466,667	33,667	30,400	17.8	599,667
Towner	151,333	146,167	31.9	4,828,333	34,500	32,967	27.5	949,667
Walsh	246,667	235,000	40.7	10,030,000	3,300	3,067	32.1	106,000
NORTHEAST	1,445,000	1,376,667	36.7	52,960,000	107,000	100,000	26.2	2,800,000
Dunn	134,000	127,833	28.2	3,780,000	14,500	14,233	24.3	351,667
McKenzie	81,333	77,333	25.9	2,106,667	104,667	103,500	28.7	3,002,333
McLean	229,667	223,000	31.6	7,266,667	145,667	142,333	28.3	4,126,667
Mercer	67,333	64,333	26.9	1,810,000	26,167	24,433	25.4	665,333
Oliver	58,000	55,167	28.4	1,650,000	4,000	3,833	26.0	104,000
WEST CENTRAL	570,333	547,667	29.1	16,613,333	295,000	288,333	28.0	8,250,000
Eddy	46,000	45,000	30.8	1,416,667	3,533	3,333	20.8	73,333
Foster	87,333	83,000	31.2	2,721,667	4,767	4,600	22.0	105,000
Kidder	52,667	44,833	22.2	1,168,333	4,433	3,900	19.1	84,667
Sheridan	95,667	91,667	26.6	2,541,667	6,467	6,333	26.6	172,333
Stutsman	224,000	210,333	31.7	7,095,000	16,567	15,233	20.0	331,000
Wells	202,667	194,500	29.5	5,983,333	11,233	10,833	30.1	338,667
CENTRAL	708,333	669,333	29.5	20,926,667	47,000	44,233	23.5	1,105,000
Barnes	235,000	227,833	40.8	9,581,667	3,543	3,359	23.3	82,599
Cass	283,667	274,833	45.2	12,833,333	0	0		0
Griggs	78,667	76,000	35.8	2,818,333	4,457	4,275	30.8	137,401
Steele	118,667	113,333	39.0	4,626,667	0	0		0
Traill	132,333	126,000	39.2	5,190,000	0	0		0
EAST CENTRAL	848,333	818,000	41.3	35,050,000	8,000	7,633	27.5	220,000

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Appendix Table A1. Continued

County and Production Region	Spring Wheat				Durum			
	Acres Planted	Acres Harvested	Yield Per Plt'd Acre	Production bu	Acres Planted	Acres Harvested	Yield per Plt'd Acre	Production bu
Adams	129,000	105,333	19.8	2,560,000	25,500	19,667	17.3	440,000
Billings	17,167	15,667	22.8	391,667	6,000	5,733	26.0	156,000
Bowman	71,333	57,000	19.6	1,396,667	50,833	46,167	24.3	1,233,333
Golden Valley	38,167	35,000	24.8	948,333	29,667	27,000	25.7	762,667
Hettinger	211,667	194,000	26.7	5,653,333	91,000	86,167	28.6	2,600,000
Slope	93,667	84,000	24.0	2,248,333	45,333	37,433	23.7	1,075,667
Stark	192,333	180,333	28.3	5,435,000	41,667	40,167	25.9	1,080,667
SOUTHWEST	753,333	671,333	24.7	18,633,333	290,000	262,333	25.3	7,348,333
Burleigh	105,667	95,667	26.7	2,825,000	13,470	12,166	27.3	367,800
Emmons	135,000	106,667	24.5	3,307,667	3,298	2,958	31.8	104,895
Grant	127,667	105,333	19.9	2,546,667	11,977	7,159	12.9	154,670
Morton	173,000	147,667	18.9	3,266,667	16,317	11,965	14.2	231,169
Sioux	26,000	16,667	15.7	407,333	2,604	2,420	23.6	61,467
SOUTH CENTRAL	567,333	472,000	21.8	12,353,333	47,667	36,667	19.3	920,000
Dickey	73,667	69,667	38.1	2,806,667	0	0		0
LaMoure	137,000	128,000	35.3	4,835,000	808	773	39.5	31,917
Logan	73,667	62,167	24.9	1,833,333	4,007	3,727	22.7	91,090
McIntosh	76,667	65,833	25.6	1,960,000	5,518	5,133	24.8	136,993
Ransom	82,000	79,333	44.6	3,656,667	0	0		0
Richland	147,333	142,667	45.9	6,761,667	0	0		0
Sargent	83,667	76,000	40.6	3,393,333	0	0		0
SOUTHEAST	674,000	623,667	37.5	25,246,667	10,333	9,633	25.2	260,000
NORTH DAKOTA	6,833,333	6,400,000	31.8	217,533,333	2,100,000	2,010,000	25.7	53,920,000

Source: North Dakota Agricultural Statistics Service.

Appendix Table A2. Winter Wheat and All Wheat, By County and Production Region, North Dakota, Average 2001 Through 2003

County and Production Region	Winter Wheat				Spring, Durum, and Winter Wheat			
	Acres Planted	Acres Harvested	Yield Per Pltd Acre	Production	Acres Planted	Acres Harvested	Yield per Pltd Acre	Production
			----- bu -----				----- bu -----	
Burke	0	0		0	216,000	207,000	22.8	4,918,333
Divide	1,030	700	20.3	20,909	268,863	261,866	24.6	6,625,909
Mountrail	577	411	13.4	7,744	300,577	294,078	25.4	7,634,411
Renville	2,883	2,510	41.9	120,808	211,550	201,843	25.9	5,479,141
Ward	2,471	2,140	30.7	75,892	386,471	375,473	28.4	10,974,226
Williams	206	206	22.6	4,646	407,039	400,039	27.3	11,111,313
NORTHWEST	7,167	5,967	32.1	230,000	1,790,500	1,740,300	26.1	46,743,333
Benson	4,478	3,813	34.0	152,381	167,144	159,647	27.7	4,625,714
Bottineau	7,541	5,703	31.4	236,476	247,875	239,203	29.9	7,418,809
McHenry	1,010	844	41.3	41,711	164,843	157,177	25.8	4,254,045
Pierce	1,111	1,012	48.7	54,157	130,611	123,846	29.0	3,788,824
Rolette	6,026	4,961	35.6	214,275	88,026	84,627	32.5	2,864,941
NORTH CENTRAL	20,167	16,333	34.7	699,000	798,500	764,500	28.7	22,952,333
Cavalier	1,152	1,123	47.0	54,106	364,985	350,823	35.5	12,973,439
Grand Forks	1,397	1,193	41.5	57,970	236,897	222,893	38.6	9,149,637
Nelson	2,863	2,526	50.1	143,345	118,896	114,193	33.5	3,977,678
Pembina	0	0		0	246,500	232,000	40.3	9,934,333
Ramsey	3,631	2,772	41.8	151,777	157,964	147,172	26.7	4,218,110
Towner	4,574	3,578	38.9	177,776	190,407	182,712	31.3	5,955,776
Walsh	384	175	18.3	7,027	250,351	238,242	40.5	10,143,027
NORTHEAST	14,000	11,367	42.3	592,000	1,566,000	1,488,033	36.0	56,352,000
Dunn	2,480	1,766	32.8	81,293	150,980	143,832	27.9	4,212,959
McKenzie	719	699	37.5	26,976	186,719	181,532	27.5	5,135,976
McLean	2,301	1,802	32.5	74,731	377,634	367,136	30.4	11,468,064
Mercer	0	0		0	93,500	88,767	26.5	2,475,333
Oliver	0	0		0	62,000	59,000	28.3	1,754,000
WEST CENTRAL	5,500	4,267	33.3	183,000	870,833	840,267	28.8	25,046,333
Eddy	855	752	38.5	32,924	50,388	49,085	30.2	1,522,924
Foster	957	718	37.2	35,640	93,057	88,318	30.8	2,862,306
Kidder	342	205	27.8	9,504	57,442	48,938	22.0	1,262,504
Sheridan	171	137	41.7	7,128	102,304	98,137	26.6	2,721,128
Stutsman	10,632	7,893	30.2	320,757	251,199	233,459	30.8	7,746,757
Wells	3,043	2,597	37.5	114,047	216,943	207,930	29.7	6,436,047
CENTRAL	16,000	12,300	32.5	520,000	771,333	725,867	29.2	22,551,667
Barnes	2,692	1,646	25.5	68,666	241,235	232,838	40.3	9,732,932
Cass	1,594	1,097	34.3	54,589	285,260	275,931	45.2	12,887,923
Griggs	2,408	1,509	28.5	68,666	85,532	81,784	35.4	3,024,400
Steele	1,204	1,097	36.2	43,603	119,871	114,431	39.0	4,670,269
Traill	602	583	46.2	27,810	132,935	126,583	39.3	5,217,810
EAST CENTRAL	8,500	5,933	31.0	263,333	864,833	831,567	41.1	35,533,333

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Appendix Table A2. Continued

County and Production Region	Winter Wheat				Spring, Durum, and Winter Wheat			
	Acres Planted	Acres Harvested	Yield Per Pltd Acre	Production bu	Acres Planted	Acres Harvested	Yield per Pltd Acre	Production bu
Adams	1,744	971	11.3	19,622	156,244	125,971	19.3	3,019,622
Billings	0	0		0	23,167	21,400	23.6	547,667
Bowman	1,139	720	15.0	17,079	123,305	103,886	21.5	2,647,079
Golden Valley	2,064	1,727	24.5	50,510	69,897	63,727	25.2	1,761,510
Hettinger	3,416	2,843	22.2	75,946	306,083	283,009	27.2	8,329,279
Slope	249	252	36.5	9,084	139,249	121,685	23.9	3,333,084
Stark	1,388	1,187	29.8	41,425	235,388	221,687	27.9	6,557,092
SOUTHWEST	10,000	7,700	21.4	213,667	1,053,333	941,367	24.9	26,195,333
Burleigh	2,067	1,067	18.4	38,000	121,204	108,900	26.7	3,230,800
Emmons	8,567	4,533	19.5	167,000	146,865	114,158	24.4	3,579,561
Grant	4,267	2,733	19.8	84,333	143,911	115,225	19.4	2,785,670
Morton	2,400	1,700	21.4	51,333	191,717	161,331	18.5	3,549,169
Sioux	2,700	1,200	12.1	32,667	31,304	20,286	16.0	501,467
SOUTH CENTRAL	20,000	11,233	18.7	373,333	635,000	519,900	21.5	13,646,667
Dickey	4,453	3,343	39.6	176,322	78,119	73,009	38.2	2,982,989
LaMoure	685	345	22.2	15,182	138,493	129,118	35.3	4,882,100
Logan	3,836	2,516	26.5	101,791	81,510	68,409	24.9	2,026,214
McIntosh	3,973	2,619	35.0	139,057	86,158	73,586	26.0	2,236,050
Ransom	3,117	2,447	38.1	118,698	85,117	81,780	44.4	3,775,365
Richland	0	0		0	147,333	142,667	45.9	6,761,667
Sargent	2,603	1,964	44.7	116,283	86,270	77,964	40.7	3,509,616
SOUTHEAST	18,667	13,233	35.8	667,333	703,000	646,533	37.2	26,174,000
NORTH DAKOTA	120,000	88,333	31.2	3,741,667	9,053,333	8,498,333	30.4	275,195,000

Source: North Dakota Agricultural Statistics Service.

Appendix Table A3. Spring Seed Wheat Adjustments

County	Crop Rprt Dist.	Acres Planted	Bushels Production	Planting Rate bu/ac	Total Seed Used	Certified Seed Production	Wheat Entering the Mktng System	Wheat Handled by Local Elevators
Eddy	c	46,000	1,416,667	1.25	57,500	13,922	1,345,575	1,373,088
Foster	c	87,333	2,721,667	1.25	109,167	62,245	2,586,375	2,674,745
Kidder	c	52,667	1,168,333	1.25	65,833	13,810	1,091,475	1,116,310
Sheridan	c	95,667	2,541,667	1.25	119,583	12,116	2,397,863	2,434,199
Stutsman	c	224,000	7,095,000	1.25	280,000	71,587	6,746,850	6,886,587
Wells	c	202,667	5,983,333	1.25	253,333	177,493	5,672,700	5,907,493
Barnes	ec	235,000	9,581,667	1.75	411,250	340,293	9,078,713	9,510,709
Cass	ec	283,667	12,833,333	1.75	496,417	792,800	12,213,548	12,336,917
Griggs	ec	78,667	2,818,333	1.75	137,667	120,019	2,653,860	2,800,686
Steele	ec	118,667	4,626,667	1.75	207,667	281,023	4,374,810	4,419,000
Traill	ec	132,333	5,190,000	1.75	231,583	250,491	4,908,833	4,958,417
Benson	nc	136,000	3,918,333	1.25	170,000	129,746	3,710,850	3,878,080
Bottineau	nc	185,333	5,696,667	1.25	231,667	67,540	5,410,350	5,532,540
McHenry	nc	151,333	3,888,333	1.25	189,167	24,020	3,662,175	3,723,187
Pierce	nc	113,667	3,373,333	1.25	142,083	32,415	3,198,938	3,263,665
Rolette	nc	63,667	2,076,667	1.25	79,583	9,528	1,977,113	2,006,612
Cavalier	ne	337,000	11,988,333	1.5	505,500	286,103	11,368,005	11,768,936
Grand F.	ne	233,667	9,038,333	1.5	350,500	454,365	8,600,955	8,687,833
Nelson	ne	110,000	3,706,667	1.5	165,000	199,398	3,506,250	3,541,667
Pembina	ne	245,667	9,901,667	1.5	368,500	337,991	9,437,835	9,871,157
Ramsey	ne	120,667	3,466,667	1.5	181,000	113,023	3,252,810	3,398,690
Towner	ne	151,333	4,828,333	1.5	227,000	47,894	4,555,320	4,649,227
Walsh	ne	246,667	10,030,000	1.5	370,000	491,871	9,563,400	9,660,000
Burke	nw	81,000	1,878,333	1	81,000	3,155	1,779,360	1,800,488
Divide	nw	9,500	228,333	1	9,500	1,699	216,645	220,532
Mountrail	nw	71,667	1,898,333	1	71,667	17,650	1,808,400	1,844,317
Renville	nw	135,333	3,623,333	1	135,333	76,719	3,453,120	3,564,719
Ward	nw	245,667	7,270,000	1	245,667	153,474	6,954,090	7,177,808
Williams	nw	73,500	1,898,333	1	73,500	12,629	1,806,585	1,837,463
Burleigh	sc	105,667	2,825,000	1	105,667	16,588	2,692,140	2,735,921
Emmons	sc	135,000	3,307,667	1	135,000	32,388	3,140,940	3,205,055
Grant	sc	127,667	2,546,667	1	127,667	9,776	2,394,810	2,428,776
Morton	sc	173,000	3,266,667	1	173,000	10,249	3,062,730	3,103,916
Sioux	sc	26,000	407,333	1	26,000	1,339	377,520	382,672
Dickey	se	73,667	2,806,667	1.5	110,500	96,681	2,669,205	2,792,847
LaMoure	se	137,000	4,835,000	1.5	205,500	139,801	4,583,205	4,769,301
Logan	se	73,667	1,833,333	1.5	110,500	10,988	1,705,605	1,733,822
McIntosh	se	76,667	1,960,000	1.5	115,000	15,661	1,826,550	1,860,661
Ransom	se	82,000	3,656,667	1.5	123,000	83,831	3,498,330	3,617,498
Richland	se	147,333	6,761,667	1.5	221,000	107,807	6,475,260	6,648,474
Sargent	se	83,667	3,393,333	1.5	125,500	96,212	3,235,155	3,364,046
Adams	sw	129,000	2,560,000	1	129,000	10,204	2,406,690	2,441,204
Billings	sw	17,167	391,667	1	17,167	15,009	370,755	389,509

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Appendix Table A3. Continued

County	Crop Rprt Dist.	Acres Planted	Bushels Production	Planting Rate bu/ac	Total Seed Used	Certified Seed Production	Wheat Entering the Mktng System	Wheat Handled by Local Elevators
Bowman	sw	71,333	1,396,667	1	71,333	14,049	1,312,080	1,339,382
Golden V.	sw	38,167	948,333	1	38,167	14,000	901,065	924,166
Hettinger	sw	211,667	5,653,333	1	211,667	25,019	5,387,250	5,466,686
Slope	sw	93,667	2,248,333	1	93,667	40,782	2,133,120	2,195,448
Stark	sw	192,333	5,435,000	1	192,333	27,934	5,190,240	5,270,601
Dunn	wc	134,000	3,780,000	1	134,000	14,099	3,609,540	3,660,099
McKenzie	wc	81,333	2,106,667	1	81,333	35,234	2,005,080	2,060,567
McLean	wc	229,667	7,266,667	1	229,667	97,350	6,966,630	7,134,350
Mercer	wc	67,333	1,810,000	1	67,333	1,309	1,725,240	1,743,975
Oliver	wc	58,000	1,650,000	1	58,000	0	1,576,080	1,592,000
State		6,833,333	217,533,333		8,868,667	5,511,327	206,578,020	211,706,045

Appendix Table A4. Durum Seed Wheat Adjustments

County	Crop Rprt Dist.	Acres Planted	Bushels Production	Planting Rate bu/ac	Total Seed Used	Certified Seed Production	Wheat Entering the Mktng System	Wheat Handled by local Elevators
Eddy	c	3,533	73,333	1.25	4,417	2,426	68,228	71,343
Foster	c	4,767	105,000	1.25	5,958	3,620	98,051	102,661
Kidder	c	4,433	84,667	1.25	5,542	4,720	78,334	83,845
Sheridan	c	6,467	172,333	1.25	8,083	200	162,608	164,450
Stutsman	c	16,567	331,000	1.25	20,708	132	307,189	310,424
Wells	c	11,233	338,667	1.25	14,042	24,590	321,379	324,625
Barnes	ec	3,543	82,599	1.5	5,314	8,704	76,512	77,285
Cass	ec	0	0	1.5	0	0	0	0
Griggs	ec	4,457	137,401	1.5	6,686	1,317	129,408	132,032
Steele	ec	0	0	1.5	0	0	0	0
Traill	ec	0	0	1.5	0	0	0	0
Benson	nc	26,667	555,000	1.25	33,333	30,672	516,450	552,339
Bottineau	nc	55,000	1,485,667	1.25	68,750	22,058	1,402,748	1,438,975
McHenry	nc	12,500	324,000	1.25	15,625	8,113	305,291	316,488
Pierce	nc	15,833	361,333	1.25	19,792	10,079	338,126	351,620
Rolette	nc	18,333	574,000	1.25	22,917	1,018	545,573	552,101
Cavalier	ne	26,833	931,000	1.5	40,250	53,086	881,843	890,750
Grand Forks	ne	1,833	53,333	1.5	2,750	1,348	50,078	51,931
Nelson	ne	6,033	127,667	1.5	9,050	2,452	117,431	121,068
Pembina	ne	833	32,667	1.5	1,250	0	31,103	31,417
Ramsey	ne	33,667	599,667	1.5	50,500	40,130	543,675	589,297
Towner	ne	34,500	949,667	1.5	51,750	20,704	888,938	918,621
Walsh	ne	3,300	106,000	1.5	4,950	9,525	100,040	101,050
Burke	nw	135,000	3,040,000	1	135,000	45,203	2,875,950	2,950,203
Divide	nw	258,333	6,376,667	1	258,333	23,952	6,057,150	6,142,286
Mountrail	nw	228,333	5,728,333	1	228,333	57,753	5,445,000	5,557,753
Renville	nw	73,333	1,735,000	1	73,333	76,309	1,645,050	1,661,667
Ward	nw	138,333	3,628,333	1	138,333	132,720	3,455,100	3,622,720
Williams	nw	333,333	9,208,333	1	333,333	69,367	8,786,250	8,944,367
Burleigh	sc	13,470	367,800	1	13,470	4,681	350,786	359,011
Emmons	sc	3,298	104,895	1	3,298	693	100,581	102,289
Grant	sc	11,977	154,670	1	11,977	93	141,265	142,785
Morton	sc	16,317	231,169	1	16,317	7,357	212,704	222,209
Sioux	sc	2,604	61,467	1	2,604	0	58,275	58,863
Dickey	se	0	0	1.5	0	0	0	0
LaMoure	se	808	31,917	1.5	1,213	0	30,398	30,705
Logan	se	4,007	91,090	1.5	6,010	1,743	84,229	86,822
McIntosh	se	5,518	136,993	1.5	8,277	3,447	127,429	132,163

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Appendix Table A4. Continued

County	Crop Rprt Dist.	Acres Planted	Bushels Production	Planting Rate bu/ac	Total Seed Used	Certified Seed Production	Wheat Entering the Mktng System	Wheat Handled by local Elevators
Ransom	se	0	0	1.5	0	0	0	0
Richland	se	0	0	1.5	0	0	0	0
Sargent	se	0	0	1.5	0	0	0	0
Adams	sw	25,500	440,000	1	25,500	7,627	410,355	422,127
Billings	sw	6,000	156,000	1	6,000	0	148,500	150,000
Bowman	sw	50,833	1,233,333	1	50,833	27,177	1,170,675	1,209,677
Golden V.	sw	29,667	762,667	1	29,667	16,366	725,670	749,366
Hettinger	sw	91,000	2,600,000	1	91,000	36,814	2,483,910	2,545,814
Slope	sw	45,333	1,075,667	1	45,333	7,492	1,020,030	1,037,826
Stark	sw	41,667	1,080,667	1	41,667	10,228	1,028,610	1,049,228
Dunn	wc	14,500	351,667	1	14,500	17,693	333,795	337,167
McKenzie	wc	104,667	3,002,333	1	104,667	41,134	2,868,690	2,938,801
McLean	wc	145,667	4,126,667	1	145,667	47,043	3,941,190	4,028,043
Mercer	wc	26,167	665,333	1	26,167	5,090	632,775	644,256
Oliver	wc	4,000	104,000	1	4,000	556	99,000	100,556
State		2,100,000	53,920,000		2,206,500	885,430	51,196,365	52,409,022

Appendix Table A5. Winter Seed Wheat Adjustments

County	Crop Rprt Dist	Acres Planted	Bushels Production	Planting Rate bu/ac	Total Seed Used	Certified Seed Production	Wheat Entering the Mktng System	Wheat Handled by Local Elevators
Eddy	c	833	32,924	1.25	1,042	368	31,564	32,250
Foster	c	933	35,640	1.25	1,167	1,909	34,128	34,473
Kidder	c	333	9,504	1.25	417	697	8,996	9,087
Sheridan	c	167	7,128	1.25	208	0	6,850	6,920
Stutsman	c	10,367	320,757	1.25	12,958	2,165	304,721	309,964
Wells	c	2,967	114,047	1.25	3,708	1,000	109,235	111,338
Barnes	ec	2,533	68,666	1.75	4,433	4,694	63,590	64,232
Cass	ec	1,500	54,589	1.75	2,625	1,806	51,445	53,770
Griggs	ec	2,267	68,666	1.75	3,967	3,100	64,052	67,799
Steele	ec	1,133	43,603	1.75	1,983	1,334	41,203	42,953
Traill	ec	567	27,810	1.75	992	0	26,550	26,818
Benson	nc	4,433	152,381	1.25	5,542	1,575	145,371	148,414
Bottineau	nc	7,467	236,476	1.25	9,333	9,403	224,871	227,143
McHenry	nc	1,000	41,711	1.25	1,250	1,668	40,057	40,461
Pierce	nc	1,100	54,157	1.25	1,375	0	52,255	52,782
Rolette	nc	5,967	214,275	1.25	7,458	0	204,748	206,816
Cavalier	ne	1,100	54,106	1.5	1,650	0	51,931	52,456
Grand Forks	ne	1,333	57,970	1.5	2,000	0	55,411	55,970
Nelson	ne	2,733	143,345	1.5	4,100	2,643	137,852	141,887
Pembina	ne	0	0	1.5	0	0	0	0
Ramsey	ne	3,467	151,777	1.5	5,200	5,283	145,111	146,577
Towner	ne	4,367	177,776	1.5	6,550	5,029	169,513	176,255
Walsh	ne	367	7,027	1.5	550	0	6,412	6,477
Burke	nw	0	0	1	0	0	0	0
Divide	nw	833	20,909	1	833	201	19,875	20,276
Mountrail	nw	467	7,744	1	467	0	7,205	7,277
Renville	nw	2,333	120,808	1	2,333	0	117,290	118,475
Ward	nw	2,000	75,892	1	2,000	3,775	73,153	73,892
Williams	nw	167	4,646	1	167	2,588	4,435	4,480
Burleigh	sc	2,067	38,000	1	2,067	0	35,574	35,933
Emmons	sc	8,567	167,000	1	8,567	106	156,849	158,540
Grant	sc	4,267	84,333	1	4,267	0	79,266	80,067
Morton	sc	2,400	51,333	1	2,400	0	48,444	48,933
Sioux	sc	2,700	32,667	1	2,700	0	29,667	29,967
Dickey	se	4,333	176,322	1.5	6,500	231	168,124	170,053
LaMoure	se	667	15,182	1.5	1,000	865	14,041	15,048
Logan	se	3,733	101,791	1.5	5,600	1,030	95,229	97,221
McIntosh	se	3,867	139,057	1.5	5,800	0	131,924	133,257

- continued -

Appendix Table A5. Continued

County	Crop Rprt Dist	Acres Planted	Bushels Production	Planting Rate bu/ac	Total Seed Used	Certified Seed Production	Wheat Entering the Mktng System	Wheat Handled by Local Elevators
Ransom	se	3,033	118,698	1.5	4,550	2,104	113,007	116,253
Richland	se	0	0	1.5	0	0	0	0
Sargent	se	2,533	116,283	1.5	3,800	165	111,358	112,648
Adams	sw	1,633	19,622	1	1,633	0	17,809	17,989
Billings	sw	0	0	1	0	0	0	0
Bowman	sw	1,067	17,079	1	1,067	480	15,852	16,492
Golden Valley	sw	1,933	50,510	1	1,933	2,872	48,091	48,576
Hettinger	sw	3,200	75,946	1	3,200	475	72,019	73,221
Slope	sw	233	9,084	1	233	0	8,763	8,851
Stark	sw	1,300	41,425	1	1,300	1,278	39,724	41,403
Dunn	wc	2,300	81,293	1	2,300	577	78,203	79,570
McKenzie	wc	667	26,976	1	667	644	26,046	26,954
McLean	wc	2,133	74,731	1	2,133	0	71,872	72,598
Mercer	wc	0	0	1	0	0	0	0
Oliver	wc	0	0	1	0	0	0	0
State		115,367	3,741,667		146,025	60,064	3,559,685	3,622,817

APPENDIX B

**Crop Production, Truck and Railroad,
and County Elevator Budgets**

Acreage and yields were averaged from 2001 through 2003 (North Dakota Agricultural Statistics Service). Farm program payments and disaster payments were obtained from U.S. Department of Agriculture (2004a). Average market prices were obtained from the North Dakota Agricultural Statistics Service and weighted by production each year from 2001 through 2003. Crop insurance enrollment and indemnities were obtained from U.S. Department of Agriculture (2004b) and averaged from 2001 through 2003. Crop expenses were obtained from North Dakota Farm and Ranch Business Management (2004).

Appendix Table B1. Spring Wheat, Durum, and Winter Wheat Budgets, North Dakota, Average 2001 through 2003

Total Acres	State Averages		
	Spring Wheat	Durum	Winter Wheat
Revenue per Acre			
Yield	31.8	25.7	31.2
Price	\$3.27	\$3.58	\$2.95
Program and Disaster Payments	\$17.08	\$17.08	\$17.08
Federal Crop Insurance Indemnities	\$8.26	\$8.26	\$8.26
Total Revenue	\$129.50	\$117.13	\$117.40
Variable Expenses per Acre			
Seed	\$7.85	\$8.90	\$6.48
Fertilizer	\$18.19	\$15.13	\$15.16
Chemicals	\$13.13	\$11.65	\$8.12
Crop Insurance	\$4.14	\$4.14	\$4.14
Fuel & Lubrication	\$6.46	\$5.90	\$6.11
Rent	\$18.72	\$13.60	\$18.84
Repairs	\$10.06	\$9.29	\$9.15
Custom Hire	\$3.04	\$2.08	\$4.00
Miscellaneous	\$0.48	\$0.41	\$0.32
Operating Interest	\$2.39	\$1.86	\$1.25
Total Variable	\$84.46	\$72.96	\$73.57
Fixed Expenses per Acre			
Misc. Overhead	\$2.83	\$2.93	\$2.59
Machinery and Building Depreciation & Leases	\$9.98	\$9.18	\$10.90
Farm Insurance	\$1.85	\$1.31	\$1.93
Land Taxes	\$5.95	\$4.04	\$5.86
Hired Labor	\$3.29	\$3.16	\$4.13
Utilities	\$1.37	\$1.09	\$1.35
Land Interest Payment	\$5.57	\$5.53	\$3.23
Total Fixed Costs	\$30.84	\$27.24	\$29.99
Returns to Unpaid Labor, Management, and Equity	\$14.20	\$16.93	\$13.83

TRUCK TRANSPORTATION BUDGET

Round trip distance (miles)	50	200	400
	<u>Cost per Every Mile</u>		
Variable Costs			
Tires	0.04	0.04	0.04
Labor	0.55	0.40	0.38
Maintenance and Repairs	0.08	0.08	0.08
Fuel	<u>0.27</u>	<u>0.27</u>	<u>0.27</u>
Total Variable Costs	0.95	0.80	0.78
Fixed Costs			
Equipment Costs/Tractor	0.26	0.26	0.26
License and Taxes/Tractor	0.04	0.04	0.04
Insurance	0.06	0.06	0.06
Management and Admn Overhead	<u>0.01</u>	<u>0.01</u>	<u>0.01</u>
Total Fixed Costs	0.37	0.37	0.37
Total Costs	1.32	1.17	1.14
Costs per Loaded Mile	2.63	2.33	2.28

Truck transportation costs were obtained from the Upper Great Plains Transportation Institute's *Truckcost Spreadsheet Model* (Upper Great Plains Transportation Institute 2004). Characteristics of trucking operations were as follows: owned tractor& trailer, hopper trailer, 75,000 miles per year, payload 56,600 pounds, fuel price \$1.79/gallon, interest rate 8 percent, wage rate \$10/hr, and wait time of 1 hour.

Total trucking revenues (i.e., expenses incurred by county elevators) were estimated by multiplying mileage by trucking rate per mile by the number of shipments. In this study, trucking costs were used to approximate trucking rates. Because some trucking expenses are incurred in other states on interstate shipments and because some wheat is shipped by out-of-state trucking firms (which incur most of their operating expenses in other states), only 80 percent of the economic activity generated from interstate shipments of North Dakota wheat were allocated as direct impacts to the North Dakota economy (Dooley et al. 1988; Bangsund et al. 1994; Bangsund and Leistriz 1995). All economic activity from truck shipments of wheat to in-state destinations was included as direct impacts. Transportation expenses retained within the North Dakota economy were subsequently allocated to various economic sectors.

RAILROAD COST BREAKDOWN

<u>Variable Expenses</u>	<u>Percent of Variable Costs</u>
Train Crew ^a	43.73
Locomotive ^b	23.39
Railroad Car ^c	21.41
Transportation Charge ^d	<u>11.47</u>
Total Variable	100.00

<u>Fixed Expenses</u>	<u>Percent of Fixed Costs</u>
Maintenance-of-Way	45.44
Net Liquidation Value	45.44
Central Administration	2.03
Insurance and Other	1.20
Property Tax	<u>5.89</u>
Total Fixed	100.00

^a Includes wages, fringe benefits, and crew overnight costs.

^b Includes locomotive repairs, depreciation/rentals/leases, return on investment, servicing, fuel, overhead and machinery.

^c Includes car-day and car-mile costs.

^d Includes train inspection/lubrication, dispatching, crossing protection and signal/interlockers costs.

Source: Tolliver et al. (1987).

The amount of variable and fixed costs for rail shipments of wheat leaving North Dakota was determined using the Uniform Railroad Costing Model (URCS), a rail costing model. Grain flow statistics (i.e., amounts of wheat shipped to various destinations from various points in the state) were used in conjunction with URCS to generate an estimate of overall railroad expenses. The railroad operating budget above was used to divide costs obtained from URCS into expense categories and subsequently allocated to various economic sectors. The cost structure of wheat shipments was subtracted from shipping tariffs to determine railroad net returns. Railroad net returns were not allocated as direct impacts, since they were assumed to leave the North Dakota economy. It also was assumed that 60 percent of all variable and fixed costs remained within the North Dakota economy and resulted in direct impacts. The other 40 percent was assumed to be generated in other states (Tolliver et al. 1987; Bangsund et al. 1994; Bangsund and Leistritz 1995).

COUNTRY ELEVATOR GRAIN HANDLING BUDGET

<u>Expenses</u>	<u>--\$/bu--</u>
Labor	0.0330
Taxes and Licenses	0.0047
Insurance	0.0085
Utilities	0.0057
Services	0.0038
Interest	0.0094
Equip. Depr. and Repairs	0.0132
General Expense	0.0142
Net Returns	0.0275
	<hr/>
Gross Margin	0.1200

Country elevators typically handle grain and provide a variety of agricultural services; however, the above budget only represents likely expenses and returns for wheat handling activities for country elevators in North Dakota. Expense categories and percentages of gross margin were obtained from Bangsund et. al. (1994). The gross margin was obtained from Wilson (2004).

APPENDIX C

Grain Flow Statistics

Appendix Table C1. Spring and Winter Wheat Movements from Crop Reporting Regions in North Dakota to Various Destinations, 2001 Through 2003

Region	Market Destinations						Totals	Percent of All Spring
	Duluth	Minneapolis St. Paul	Midland/ Southwest	Pacific Northwest	ND	Other		
	----- thousands of bushels -----							
Central	1,984 10.0%	7,870 39.7%	3,704 18.7%	1,720 8.7%	661 3.3%	3,902 19.7%	19,841	9.6%
East Central	6,535 19.7%	8,197 24.7%	7,089 21.3%	1,551 4.7%	1,108 3.3%	8,751 26.3%	33,230	16.1%
North Central	2,395 13.3%	4,789 26.7%	1,676 9.3%	7,543 42.0%	1,018 5.7%	539 3.0%	17,959	8.7%
Northeast	9,386 18.7%	17,600 35.0%	3,352 6.7%	1,006 2.0%	9,051 18.0%	9,889 19.7%	50,285	24.3%
Northwest	854 5.3%	1,602 10.0%	748 4.7%	11,426 71.3%	374 2.3%	1,014 6.3%	16,018	7.8%
South Central	272 2.3%	10,151 87.0%	622 5.3%	272 2.3%	39 0.3%	311 2.7%	11,668	5.6%
Southeast	2,079 8.7%	14,716 61.3%	1,200 5.0%	0 0.0%	800 3.3%	5,199 21.7%	23,993	11.6%
Soutwest	649 3.7%	2,655 15.0%	3,068 17.3%	9,500 53.7%	531 3.0%	1,298 7.3%	17,701	8.6%
West Central	476 2.0%	10,747 44.9%	318 1.3%	1,959 8.2%	159 0.7%	2,224 9.3%	15,883	7.7%
All Regions	24,632 11.9%	78,327 37.9%	21,776 10.5%	34,976 16.9%	13,740 6.7%	33,126 16.0%	206,578	

Appendix Table C2. Durum Movements from Crop Reporting Regions in North Dakota to Various Destinations, 2001 Through 2003

Region	Market Destinations						Totals	Percent of All Durum	
	Duluth	Minneapolis St. Paul	Midland/ Southwest	Pacific Northwest	ND	Other			
	----- thousand bushels -----								
Central	159 15.3%	525 50.7%	128 12.3%	48 4.7%	66 6.3%	110 10.7%	1,036	2.0%	
East Central	58 28.3%	103 50.0%	7 3.3%	4 2.0%	2 1.0%	32 15.3%	206	0.4%	
North Central	932 30.0%	1,357 43.7%	62 2.0%	124 4.0%	446 14.3%	186 6.0%	3,108	6.1%	
Northeast	862 33.0%	723 27.7%	113 4.3%	26 1.0%	348 13.3%	540 20.7%	2,613	5.1%	
Northwest	5,841 20.7%	8,197 29.0%	5,464 19.3%	471 1.7%	7,537 26.7%	754 2.7%	28,265	55.2%	
South Central	20 2.3%	797 92.3%	0 0.0%	0 0.0%	40 4.7%	6 0.7%	864	1.7%	
Southeast	35 14.3%	164 67.7%	6 2.7%	0 0.0%	8 3.3%	29 12.0%	242	0.5%	
Southwest	47 0.7%	5,660 81.0%	722 10.3%	233 3.3%	163 2.3%	163 2.3%	6,988	13.6%	
West Central	499 6.3%	2,048 26.0%	1,339 17.0%	53 0.7%	1,365 17.3%	2,573 32.7%	7,875	15.4%	
All Regions	8,453 16.5%	19,574 38.2%	7,842 15.3%	959 1.9%	9,975 19.5%	4,393 8.6%	51,196		

Appendix Table C3. Mode of Transportation for Durum and Spring Wheat Shipments, North Dakota, 2001 Through 2003

Market Destination	Mode of Transportation		Ratio of Mode	
	Truck	Rail	Truck	Rail
	----- bu -----			
<u>Durum</u>				
Duluth	986,000	7,467,000	11.7%	88.3%
Minneapolis/St. Paul	4,110,000	15,463,000	21.0%	79.0%
Midland/Southwest	78,000	7,763,000	1.0%	99.0%
Pacific Northwest	0	959,000	0.0%	100.0%
North Dakota	3,757,000	6,218,000	37.7%	62.3%
Other	381,000	4,012,000	8.7%	91.3%
All Durum	9,312,000	41,882,000	18.2%	81.8%
<u>Spring & Winter Wheat</u>				
Duluth	4,752,000	20,260,000	19.0%	81.0%
Minneapolis/St. Paul	14,901,000	64,925,000	18.7%	81.3%
Midland/Southwest	590,000	21,531,000	2.7%	97.3%
Pacific Northwest	712,000	34,906,000	2.0%	98.0%
North Dakota	11,384,000	2,556,000	81.7%	18.3%
Other	1,457,000	32,164,000	4.3%	95.7%
All Spring and Winter	33,796,000	176,342,000	16.1%	83.9%

Appendix Table C4. Mode of Transportation for All Wheat Shipments, North Dakota, 2001 Through 2003

Market Destination	Mode of Transportation		Ratio of Mode	
	Truck	Rail	Truck	Rail
Duluth	5,739,000	27,727,000	17.1%	82.9%
Minneapolis/St. Paul	19,011,000	80,388,000	19.1%	80.9%
Midland/Southwest	668,000	29,294,000	2.2%	97.8%
Pacific Northwest	712,000	35,866,000	1.9%	98.1%
North Dakota	15,142,000	8,774,000	63.3%	36.7%
Other	1,838,000	36,176,000	4.8%	95.2%
All Destinations	43,110,000	218,225,000	16.5%	83.5%

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APPENDIX D

Wheat Processors Expenditure Survey

INSTRUCTIONS

Data provided from this survey will be used to help estimate the economic contribution of the wheat industry to the North Dakota economy. All the information provided is kept in strict confidence. The data will be synthesized in a manner that only industry-wide totals will be reported. In no way will any information presented in the study identify or be reflective of any single plant or firm.

The following general instructions are suggested in completing the questionnaire.

1. Use records from the most recently completed fiscal or calendar year.
2. Information should be recorded in dollar terms (figures can be rounded to the nearest thousand dollars).
3. If you cannot identify whether expenditures were made to North Dakota entities, please indicate this on the form.
4. When exact information is not available, please estimate.
5. Definitions for selected expenditure items and their corresponding Standard Industrial Classification (SIC) code listing are included to help group expenses into common categories.
6. We would prefer a 2 to 3 week time frame for completing the survey.
7. If you have questions, please contact:

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North Dakota State University
Fargo, ND 58105-5636

DEFINITIONS FOR EXPENDITURE ITEMS

(According to the Standard Industrial Classification Manual)

The following definitions are provided to assist in allocating expenses into various categories. If needed, the following web site could be helpful: http://www.osha.gov/pls/imis/sic_manual.html

Construction: Includes expenses for construction projects, such as construction of residential, farm, industrial, public, and other buildings and structures. (Major Groups 15, 16, and 17)

Transportation: Includes expenses for railroad, motor freight, water transportation, air transportation, pipeline transportation of petroleum, and other transportation to include packing and crating services, and rental of transportation equipment. (Major Groups 40, 41, 42, 43, 44, 45, 46, and 47)

Communications: Includes expenditures for telephone, telegraph, radio, television, satellite services, Internet transactions, and other communication services. (Major Group 48)

Public Utilities: Includes expenses for natural gas, electricity, water supply, and sanitary (sewer & garbage) services. (SIC Major Group 49)

Wholesale Trade: Expenses paid to establishments primarily engaged in selling merchandise to retailers; to industrial, commercial, institutional, or professional users; or to other wholesalers, or acting as agents in buying merchandise for or selling merchandise to such persons or companies. (Major Groups 50 and 51)

Retail Trade: Includes expenses for building materials, hardware, food, general merchandise, office supplies, automobile fuel, computers, eating and drinking establishments, work uniforms, and most other business and office-related supplies. (Major Groups 52, 53, 54, 55, 56, 57, 58, and 59)

Finance, Insurance, and Real Estate: Includes expenses for loan service, interest on loans, investment counseling, insurance, real estate transactions, brokerage fees, and any other financial service expenditures. (Major Groups 60, 61, 62, 63, 64, 65, 66, and 67)

Business and Personal Services: Examples of business and personal services include expenses for advertising, collection services, photocopying/duplication/printing services, equipment rental, computer services, computer software, security services, tax preparation, automotive/equipment/miscellaneous repairs, entertainment, janitorial services, and overnight lodging. (Major Groups 70, 72, 73, 75, 76, 78 and 79)

Professional and Social Services: Includes expenses for health/pharmaceutical, medical, legal, educational, research and development, child care, vocational training, and other professional services. (Major Groups 80, 81, 82, 83, 84, 86, 88, and 89)

WHEAT INDUSTRY EXPENDITURES QUESTIONNAIRE

Firm: _____

Contact Person: _____

I. Listing of expenditures made in _____ (please indicate year).

Expenditure Items	Estimated Annual Expenditure In North Dakota
	dollars
Purchases of wheat (paid to ND entities)	
Contract construction	
Plant maintenance and overhaul	
Transportation	
Communications	
Public utilities	
Miscellaneous manufacturing	
Wholesale trade	
Retail trade	
Finance, insurance, and real estate	
Business and personal services	
Professional and social services	
Coal and bulk petroleum	
Wages and salaries	
Employee benefits	
Government (paid in ND only)	
Property taxes	
Sales and use taxes	
Workman's compensation	
Unemployment	

Other taxes (please specify)	
I. Listing of expenditures (continued)	
Any other expenses not covered (please specify)	

II. Total annual revenue: \$_____.

III. Number of workers in full-time equivalents (FTE): _____.

IV. Bushels of wheat per year processed from North Dakota: _____.

V. Bushels of wheat per year processed from other states/countries: _____.

VI. Of all the wheat processed at your North Dakota facility, what percent is delivered directly to the plant by producers: _____.