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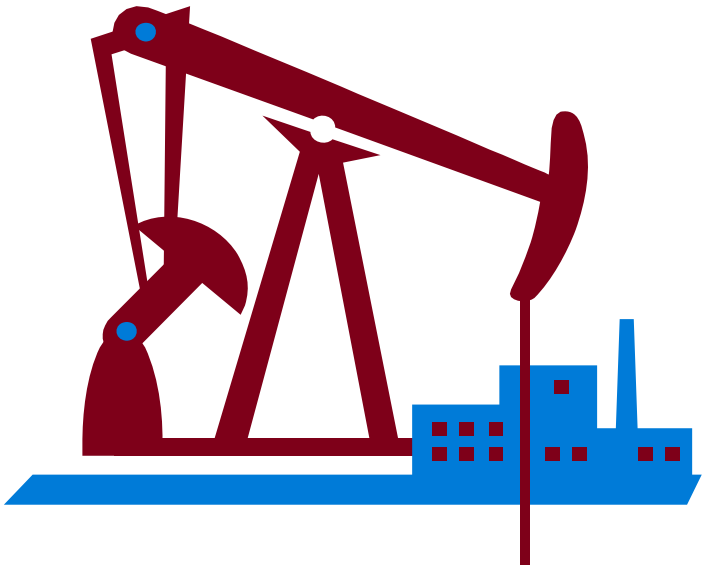
Economic Contribution of the Petroleum Industry to North Dakota



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A single copy of this publication is available free of charge. Please address your inquiry to the Department of Agribusiness and Applied Economics, North Dakota State University, PO Box 5636, Fargo, ND 58105-5636, phone (701-231-7441), fax (701-231-7400), or e-mail: Norma.Ackerson@ndsu.edu. This publication is also available electronically at the following web site: http://ageconsearch.umn.edu/.

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Executive Summary

The purpose of this study was to estimate the economic contribution of crude oil and natural gas exploration, extraction, transportation, and processing in North Dakota in 2005. Expenditures made in North Dakota by oil companies represented the direct impacts of the industry. Secondary economic impacts result from the spending and respending of the direct impacts and were estimated using the North Dakota Input-Output Model.

Surveys were used to collect production, expenditure, and employment data for the petroleum industry in North Dakota. Oil operators (i.e., firms that own or operate oil wells) in the state were surveyed to obtain information on in-state expenses for oil and gas exploration, oil and gas extraction, general business expenditures, employment, oil and gas production, and leasing and drilling activity. A similar survey was conducted for firms engaged in pipeline transportation and processing of crude oil and natural gas in North Dakota. A third survey was used to obtain information from firms that provide service and support in the oil fields and collected information on the type and extent of involvement in the petroleum industry, in-state expenditures, and employment in North Dakota.

The survey of oil operators produced financial data on about 20 percent of North Dakota's oil and gas production in 2005. Secondary data, obtained from government agencies, was combined with survey data to estimate royalties, lease bonuses, and severance taxes.

Estimates of total in-state expenditures in 2005 for oil and gas exploration (e.g., seismic testing, well drilling) were derived from survey data and statewide drilling statistics. The combination of in-state expenses for exploration and lease bonuses resulted in $445.1 million in direct impacts in 2005. The secondary economic impacts associated with exploration activities were estimated at $775 million. The in-state gross business volume (direct and secondary impacts) of exploration activities was estimated at $1.2 billion in 2005.

Estimates of oil and gas extraction expenses, general business expenses for oil operators, private and public mineral royalties, and state severance taxes were derived from survey data and secondary information obtained from various government agencies. Total direct impacts for oil and gas extraction were estimated at $909.6 million in 2005. Total secondary economic impacts associated with extraction activities were estimated at $1.4 billion. The in-state gross business volume of oil and gas extraction was estimated at $2.3 billion in 2005.

In-state expenditures for pipeline operation, natural gas processing, and crude oil refining were estimated to have a direct impact in North Dakota of $132 million. Total secondary economic impacts associated with processing and transporting crude oil and natural gas were estimated at $238 million. Processing and transporting crude oil and natural gas generated a gross business volume of $370 million in 2005.

Industry-wide direct and secondary economic impacts from the petroleum industry were estimated at $1.5 billion and $2.4 billion, respectively. The gross business volume for the entire industry in North Dakota in 2005 was estimated at $3.9 billion.

Additional measures of the petroleum industry's economic importance to the state include direct employment for 5,267 full-time jobs, economy-wide personal income of $1.5 billion, statewide retail sales of over $900 million, direct contributions to local and state government tax revenues of over $280 million, indirect contribution of $55 million in state government general tax collections, and secondary employment of 20,650 full-time equivalent jobs.

The industry generally receives little outside attention when production is declining or energy prices remain modest; however, when oil revenues increase either through expanded production and/or higher prices, the industry garners much attention from policymakers, business leaders, and the general public. While this study is a snapshot in time, results from this study would suggest that recent upswings in energy prices, drilling activity, and oil and gas production in North Dakota have made the petroleum industry the one of largest single industries in the state.

Considering that the industry's direct impacts (i.e., first round of spending) are concentrated geographically in the western portion of the state, the economic health of western North Dakota is perhaps tied more to the petroleum industry than any other single industry. Yet, despite the strong influence of the petroleum industry in western North Dakota, the magnitude of the contributions to the state government and the shear volume of secondary economic effects in nearly all sectors of the North Dakota economy would suggest that the economic effects of the industry are felt statewide. Current activity levels in the petroleum industry clearly make it one of the key forces in the North Dakota economy.

Economic Contribution of the Petroleum Industry to North Dakota

Dean A. Bangsund and F. Larry Leistritz*

Introduction

North Dakota's largest basic sector industries, which include agriculture, manufacturing, and energy, provide much of the economic stimuli for the state's economy. These large industries are generally comprised of distinct sectors or economic groups. For example, agriculture in North Dakota is often considered a combination of crop production and livestock. The energy industry in North Dakota is similar in that it is also comprised of several distinct sectors that are commonly treated as separate activities. North Dakota's energy industries can be conveniently separated into the activities that produce and distribute electricity, coal, and petroleum.

While separating the energy industry into similar activities is relatively straight forward, identifying the economic players within those sectors is less clear. In the case of electricity generation, a handful of firms and generating facilities exist within the state. The same situation exists with coal production–a handful of companies operate at a limited number of locations. However, the industrial organization associated with oil and natural gas production is very different. Rather than having a handful of firms and a limited number of site-specific facilities and locations, the petroleum industry involves hundreds of firms and a multitude of facilities spread out over the western third of North Dakota.

North Dakota's rank among the nation's top 10 oil producing states is common knowledge to those in the petroleum sector, and national oil production statistics are readily available to the general public (U.S. Department of Energy 2007). Yet, despite the obvious importance of oil and gas production to North Dakota and that the major economic industries in the state are rather limited in number, there has been no assessment of the contribution of the petroleum industry to the state economy. As a result, from an economic perspective, the degree of knowledge pertaining to the petroleum industry in the state is rather limited. This is in stark contrast to the coal industry, which has through the Lignite Energy Council, frequently funded studies to evaluate the economic importance of their industry (Coon and Leistritz 2006). Other industries and activities in the state, many of which are agriculturally-based, also have researched their economic importance. However, virtually no public information is available regarding the role the petroleum industry plays in the North Dakota economy.

Recent upswings in oil activity, due in-part to increased energy prices, the availability of improved exploration and extraction technology, and substantial potential for oil recovery from various formations in the Williston Basin, have brought new attention to the petroleum industry in North Dakota. Increase in leasing activity, more well drilling rigs operating in the

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state, substantial increases in severance tax collections, and other financial and economic aspects of the industry have all been discussed in the media. Given the obvious value of the petroleum industry to the state, and the level of government revenues stemming from petroleum activities, an economic assessment of the industry would be a valuable tool for both industry representatives, policy makers, business owners, government officials, and the general public. Determining the economic contribution of a given industry quantifies its importance to state and local economies. Not only can the economic impacts to the state and local economies be measured, but the effects on specific economic sectors and related industries also can be identified. Finally, economic studies can demonstrate the susceptibility of the North Dakota economy to fluctuations in factors affecting petroleum exploration and extraction, demonstrate the economic dependence of the state on natural resource-based industries, and indicate the economic impacts that could result from potential changes in policies which affect the petroleum industry.

Objectives

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

1) estimate the economic size of petroleum exploration, extraction, and processing sectors, and

2) provide estimates of industry-wide employment, tax revenues, and other key economic measures.

Background

The industrial organization of the petroleum industry in the United States is often divided into upstream and downstream components. The upstream components of the petroleum industry generally include exploration, development, and production of crude oil and natural gas. The downstream components include transportation, processing, distribution, marketing, and retail delivery of petroleum products.

Industry Organization

The petroleum industry in North Dakota consists of both upstream and downstream components. For this study, the petroleum industry was defined to only include in-state exploration, extraction, transportation, and processing of crude oil and natural gas. Exploration can be generally thought of as the process of finding mineral resources. Extraction is the process of developing and recovering mineral resources. Transportation components of the industry were limited to the movement of oil and gas from wells to collection points, and then on to processing facilities located either in-state or out-of-state. Petroleum processing in North Dakota included refining of crude oil and natural gas processing. The distribution, marketing, and retail sale of processed petroleum products

(e.g., diesel, gasoline, kerosene, motor oil, lubricants, propane, natural gas) were not included.

The exploration and extraction phases of the petroleum industry are not organized like other industries in the state. Firms that own producing wells (oil operators) contract much of the work of exploration and extraction of oil and gas to other firms that specialize in various aspects of those processes. As a result, much of the expenditures incurred in the state for oil and gas production start with the oil operator but flow through the various firms engaged in providing support and service within the oil fields. While oil operators represent a mix of small to large firms, a majority of the prominent oil operators in North Dakota also have operations in other states. For many oil operators, their operations in North Dakota do not represent the majority of their oil and gas revenues. As a result of having operations and/or headquarters in other states, net revenues from North Dakota oil and gas production may leave the state for a variety of reasons. However, North Dakota may be the beneficiary of exploration and discovery expenses from firms that have minimal operations in the state.

Oil and gas wells typically have three types of economic interests. These players are often referred to as royalty interests, owner/operator interests, and working interests. Royalty interests receive a share of the value of a well's output but do not share in the expenses associated with the well. Owner and working interests share, based on various percentages or arrangements, the remaining revenues and all of the expenses of a well. The well owner or operator is generally responsible or in charge of all operations. The owner arranges to have work completed for most of the necessary activities associated with the well, and charges working interests for their share of the expenses. As a result of these typical arrangements, the total number of firms receiving revenues and incurring expenses from oil and gas wells in North Dakota is unknown. However, the number of oil operators (firms that own or operate wells) is known.

For various reasons, the magnitude of economic effects of oil and gas production are not necessarily equivalent to the market value (i.e., price times quantity) of oil and gas produced. Exploration and extraction technologies use specialized inputs and services, many of which are not available in North Dakota and must be purchased from out-of-state sources. Many oil operators have operations and/or are headquartered in other states, and revenues for some firms may leave the state to be used for projects elsewhere. The same situation may exist where firms use resources obtained from out-of-state operations for oil and gas exploration in the state. In addition, oil operators headquartered out-of-state often have minimal general business expenses in the state. Similarly, firms that only have working interests in producing wells may or may not have physical operations in the state. All of these factors make it very problematic to base economic importance of the petroleum industry solely on the value of oil and gas production.

Production Statistics

Oil and gas production is limited to the western third of North Dakota (Figure 1). While crude oil has been produced in 19 western counties, only 16 counties are currently producing crude oil (North Dakota Industrial Commission 2007). Of the 16 counties producing oil, production is concentrated in Billings, Bottineau, Bowman, McKenzie, Stark, and Williams Counties. Those counties accounted for nearly 87 percent of state oil production in 2006 (North Dakota Industrial Commission 2007). Production in key counties has fluctuated over the last 50 years as new oil deposits are found and developed in various locations in the state (Figure 2). From 2002 through 2006, the major increase in oil production has occurred in Bowman County with relatively minor increases in production observed in a handful of other counties in the state.

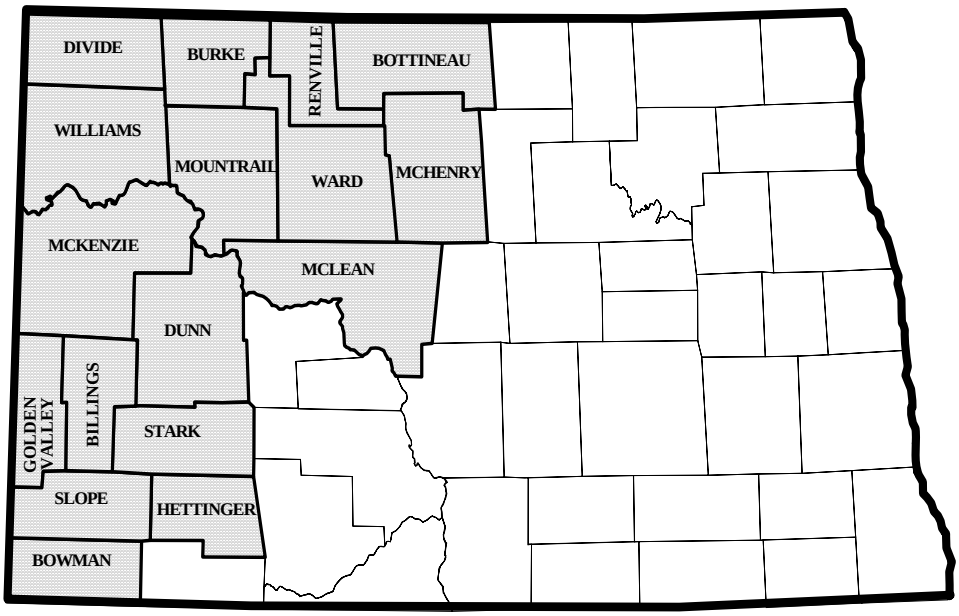


Figure 1. Oil Producing Counties, North Dakota

Nationally, North Dakota is ninth among all oil producing states based on cumulative crude oil production from 1981 through 2005 (Figure 3) (U.S. Department of Energy 2007). Based on crude oil production in 2005, North Dakota ranked eighth nationally among oil producing states. North Dakota accounted for about 2 percent of domestic crude oil production in 2005.

North Dakota is less of a factor in domestic natural gas production. From 1981 through 2005, North Dakota accounted for only 0.3 percent of national production and was ranked 20th among all states (U.S. Department of Energy 2007). North Dakota was ranked 21st in natural gas production in 2005.

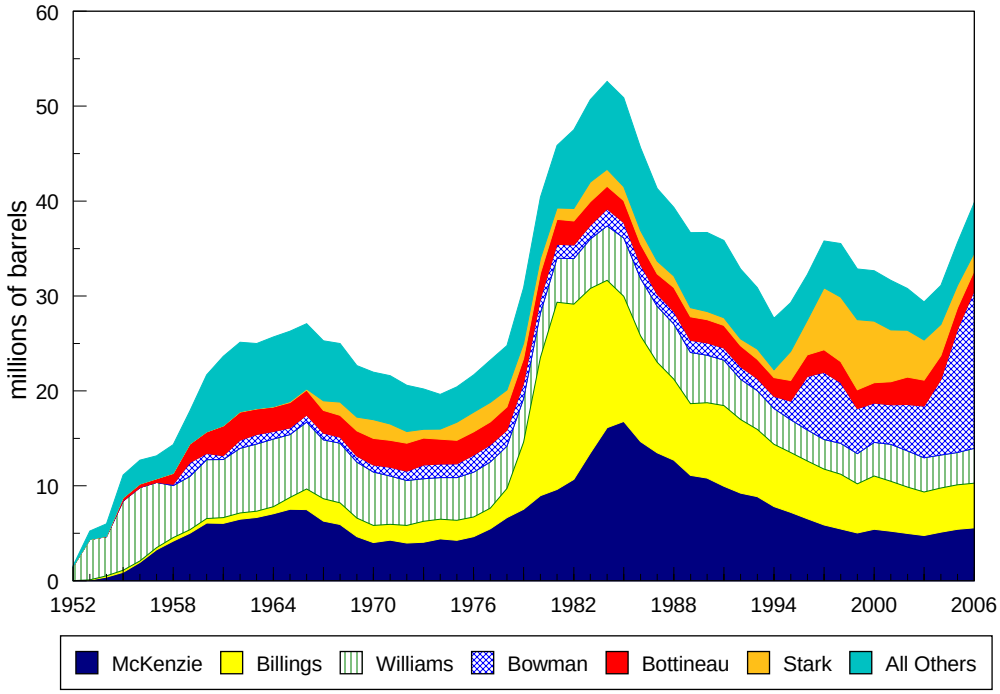


Figure 2. Historic Oil Production, Key Counties, North Dakota, 1952 through 2006
Source: North Dakota Industrial Commission (2007).

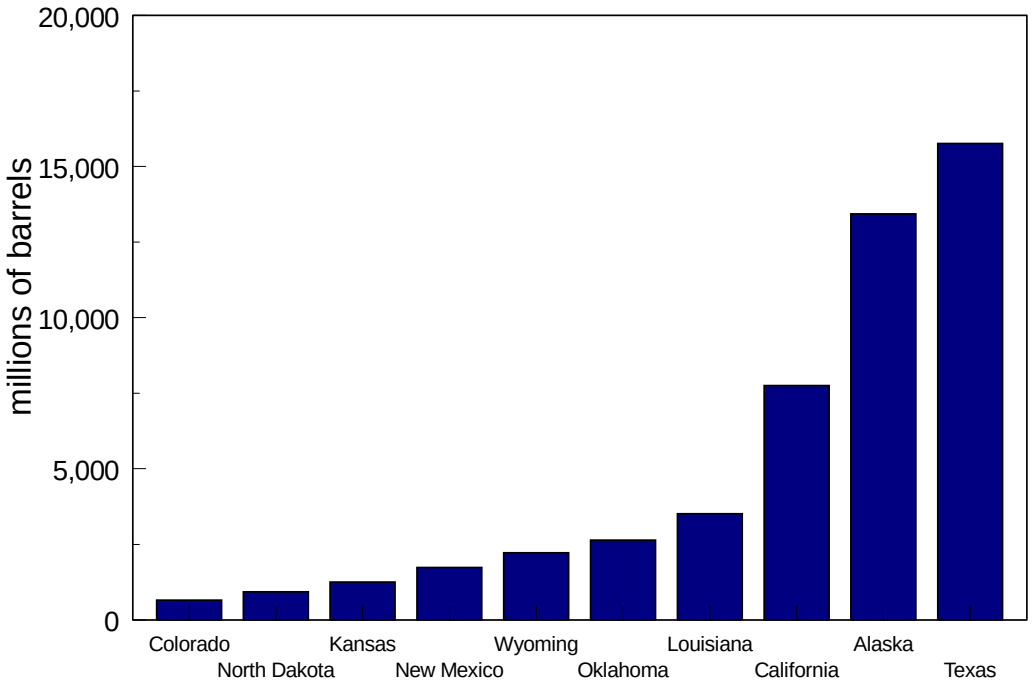


Figure 3. Top States in Crude Oil Production, United States, 1981 through 2005
Source: U.S. Department of Energy (2007).

Oil production in North Dakota has fluctuated substantially since commercial production began in the early 1950s (Figure 4). Overall, there have been two periods of rapid growth in oil production in North Dakota. The first period was from 1951 through 1962, and the second period occurred from 1974 to 1984. After historic highs in 1984, overall oil production in the state declined rapidly for 10 years. Since 1994, oil production in the state has seen two periods of expansion and one period of declining production. Crude oil production in the state is currently increasing, and crude oil production in 2006 was the highest since the early 1980s.

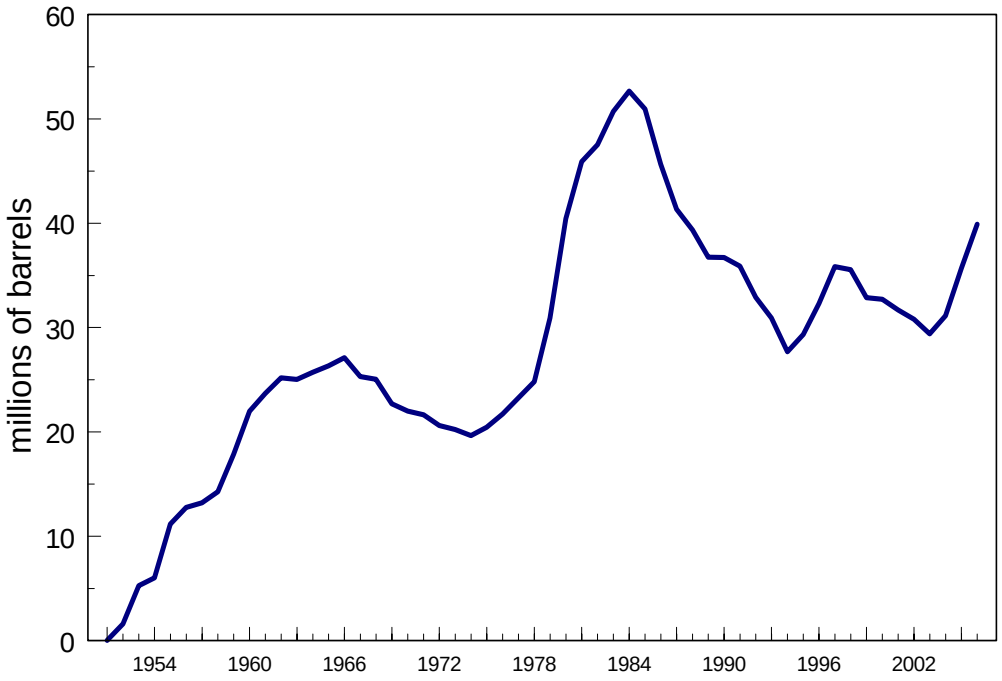


Figure 4. Crude Oil Production, North Dakota, 1951 through 2006
Source: North Dakota Industrial Commission (2007).

The annual value of oil production in North Dakota was estimated using monthly average price and production data from the North Dakota Industrial Commission (2007). The overall value of oil production in North Dakota, in nominal terms, has generally paralleled oil production despite price fluctuations over time (Figure 5). Nominal oil prices were converted to real dollars (2006) using the Producer Price Index for Crude Energy Materials (U.S. Department of Labor 2007). In real terms, from 1980 to 2005 the value of crude oil production in North Dakota has largely declined (Figure 6).

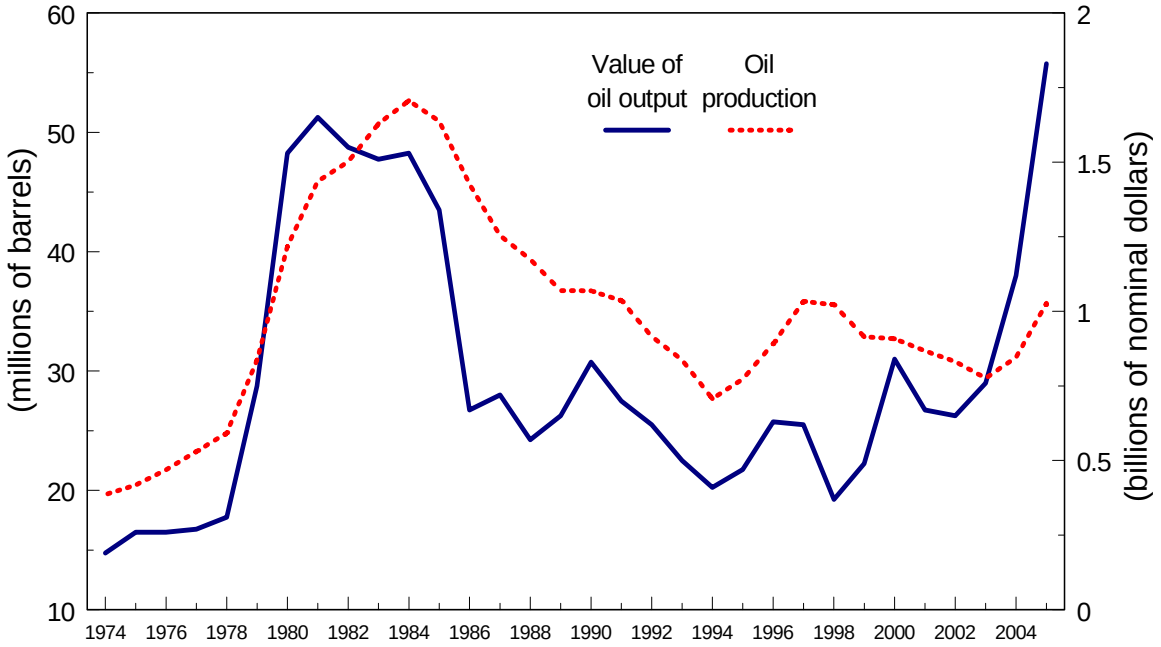


Figure 5. Production and Market Value of Crude Oil, North Dakota, 1974 through 2005
Source: North Dakota Industrial Commission (2007).

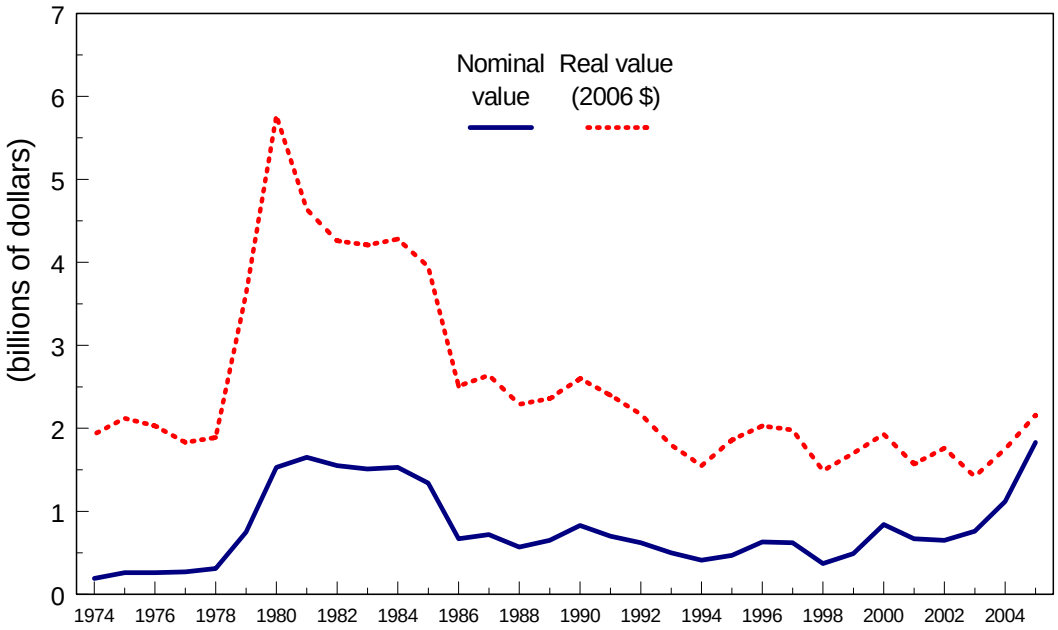


Figure 6. Value of Crude Oil Production in Nominal and Real Dollars, North Dakota, 1974 through 2005

Procedures

An economic contribution analysis, as defined in this study, represents an estimate of all relevant in-state expenditures and returns associated with an industry. The economic contribution approach to estimating economic activity has been used for several other industries in North Dakota (Bangsund and Leistritz 1995a, 1995b, 1998, 1999, 2004, 2005; Coon and Leistritz 2006).

Data Collection

Due to the complexities of how the oil and gas industry is structured, and that in-state effects (i.e., first round spending or direct impacts) from oil and gas production in any given year may not equal the market value of oil and gas production, an expenditure-based approach to measuring the economic size of the petroleum industry was used in this study. In this approach, a sample of firms active in the petroleum industry in North Dakota were asked to provide estimates of the amount of expenditures made to entities (i.e., individuals, firms, and governments) in North Dakota. Three separate survey efforts were conducted for the study and provided the basis for most of the economic data needed to complete the study.

Oil Operators

Firms that own or operate oil wells in the state were surveyed to obtain information on expenditures for oil and gas exploration and extraction, general business expenses in the state, employment, physical measures of oil and gas production, and leasing and drilling activity (Appendix A). The North Dakota Petroleum Council provided names and addresses for 135 oil operators in the state. The survey process started with sending cover letters and a questionnaire to each firm on the mailing list. A second mailing was conducted one month later for all firms that had not responded[1] to the first mailing. After two mailings with little industry response, the focus of the survey shifted to only the 30 largest operators in the state, based on volume of in-state oil production. Firms that were not on the original mailing list but were among the state's top 30 operators were added to the mailing list and included in a third mailing. The third mailing was limited to only the 30 largest operators in the state.

As a result of changing the size and composition of the initial mailing list, each top 30 firm received at least one mailing, while others received three mailings. Finally, the North Dakota Petroleum Council, along with its executive committee and the study authors, organized personal contacts with oil operators that had not responded to the survey. Industry representatives from the North Dakota Petroleum Council's executive committee volunteered to contact firms through telephone and e-mail in an attempt to solicit cooperation with the study. At that point several people became involved in the process and it became impossible

[1]Firms with non-deliverable addresses, those who responded with completed questionnaires, and those who indicated they would not or could not participate were excluded in the second mailing.

to track how many times each firm was contacted, when they were contacted, and by whom they were contacted.

The survey of oil operators resulted in useable information from 17 firms. The firms' production from owned/operated wells represented about 20 percent of the state's 2005 production of crude oil and natural gas (Table 1). The survey respondents had additional production from working interests, but those production figures were not used in the study.

Table 1. Basic Production Statistics from Survey of Oil Operators, North Dakota, 2005

Number of firms responding with useful information	17
Number of wells owned or operated in North Dakota (17 firms)	1,633
Crude oil production in 2005 in North Dakota (17 firms)	8,062,219 barrels[a]
Natural gas production in 2005 in North Dakota (17 firms)	10,289,325 mcf[a]
Number of oil wells drilled in 2005 (11 firms)	75
Total acreage leased in 2005 (9 firms)	221,862

[a] Output from wells operated or owned. Does not include production from working interests.

Pipelines and Processors

Another survey was conducted for firms engaged in pipeline transportation of crude oil and unprocessed natural gas produced in North Dakota and for firms involved with processing of crude oil and natural gas in North Dakota. The survey was used to obtain estimates of the amount and type of expenditures made in North Dakota and in-state employment by those firms (Appendix B). A mailing list of 10 firms operating pipelines, gas processing plants, and oil refineries was provided by the North Dakota Petroleum Council. The firms on the mailing list received two mailings, with some firms being contacted numerous times by industry representatives. A total of four firms provided useable information. While representative data for industry activities in this segment of the industry was obtained through the survey, a breakout of survey data for crude oil pipelines, natural gas processing plants and pipelines, and crude oil refineries is not possible due to confidentiality reasons. Firms operating pipelines for the transport of refined or processed petroleum products were not included in the study.

Service and Support

A third survey was used to obtain information from firms that provide service and support to oil operators in the state. The survey solicited information on the type and extent of involvement in the petroleum industry, in-state expenditures, and employment in North Dakota (Appendix C). The mailing list was obtained from lists of contractors or vendor lists

provided by firms responding to the oil operator survey. Oil operators were asked to provide lists of firms with whom they contract for the provision of various exploration, extraction, and transportation services in North Dakota. The vender or contractor lists were processed to remove the names of oil operators, pipeline firms, and processors, as well as any firm without a complete address. A total of 250 firms were randomly selected from a final list of 799 firms. The random sample was weighted to account for the overall ratio of in-state versus out-of-state firms and the ratio of firms listed by more than one operator versus those listed by only one operator. Undeliverable addresses were present on 13 of the 250 firms. One mailing resulted in 42 firms responding, with 40 firms providing useable information.

Estimation Techniques

The three surveys of firms directly involved in the petroleum industry in North Dakota provided data for two critical aspects of the study. First, data from the oil operator and processor surveys was used to set the level of spending in North Dakota. In other words, the data was used to determine the magnitude of spending within the state. Second, data from all three surveys was used to determine the type and distribution of spending among various sectors of the North Dakota economy. The expenditure data from the three surveys provided critical information on the amount of spending in the state and how those dollars were spent.

The survey of oil operators provided financial data on about one-fifth of all oil and gas production in the state. In addition, survey respondents provided information on exploration expenses, wells drilled, and leasing data. Benchmark expenses for extraction, transportation, and operational expenses (e.g., general administrative costs) were estimated per barrel of oil equivalent (BOE). Total state production in 2005, expressed in BOE, was then used with survey estimates of in-state expenditures per BOE to generate state-level estimates for extraction, transportation, and administrative spending. In-state employment by oil operators was estimated in the same manner. Benchmark expenses for exploration were estimated on a per-well drilled basis and were used with data on the number of wells drilled in North Dakota in 2005. Data from the Oil and Gas Division of the North Dakota Industrial Commission on wildcat and extension wells drilled (i.e., a subset of all wells drilled) was used with survey data on acreage and bonus payments for private leases and total wells drilled to arrive at state-level spending for private lease bonuses. Other economic components of the petroleum industry's direct impacts, such as severance taxes, public lease bonuses, and royalty revenues represented a combination of survey data, state-level statistics, and information obtained from various state and federal governmental agencies.

The survey of service and support firms for oil and gas production in North Dakota provided estimates of in-state spending by various types of expenses (e.g., salaries/wages, utilities, office supplies, business services) (Appendix C). The percentage of spending in various categories by firms responding to the survey was used to allocate state-level expenditures for exploration and extraction to various economic sectors of the North Dakota Input-Output Model. The amount of spending was determined using data from the survey of

oil operators, while the survey of service and support firms provided insights on how those dollars impacted various sectors of the North Dakota economy.

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 an economic 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 2005).

Economic Impacts

The economic contribution of the petroleum industry was primarily based on estimates of in-state expenditures from exploration, extraction, transportation, and processing of crude oil and natural gas. Estimates of in-state expenditures were combined with estimates of oil and gas royalties, state severance taxes, and lease bonuses to determine total direct impacts. Subsequently, the direct impacts were applied to the North Dakota Input-Output Model to estimate the secondary impacts. Secondary impacts result from the respending of direct impacts within the economy. The following section is divided into five major parts: (1) direct impacts, (2) secondary impacts, (3) employment, (4) tax revenue, and (5) total economic impacts.

Direct Impacts

From an economic perspective, direct impacts are those changes in economic output, employment, or income that represent the initial or first-round effects of a project, program, or activity. The direct impacts from the petroleum industry in North Dakota included expenditures for (1) oil and gas exploration, (2) oil and gas extraction, (3) transportation of crude oil and unprocessed gas, and (4) processing crude oil and natural gas. Direct impacts also included various revenue streams originating from either oil and gas exploration, such as lease bonuses, or oil and gas production, such as severance taxes and royalty payments. The following sections describe these direct economic impacts.

Exploration

The economic effects of exploration come from expenditures within North Dakota for a variety of activities that involve searching and discovering viable oil and gas resources. Exploration was defined to include, but not limited to, seismic testing, geological research, lease expenses, other environmental research, land survey work, excavation, road building, construction of drill site, construction and delivery of electricity, pipeline development, and all other activities associated with drilling oil and/or gas wells (Appendix A).

Estimates of total in-state expenditures in 2005 for exploration were derived from the survey of oil operators and used with drilling statistics from the Oil and Gas Division of the North Dakota Industrial Commission. In-state expenditures for exploration and drilling were estimated at about $1.5 million per well drilled[2]. The petroleum industry drilled 240 wells in North Dakota in 2005, yielding about $362.9 million in direct impacts. Lease bonuses in North Dakota were estimated at over $82 million in 2005, which included $12.5 million for state leases, $4.7 million for federal leases (public domain lands only) (U.S. Department of Interior 2007), and about $65 million for private mineral leases. The $4.7 million in federal lease bonuses from public domain lands represented the portion of those leases that were returned to North Dakota. Federal lease bonuses for acquired lands (i.e., primarily National Grasslands) were included in royalty payments and not included in exploration impacts. The combination of exploration expenses and lease bonuses resulted in $445.1 million in direct impacts in 2005 (Table 2). In-state expenditures for general exploration and drilling were allocated to various economic sectors of the North Dakota Input-Output Model using information from the survey of service and support firms (Table 2). State and federal lease bonuses were allocated to the *Government* sector and private lease bonuses were allocated to the *Households* sector.

[2] Antidotal evidence from industry sources indicates that average drilling costs in 2006 were nearly three times higher than those reported for 2005.

Table 2. Direct Impacts from General Exploration, Drilling Activities, and Lease Bonuses, North Dakota, 2005

Economic Sector	In-state Expenditures (000s $)
Communications and Public Utilities	6,793
Retail Trade	67,249
Finance, Insurance, and Real Estate	19,618
Business and Personal Services	25,133
Professional and Social Services	10,526
Households (personal income)	273,629
Government	42,174
Total	445,122

Extraction

The economic effects of extraction come from expenditures within North Dakota for a variety of activities that involve bringing crude oil and natural gas from underground formations to the earth's surface. Extraction and production was defined to include, but not limited to, all activities associated with the removal of crude oil and natural gas from the ground, and maintenance and periodic inspections of equipment used to extract oil and gas, and other production related activities, such as well work overs, well idling, shutdown, and abandonment activities (Appendix A). Also included in this segment of the industry are the general business expenditures incurred by oil operators in North Dakota. Examples of these expenditures include, but are not limited to, office rent, office supplies, wages and salaries, communications, public utilities, business and professional services, insurance, and interest expenses (Appendix A). Royalty revenues, both private and public, were included as direct impacts in the extraction segment of the petroleum industry. Collections from state severance taxes, which include the gross production tax and extraction tax, also were included in the direct impacts.

Estimates of total in-state expenditures in 2005 for extraction/production and general business expenses were derived from the survey of oil operators and estimated on a BOE basis. North Dakota produced 35,659,583 barrels of oil and 57,970,459 mcf of natural gas in 2005. Those volumes of oil and gas resulted in an estimated $304.4 million for in-state expenditures for extraction and $218.3 million for general business expenses. State oil and gas royalties were about $18 million (North Dakota State Land Department 2007). Total

federal royalties returned to North Dakota were about $19.4 million (U.S. Department of the Interior 2007, U.S. Forest Service 2007).

Private royalties were based on data obtained from the survey of oil operators and data on the value of state oil and gas production. Total royalties reported by oil operators were estimated at 13 percent and 13.3 percent of well output for oil and gas, respectively. Private royalties were estimated by subtracting state and gross federal royalties from estimated total royalties. Private royalties from oil and gas production in North Dakota in 2005 were estimated at $197 million.

Total collections from the gross production tax and extraction tax in calendar year 2005 were $91,567,338.26 and $60,941,425.13, respectively (Office of State Tax Commissioner 2007). Those tax collections were included in the extraction/production segment of the petroleum industry.

Total direct impacts in the extraction/production segment of the petroleum industry in North Dakota in 2005 were estimated at $909.6 million (Table 3). Data from the survey of service and support firms was used to allocate the in-state expenditures for extraction to various sectors of the North Dakota Input-Output Model. Direct impacts for general business expenses for oil operators, royalties, and state severance taxes were also allocated to various sectors of the North Dakota Input-Output Model (Table 3).

Table 3. Direct Impacts from Oil and Gas Extraction and Production Activities, North Dakota, 2005

Economic Sector	In-state Expenditures (000s $)
Construction	983
Transportation	10,414
Communications and Public Utilities	39,214
Agricultural Processing and Miscellaneous Manufacturing	36,822
Retail Trade	58,785
Finance, Insurance, and Real Estate	30,767
Business and Personal Services	25,713
Professional and Social Services	10,541
Households (personal income)	468,012
Government	228,318
Total	909,569

Processing

The processing segment of the petroleum industry included transportation of crude oil and natural gas by truck and pipeline to collection points and processing centers, natural gas processing, and crude oil refining. In-state transportation expenses paid by oil operators were estimated on a BOE equivalent. Those expenses were extrapolated based on state production statistics. Estimates of in-state expenditures for natural gas pipeline operation, crude oil pipeline operation, natural gas processing, and crude oil refining were obtained from the survey of processors. Results from the survey of processors were combined with state statistics to estimate state-level expenditures.

Direct impacts included $26.7 million in transportation expenses paid to in-state entities by oil operators. Processing activities, which included pipeline transportation of unprocessed natural gas and crude oil, natural gas processing, and crude oil refining were estimated to have in-state expenditures of $105.8 million. Total direct impacts of $132.5 million were allocated to the North Dakota Input-Output Model (Table 4). To avoid double counting of potential impacts, in-state purchases of crude oil and unprocessed natural gas by processors were excluded in the study.

Table 4. Direct Impacts from Oil and Gas Processing, North Dakota, 2005

Economic Sector	In-state Expenditures (000s $)
Construction	22,591
Transportation	27,479
Communications and Public Utilities	19,691
Agricultural Processing and Miscellaneous Manufacturing	5,090
Retail Trade	4,527
Finance, Insurance, and Real Estate	6,287
Business and Personal Services	4,190
Professional and Social Services	900
Households (personal income)	31,380
Government	10,350
Total	132,485

Total Direct Impacts

Direct impacts are defined as the initial or first-round effects of project, program, or activity. The petroleum industry in North Dakota was divided into several segments or components for purposes of reporting study results. Total direct impacts for the petroleum industry included in-state expenditures for oil and gas exploration, oil and gas extraction, transportation of crude oil and unprocessed gas, and processing crude oil and natural gas, as well as, lease bonuses, severance taxes, and royalty payments.

Total direct impacts from the petroleum industry in North Dakota in 2005 were estimated at $1.487 billion (Table 5). Exploration accounted for 30 percent of the industry's direct impacts. The largest segment of the industry was extraction with 61 percent of all direct impacts. Processing and pipeline transportation accounted for 9 percent of the industry's direct impacts.

Expenditures and revenues which constitute the petroleum industry's direct impacts were allocated to various economic sectors of the North Dakota Input-Output Model. The sectors of the North Dakota economy that received the greatest direct impacts were *households* (economy-wide personal income) ($773 million), *government* (tax collections and public royalties) ($280 million), *retail trade* ($131 million), *communications and public utilities* ($65 million), and *finance, insurance, and real estate* ($57 million) (Table 5).

Table 5. Total Direct Impacts, Petroleum Industry, North Dakota, 2005

	Industry Component			
Economic Sector	Exploration	Extraction	Processing	Totals
	---------- 000s $ ----------			
Construction		983	22,591	23,574
Transportation		10,414	27,479	37,893
Communications and Public Utilities	6,793	39,214	19,691	65,698
Agricultural Processing and Miscellaneous Manufacturing		36,822	5,090	41,912
Retail Trade	67,249	58,785	4,527	130,561
Finance, Insurance, and Real Estate	19,618	30,767	6,287	56,672
Business and Personal Services	25,133	25,713	4,190	55,036
Professional and Social Services	10,526	10,541	900	21,967
Households (personal income)	273,629	468,012	31,380	773,021
Government	42,174	228,318	10,350	280,842
Total	445,122	909,569	132,485	1,487,176

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).

This process of spending and respending can be explained by using an example. A single dollar from an in-state 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 exploration, extraction, and processing components of the petroleum industry. Results from the North Dakota Input-Output Model revealed that secondary economic impacts from exploration in North Dakota in 2005 would be nearly $775 million (Table 6). The $910 million in direct impacts for oil and gas extraction (production) activities produced an estimated $1.4 billion in secondary economic impacts. Finally, the transportation and processing segment of the petroleum industry was responsible for $238 million in secondary economic impacts. Total secondary economic impacts from all components of the petroleum industry were estimated at $2.4 billion. Across all three major components of the petroleum industry, considerable secondary impacts were generated in the *retail trade* ($774 million), *households* ($740 million), *government* ($121 million), and *communications and public utilities* sectors ($119 million) (Table 6).

Table 6. Total Secondary Impacts, Petroleum Industry, North Dakota, 2005

Economic Sector	Industry Component			
	Exploration	Extraction	Processing	Totals
	---------- 000s $ ----------			
Construction	31,111	54,167	7,848	93,126
Transportation	3,973	6,835	1,258	12,066
Communications and Public Utilities	39,730	68,343	10,991	119,064
Agricultural Processing and Miscellaneous Manufacturing	16,970	53,828	7,554	78,352
Retail Trade	256,751	449,618	67,274	773,643
Finance, Insurance, and Real Estate	57,636	101,337	15,105	174,078
Business and Personal Services	21,356	37,362	5,582	64,300
Professional and Social Services	33,014	57,045	7,660	97,719
Households (personal income)	236,240	417,550	85,710	739,500
Government	37,854	68,665	15,287	121,806
Other sectors[a]	30,320	93,695	13,842	147,857
Total	774,955	1,408,445	238,111	2,421,511

[a] Includes various agricultural and mining sectors.

Employment

The petroleum industry is responsible for 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 is a term used to describe jobs that are considered to be a part of an industry. For example, workers operating an oil drilling rig would represent direct

employment in the petroleum industry. Similarly, someone who works at a natural gas processing plant or crude oil refinery would be considered direct employment in the petroleum industry.

While employment figures are frequently reported by various governmental agencies and are broken into a hierarchy of categories (e.g., North American Industry Classification System), deriving specific estimates of employment for large basic-sector industries can be problematic. Much of the problem arises in defining the type of job, and attributing to which industry(s) created that employment. For example, the process of drilling an oil well typically requires developing a road and a drilling site; work that requires heavy construction with earth moving or excavating equipment. Most oil companies will contract that work to local firms that specialize in heavy construction or excavating. The individuals performing the road building and preparation of the drill site are likely to be employed with some type of construction firm, and as a result, those jobs are typically classified and reported by government agencies as construction. Government agencies (e.g., Bureau of the Census, Bureau of Labor Statistics) that track employment often base the classification of those jobs on the type of activities that generate the most revenue for a firm (primary activities). In this example, the primary activity for this firm is likely to be construction, even if the specific activities are road building and drill site preparation. However, in the case of assigning which basic-sector industry created that employment, it may be more accurate to suggest those jobs exist as a result of the petroleum industry rather than the construction industry. Yet, in other cases, the level of oil well drilling activity may be insufficient to sustain employment in heavy construction for an entire year. Those situations result in seasonal or part-time job creation. The challenge is to measure or estimate the total number of full-time jobs created and sustained by the petroleum industry, even if those jobs appear to be part of another industry or are only created for part of a year.

Estimates of direct employment were generated from the survey of oil operators, processors, and service and support firms. The survey of oil operators and processors specifically asked for the number of full-time jobs in North Dakota (Appendices A and B). Employment figures from the survey of oil operators were extrapolated to state totals based on a BOE basis, while employment data from the survey of processors was extrapolated based on state-level statistics for those operations (e.g., processing volumes). Thus, estimating full-time employment by oil operators, pipeline firms, and processors in North Dakota was relatively straightforward.

Oil operators (firms owning or operating wells) contract much of the work of exploration and extraction of oil and gas to firms that specialize in various aspects of the those processes. While some of the work in the oil fields is performed by firms located in other states, much of the work is performed by firms located in close proximity to production. One of the difficulties of estimating employment in the service and support capacities is determining those jobs that are fully supported versus those jobs that are only partially supported by the petroleum industry. An additional complexity is to only attribute full-time employment to the petroleum activities located in North Dakota. For many firms located in the oil producing region of North Dakota, the obvious possibility is that some

employment by those firms could be partially or wholly supported by petroleum activities in Montana, Canada, or possibly in other states.

The questionnaire used in the service and support survey was designed to address the degree of job support from the petroleum industry and the level of job support attributable to only petroleum activities in North Dakota (Appendix C). Data from the survey was used to produce an estimate of the average amount of gross revenue needed to support one-full time position within the oil field in North Dakota. Total state employment for work in the oil fields was then estimated based on examining the gross level of spending, by oil operators, for contract work in the areas of exploration, extraction, and transportation in North Dakota.

Employment in North Dakota by oil operators in 2005 was estimated at 1,794 full-time equivalent (FTE) positions. Employment in the processing segment of the industry, which included some pipeline employment, was estimated at 471 FTE jobs. Total employment in the oil field for contract work, which includes exploration and extraction segments of the industry, was estimated at 3,001 FTE jobs. The petroleum industry[3], as defined and evaluated in this study, was estimated to create and support 5,267 FTE positions in North Dakota in 2005.

Secondary Employment

Secondary employment is a term used to describe jobs that are created and supported by the volume of business activity generated by an industry, but does not include jobs that are part of the industry. Direct employment and secondary employment are two distinctly different measures. Productivity ratios[4] were used with estimates of business activity in various sectors of the North Dakota economy to obtain estimates of secondary employment. The petroleum industry in North Dakota was estimated to generate an additional $2.4 billion in secondary business activity, which was sufficient to support 20,650 FTE jobs.

[3] The petroleum industry in this study did not include employment associated with transportation of processed petroleum products, marketing, or retail sales. In many cases, those downstream components of the industry generate substantial employment. The American Petroleum Institute reported that the petroleum industry in North Dakota was responsible for 5,796 jobs in 2005 (American Petroleum Institute 2006). However, industry-wide direct employment included 1,379 jobs in transportation and 1,681 jobs in wholesale operations; two components of the petroleum industry that were only partially included in this study. The American Petroleum Institute also estimated that retail gasoline stations in the state were responsible for 4,115 jobs in 2005; employment that was considered in addition to the 5,796 jobs attributable to other segments of the petroleum industry (American Petroleum Institute 2006).

[4] A measure of the amount of business activity needed in an economic sector to support one full-time job.

Government Revenues

Governmental revenues, usually based on tax collections, are another important measure of the economic impact of an industry on an economy. The petroleum industry in North Dakota, specifically oil and gas production, is responsible for substantial amounts of state and local government revenues. One distinction is that unlike many other industries in North Dakota, severance taxes (taxes placed on the value of oil and gas removed from the ground) collect money based on gross revenues produced by the industry. In contrast, taxation for most other industries is more traditional and usually limited to real property and net income. Another distinction that makes the petroleum industry different from other industries in the state is that governments can hold oil and gas leases and receive royalties from the value of oil and gas production. Of course, the petroleum industry also generates revenues from traditional sources, such as personal income, corporate income, sales and use, and property tax collections.

Severance taxes, sales and use taxes, personal income taxes, corporate income taxes, property taxes, royalties, lease bonuses, charitable donations, and licenses, fees, and permits combined for $280.8 million in government revenues that were directly attributable to the petroleum industry in North Dakota in 2005 (Table 7). Exploration, extraction, and processing segments of the industry were responsible for about 9, 87, and 4 percent, respectively, of the total government revenues from the petroleum industry in North Dakota.

Severance taxes accounted for over half (54 percent) of all government revenues from the petroleum industry in North Dakota in 2005. The second largest source was the most common general taxes (i.e., property, personal income, sales and use, and corporate income) at 24 percent, followed by royalties at 14 percent, and lease bonuses at 6 percent.

In addition to the government revenues that were included as direct impacts, collections from personal income and sales and use taxes were estimated based on the secondary economic activity generated by the petroleum industry. Secondary economic impacts in the *Retail Trade* sector were used to estimate revenue from sales and use taxes. Economic activity in the *Households* sector (which represents economy-wide personal income) was used to estimate personal income tax collections. Total collections of personal income and sales and use taxes arising from secondary economic activity were estimated at $55.5 million (Table 7).

Table 7. State and Local Government Revenues Attributable to the Petroleum Industry, North Dakota, 2005

Revenue Type	Revenue included as part of direct impacts	Revenue estimated from secondary economic impacts
	---------- 000s $ ----------	
Sales and Use Taxes	8,226	35,820
Property Taxes	13,980	not applicable
Personal Income Tax	6,741	19,663
Corporate Income Tax	8,035	not available
Royalties	38,054	not applicable
Severance Taxes	152,509	not applicable
Lease Bonuses	17,145	not applicable
Licenses, Permits, Fees	5,118	not available
Charitable Donations	184	not available
Undetermined Taxes[a]	30,850	not applicable
Total	280,842	55,483

[a] Represents general in-state taxes paid that were not specifically identified by survey respondents.

Total Economic Impacts

The total economic effect of an industry on a local, state, or regional economy can be measured by estimating the total amount of business activity generated by that industry. Total business activity, sometimes called gross business volume, is generally defined as a combination of direct and secondary economic impacts. Direct impacts are those changes in output, employment, or income that represent the initial or first-round effects of a project, program, policy, or activity. Secondary impacts (sometimes further categorized into indirect and induced effects) result from subsequent rounds of spending and respending within an 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. Further, additional economic measures, such as personal income, tax revenue, and employment, are often used to measure the relative size of an industry.

The petroleum industry in North Dakota was defined to include exploration, extraction, transportation, and processing of crude oil and natural gas. Direct impacts were based on in-state expenditures, private and public royalties, taxes, and lease bonuses. Direct impacts were allocated to various sectors of the North Dakota Input-Output Model to generate estimates of the secondary economic impacts.

The direct impact of exploration in 2005 was estimated at $445 million. Total secondary economic impacts associated with exploration activities were estimated at $775 million. The in-state gross business volume of exploration activities was estimated at $1.2 billion in 2005 (Table 8).

The direct impact of extraction in 2005 was estimated at $909.6 million. Total secondary economic impacts associated with extraction activities were estimated at $1.4 billion. The in-state gross business volume of oil and gas extraction was estimated at $2.3 billion in 2005 (Table 8).

The processing component of the petroleum industry was estimated to have a direct impact in North Dakota of $132 million. Total secondary economic impacts associated with processing and transporting crude oil and natural gas were estimated at $238 million. The in-state gross business volume of processing and transporting crude oil and natural gas was estimated at $370 million in 2005 (Table 8).

Industry-wide direct impacts from the petroleum industry were estimated at $1.487 billion in 2005. Total secondary economic impacts associated with the industry were estimated at $2.4 billion. The gross business volume for the petroleum industry in North Dakota in 2005 was estimated at $3.9 billion.

Table 8. Total (Direct and Secondary) Economic Impacts, Petroleum Industry, North Dakota, 2005

Economic Sector	Industry Component			
	Exploration	Extraction	Processing	Totals
	---------- 000s $ ----------			
Construction	31,111	55,150	30,439	116,700
Transportation	3,973	17,249	28,737	49,959
Communications and Public Utilities	46,523	107,557	30,682	184,762
Agricultural Processing and Miscellaneous Manufacturing	16,970	90,650	12,644	120,264
Retail Trade	324,000	508,403	71,801	904,204
Finance, Insurance, and Real Estate	77,254	132,104	21,392	230,750
Business and Personal Services	46,489	63,075	9,772	119,336
Professional and Social Services	43,540	67,586	8,560	119,686
Households (personal income)	509,869	885,562	117,090	1,512,521
Government	80,028	296,983	25,637	402,648
Other sectors[a]	40,320	93,695	13,842	147,857
Gross Business Volume	1,220,077	2,318,014	370,596	3,908,687

[a] Includes various agricultural and mining sectors.

Additional measures of the petroleum industry's economic importance to the state include direct employment for 5,267 full-time jobs, economy-wide personal income of $1.5 billion, statewide retail sales of over $900 million, direct contributions to local and state government revenues of over $280 million, indirect contribution of $55 million in state government tax collections, and secondary employment of 20,650 full-time equivalent jobs. For every dollar spent in the state by the petroleum industry, another $1.63 in additional business activity was generated.

Some very generic or average impact figures can be produced for basic oil and gas production statistics. Based on a gross business volume of $3.9 billion for the petroleum industry, total economic effects in North Dakota would be about $86 per BOE, or if impacts were only evaluated for crude oil production, total effects would be nearly $110 per barrel. Based on active wells in the state, the overall economic effect (direct and secondary impacts from all segments of the industry) per well (averaged for all producing wells) would be about $11.5 million annually.

Summary

The purpose of this study was to estimate the economic contribution of the petroleum industry in North Dakota in 2005. The petroleum industry was defined to include exploration, extraction, transportation, and processing of crude oil and natural gas. Exploration is the process of finding mineral resources while extraction is the process of recovering mineral resources. Transportation was limited to the movement of oil and gas from wells to collection points, and then on to processing facilities located either in-state or out-of-state. Petroleum processing in North Dakota included refining of crude oil and natural gas processing.

Due to the complexities of how the oil and gas industry is structured, and that in-state effects (i.e., first round spending or direct impacts) from the petroleum industry in any given year may not equal the market value of oil and gas production, an expenditure-based approach to measuring the economic size of the petroleum industry was used in this study. In this approach, only money spent in North Dakota by oil companies was included in the study and represented the direct impacts of the industry. In addition to in-state expenditures, private and public royalties, lease bonuses, and severance taxes were also included as direct impacts. Secondary economic impacts result from the spending and respending of the direct impacts and were estimated using the North Dakota Input-Output Model.

Three separate surveys were used to collect production, expenditure, and employment data for the petroleum industry in North Dakota. Firms that own or operate oil wells in the state were surveyed to obtain information on in-state expenses for oil and gas exploration, oil and gas extraction, general business expenses, employment, oil and gas production, and leasing and drilling activity. A similar survey was conducted for firms engaged in pipeline transportation of crude oil and unprocessed natural gas and included firms involved with processing of crude oil and natural gas in North Dakota. A third survey was used to obtain information from firms that provide service and support to oil operators in the state. The survey solicited information on the type and extent of involvement in the petroleum industry, in-state expenditures, and employment in North Dakota.

The survey of oil operators produced financial data on about 20 percent of North Dakota's oil and gas production in 2005. Also, financial data was collected on pipeline transportation, gas processing, and crude oil refining. The survey of service and support firms obtained employment and financial data on a number of oil field activities. Secondary

data, obtained from government agencies, was combined with survey data to estimate royalties, lease bonuses, and severance taxes.

Estimates of total in-state expenditures in 2005 for oil and gas exploration were derived from the survey of oil operators and used with drilling statistics from the Oil and Gas Division of the North Dakota Industrial Commission. The combination of in-state expenses for exploration and lease bonuses resulted in $445.1 million in direct impacts in 2005. The secondary economic impacts associated with exploration activities were estimated at $775 million. The in-state gross business volume of exploration activities was estimated at $1.2 billion in 2005 (Figure 7).

Estimates of oil and gas extraction expenses, general business expenses for oil operators, private and public royalties, and state severance taxes were derived from survey data and secondary information obtained from various government agencies. Total direct impacts for oil and gas extraction were estimated at $909.6 million in 2005. Total secondary economic impacts associated with extraction activities were estimated at $1.4 billion. The in-state gross business volume of oil and gas extraction was estimated at $2.3 billion in 2005 (Figure 7).

The processing component of the petroleum industry was estimated to have a direct impact in North Dakota of $132 million. Total secondary economic impacts associated with processing and transporting crude oil and natural gas were estimated at $238 million. The in-state gross business volume of processing and transporting crude oil and natural gas was estimated at $370 million in 2005 (Figure 7).

Industry-wide direct impacts from the petroleum industry were estimated at $1.487 billion in 2005. Total secondary economic impacts associated with the industry were estimated at $2.4 billion. The gross business volume for the petroleum industry in North Dakota in 2005 was estimated at $3.9 billion (Figure 7).

Additional measures of the petroleum industry's economic importance to the state include direct employment for 5,267 full-time jobs, economy-wide personal income of $1.5 billion, statewide retail sales of over $900 million, direct contributions to local and state government revenues of over $280 million, indirect contribution of $55 million in state government tax collections, and secondary employment of 20,650 full-time equivalent jobs. For every dollar spent in the state by the petroleum industry, another $1.63 in additional business activity was generated.

North Dakota Petroleum Industry

Key Segments of the Industry

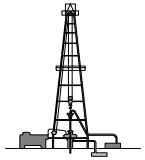
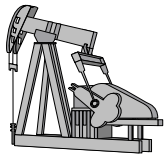
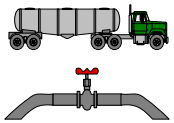
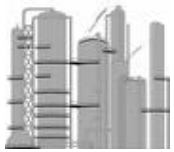
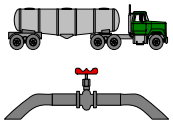
	Exploration	Extraction	Transportation	Processing	Distribution	Retail
	drilling and locating oil reserves 	bringing oil and gas to the surface 	moving oil and gas from pumps to processing centers 	oil refining and natural gas processing 	moving products from processors to retail markets 	selling petroleum products to end users
Direct Impacts	$445 million	$910 million	$132 million		not included	
Secondary Impacts	$775 million	$1.4 billion	$238 million			
Gross Business Volume	$1.2 billion	$2.3 billion	$370 million			
Direct Employment	4,795 full-time equivalent jobs		471 full-time equivalent jobs			
Secondary Employment	20,650 full-time equivalent jobs					
Direct Government Revenues	$42 million	$228 million	$10 million			

Figure 7. Economic Effects of Key Segments of the North Dakota Petroleum Industry, 2005

Conclusions

Recent upswings in energy prices, drilling activity, and oil and gas production in North Dakota have made the petroleum industry the one of largest single industries in the state. While previous comprehensive estimates of the petroleum industry's economic importance to the state are not available, based on records of historical oil production, current industry activity is approaching the peak oil boom period of the early 1980s. It would appear that the industry receives little outside attention when production is declining or energy prices remain modest; however, when production increases and prices jump, the industry garners much attention from policymakers, business leaders, and the general public.

The economic contribution of the petroleum industry was tied to activity and factors present in the industry in 2005. It is important to remember that the figures presented in this report represent a snapshot in time, and will not necessarily reflect the future economic impact of the industry. The economic importance of the industry will increase and decrease with changes in a host of factors that affect petroleum exploration, extraction, and processing levels.

Few other basic-sector industries in North Dakota, outside of various agricultural industries, have had similar comprehensive assessments of their economic importance. However, a few comparisons to those industries are helpful in placing results from this study in context. The wheat industry and the coal industry are two examples of basic-sector industries that have had economic assessments performed to measure their economic contribution to North Dakota's economy. From 2001 through 2003, the production, transportation, handling, and processing of wheat in North Dakota was estimated to produce a gross business volume of $3.56 billion annually. In 2005, the coal industry in North Dakota was estimated to generate $1.8 billion in gross business volume. Estimates of the gross business volume for the petroleum industry were $3.9 billion. Direct employment figures for the wheat industry would not be comparable to those in this study; however, direct employment in the coal industry was estimated at 3,858 FTE positions, compared to 5,267 FTE jobs in the petroleum industry.

Regardless of the economic measure used, the petroleum industry is one of the largest basic-sector industries in North Dakota. Considering that the industry's direct impacts (i.e., first round of spending) are concentrated geographically in the western portion of the state, the economic health of western North Dakota is perhaps tied more to the petroleum industry than any other single industry. Yet, despite the strong influence of the petroleum industry in western North Dakota, the magnitude of the contributions to both the state and local governments and the shear volume of secondary economic effects in nearly all sectors of the North Dakota economy would suggest that the economic effects of the industry are felt statewide. Current activity levels in the petroleum industry clearly make it one of the key forces in the North Dakota economy.

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APPENDIX A

Questionnaire, Oil Operators, North Dakota, 2005

Contribution of the Petroleum Industry to the North Dakota Economy

Survey of Oil Operators

Department of Agribusiness and Applied Economics
North Dakota State University
and
North Dakota Petroleum Council

Instructions and Guidelines for Filling Out the Questionnaire

Data provided from this survey will be used to help estimate the economic contribution of the oil industry to the North Dakota economy. The goal is to determine how much money the oil industry spends in North Dakota. All expenditure 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 firm or operation.

The following is a list of general guidelines for the questionnaire.

1. Use information from 2005 or your most recently completed fiscal year.

2. Expenditures should be expressed in U.S. dollars.

3. If the actual amount of the expenditure is not easily determined or is not readily known, please provide an estimate of the expense.

4. For contractor expenditures (Part II of this questionnaire), please include all expenditures made for services provided in North Dakota, even if the office or headquarters of the contractor or service provider is not located in North Dakota.

5. For general expenditures for day-to-day operations (Part III of the questionnaire), include only how much your company paid out to entities in North Dakota.

6. If you cannot identify whether an expenditure was made in North Dakota or in another state, indicate this on the form.

7. Definitions for some expenditure items and their corresponding Standard Industrial Classification (SIC) code listing are included to help in determining allocation of expenditures.

6. Please complete the survey by July 17, 2006 and mail the questionnaire in the return envelope.

7. If you have questions, please contact:

Dean Bangsund
701-231-7471
E-mail: bangsund@ndsuext.nodak.edu

or

Larry Leistritz
701-231-7455
E-mail: lleistri@ndsuext.nodak.edu
Department of Agribusiness and Applied Economics
North Dakota State University
Fargo, ND 58105-5636

Part I - - General Information

Business Name: _____

Mailing Address: _____

Contact Person: _____

The following questions pertain only to wells for which your company is the operator.

Number of producing oil wells in ND in 2005 for which your company was the operator _____

	Oil	**Gas**
Total production from your operated wells in 2005	_____ bbls	_____ mcf
Operator interest share of production	_____ %	_____ %
Overriding royalty interest share of production	_____ %	_____ %
Remaining working interest share of production	_____ %	_____ %

The following questions pertain to wells for which your company only has a working interest and does not serve as the operator.

Number of producing oil wells in ND in 2005 for which your company only has a working interest _____

	Oil	**Gas**
Total production of those wells in 2005	_____ bbls	_____ mcf
Operator interest share of production	_____ %	_____ %
Overriding royalty interest share of production	_____ %	_____ %
Only your company's working interest share of production	_____ %	_____ %

Total number of employees working in North Dakota: _____ (Full-time equivalents)

Number of jobs (FTE's) above dedicated to exploration/drilling	_____
Number of jobs (FTE's) above dedicated to general production/extraction	_____

Part II. Payments made to **Contractors**, **Sub-contractors**, and **Consultants**

The following instructions pertain to **Part II** of the Questionnaire.

1) Only report contracted expenses for wells in North Dakota for which your company serves as the operator even if your company's stake in those wells is small. Do not include expenses for wells for which your company only has a working interest share–those expenses will be reported by other oil operators.

2) Please include the total cost for the contracted service for those wells. The total cost will include your company's share of the costs as well as the costs billed to the working interest holders on the well.

3) Please indicate expenses for producing wells, wells currently being drilled, and wells that were drilled, but never used.

4) Only include contracted expenses for the last year.

5) Please include all expenditures made for services provided in North Dakota, even if the office or headquarters of the contractor or service provider is not located in North Dakota.

Part II. **Type of Contracting Work Performed**	**Payments for work done in North Dakota**
General Exploration Examples of services include lease brokerage costs (lease arrangements and landowner negotiations), landman expenses, environmental services, seismic testing and geological research	$
Drill Site Preparation Examples of services include land survey work, excavation, road building, construction of drill site, other drill site preparations such as providing electricity, setting up storage facilities, etc.	$
Drilling Activities Examples of services include erecting derrick, mudding operations, spudding operations, wellbore casing, case perforation, logging, fracing services, wellhead placement, pipeline development and construction, and any other services provided that are associated with drilling activities This category of expenses should include all phases of drilling for both primary wells and secondary/tertiary/EOR injection wells	$
Oil and Gas Extraction and Production Examples of services include pump, well, and storage tank maintenance and servicing; daily & weekly well visits for tank switching, periodic inspections, general monitoring, and other activities; well stimulations; well work overs; well idling, shutdown, and/or abandonment activities	$
Transportation Include expenses for truck transportation of oil from well site to pipeline collection points (terminal) and expenses for truck transportation of other products and by-products from well site to secondary locations, also include all charges for transportation of gas and oil by pipeline until products are sold to a purchaser or buyer	$
Any other services or activities provided by contracted arrangements not listed above: _____ (please specify) _____ (please specify) _____ (please specify) _____ (please specify)	 $ _____ $ _____ $ _____ $_____

Part III. The following expenses relate to your company's general business operations in North Dakota and should represent expenses paid only to North Dakota entities. These expenses should not include any payments made to oil industry contractors or consultants associated with exploration or extraction. Please refer to the accompanying sheet for definitions and clarification of what expenses should be included in the expenditure categories.

General Business Expenses	**Expenses paid to North Dakota entities**
Building and equipment leases (e.g., office space, vehicles)	$
Business and personal services	$
Professional and social services	$
Communications	$
Construction	$
Public utilities	$
Employee wages and salaries	$
Employee benefits (retirement, health insurance, etc.)	$
Payroll taxes (FICA, etc.)	$
Insurance	$
Interest, finance, and banking expenses	$
Oil and gas royalties:	
Private	$
State	$
Retail trade	$
Wholesale trade	$
Research and development	$
North Dakota taxes:	
Property	$
Income	$
Sales and use	$
Transportation (note: pipeline expenses should be reported in Part II)	$
Any miscellaneous payments to working interests	$
Any miscellaneous payments to royalty interests	$
Other expenses (please specify).	$

Definitions for Expenditure Categories–Part III of Questionnaire

The following definitions are derived from Standard Industrial Classification Manual (SIC codes) and have been provided to assist in allocating expenses into common categories. If needed, please refer to the following web site for additional examples of the expenses included in each category: http://www.osha.gov/pls/imis/sic_manual.html Each category has several Major Group numbers, which contain additional detail on the type of activities in each category.

Construction: Includes expenses for construction projects, such as construction (including new work, additions, alterations, remodeling, and repairs) of residential, industrial, public, office, warehouse, and other buildings and structures. (Major Groups 15, 16, and 17)

Transportation: Includes expenses for railroad, motor freight, water transportation, air transportation, 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. (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, 79, and 87)

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)

Part IV. Leasing and Drilling Activity in North Dakota. Please summarize your company's lease expenditures and drilling activities over the last five years. Lease expenditures and drilling activities should be for North Dakota operations only.

Leasing	**2001**	**2002**	**2003**	**2004**	**2005**
Total lease expenditures ($)					
Private leases					
State leases					
Federal leases					
Total acreage leased					
Private land					
State land					
Federal land					
Drilling	**2001**	**2002**	**2003**	**2004**	**2005**
Overall number of wells drilled					
Number of wells drilled that were plugged (dry holes)					
Number of wells drilled that went into production (completed as a producer)					

Part V. List of Contractors. Please provide the name and mailing address of all companies that your firm has contracted with over the last year to perform work in North Dakota. Please include all companies even if they do not have a North Dakota address. If a computer listing is not available, please use the following space to provide the information.

Name of Company	Address (street, city, state, zip)

Please add sheets or attach printouts as needed.

Part VI. **If needed, please use the space below to provide additional comments or explanations for any portion of this questionnaire (attach supporting material if needed):**

Thank You for completing this questionnaire!

Please return the questionnaire in the postpaid envelope.

If you would like a copy of the study results mailed to you, make sure you have provided a mailing address in Part I of the questionnaire. Otherwise, you may contact Carol Jensen in the Department of Agribusiness and Applied Economics at North Dakota State University for more information on our departmental reports. Phone 701-231 7441, fax 701-231-7400, email: cjensen@ndsuext.nodak.edu or visit our departmental listing of research reports on the internet at http://agecon.lib.umn.edu

Study results should be available in the fall of 2006.

APPENDIX B

Questionnaire, Processors, North Dakota, 2005

Contribution of the Petroleum Industry to the North Dakota Economy

Survey of Processors

Department of Agribusiness and Applied Economics
North Dakota State University
and
North Dakota Petroleum Council

Instructions and Guidelines for Filling Out the Questionnaire

Data provided from this survey will be used to help estimate the economic contribution of the oil industry to the North Dakota economy. The goal is to determine how much money the oil industry spends in North Dakota. All expenditure 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 firm or operation.

The following is a list of general guidelines for the questionnaire.

1. Use information from your most recently completed fiscal year.

2. Expenditures should be expressed in U.S. dollars.

3. If the actual amount of the expenditure is not easily determined or is not readily known, please provide an estimate of the expense.

4. Only include expenditures made to businesses, governments, or individuals in North Dakota.

5. If you cannot identify whether an expenditure was made in North Dakota or in another state, indicate this on the form.

6. Definitions for some expenditure items and their corresponding Standard Industrial Classification (SIC) code listing are included to help in determining allocation of expenditures.

7. We would prefer to have the questionnaire completed and returned by the end of 2006.

If you have questions, please contact:

Dean Bangsund
701-231-7471
E-mail: bangsund@ndsuext.nodak.edu
or
Larry Leistritz
701-231-7455
E-mail: lleistri@ndsuext.nodak.edu
Department of Agribusiness and Applied Economics
North Dakota State University
Fargo, ND 58105-5636

Part I - - General Information

Business Name: _____

Mailing Address: _____

Contact Person: _____

Total barrels of oil refined/processed/transported in the last fiscal year _____
Percent of those barrels purchased from North Dakota sources _____
Percent of those barrels purchased from sources in other states _____
Percent of those barrels purchased from Canadian sources _____

Number of employees in North Dakota (FTE) in 2005 _____

Annual Expenses. The following expenditures should represent expenses paid only to North Dakota entities. Please refer to the accompanying sheet for definitions and clarification of what expenses should be included in the expenditure categories.

Operating Expenses in Fiscal Year 2005	Expenses paid to North Dakota entities
Building and equipment leases (e.g., office space, vehicles)	$
Business and personal services	$
Professional and social services	$
Communications	$
Construction	$
Public Utilities	$
Employee wages and salaries	$
Employee benefits (retirement, health insurance, etc.)	$
Payroll taxes (FICA, etc.)	$
Insurance	$
Interest, finance, and banking expenses	$
Purchases of crude oil (from ND sources)	$
Transportation	$
Retail Trade	$
Research and Development	$
North Dakota Taxes	$
Property	$
Income	$
Sales and Use	$
Other expenses (please specify)	$
	$
	$

Definitions for Expenditure Categories

The following definitions are derived from the Standard Industrial Classification Manual (SIC codes) and have been provided to assist in allocating expenses into common categories. If needed, please refer to the following web site for additional examples of the expenses included in each category: http://www.osha.gov/pls/imis/sic_manual.html Each category has several Major Group numbers, which contain additional detail on the type of activities in each category.

Construction: Includes expenses for construction projects, such as construction (including new work, additions, alterations, remodeling, and repairs) of residential, industrial, public, office, warehouse, 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. (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, 79, and 87)

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)

Thank You for completing this questionnaire!

Please return the questionnaire in the postpaid envelope.

If you would like a copy of the study results mailed to you, make sure you have provided a mailing address in Part I of the questionnaire. Otherwise, you may contact Carol Jensen in the Department of Agribusiness and Applied Economics at North Dakota State University for more information on our departmental reports. Phone 701-231 7441, fax 701-231-7400, email: cjensen@ndsuext.nodak.edu or visit our departmental listing of research reports on the internet at http://agecon.lib.umn.edu

Study results should be available in the fall of 2006.

APPENDIX C

Questionnaire, Service and Support Firms, North Dakota, 2005

Contribution of the Petroleum Industry to the North Dakota Economy

Survey of Firms Providing Service and Support

Department of Agribusiness and Applied Economics
North Dakota State University
and
North Dakota Petroleum Council

Instructions and Guidelines for Filling Out the Questionnaire

Data provided from this survey will be used to help estimate the economic contribution of the oil industry to the North Dakota economy. The goal is to determine how much money the oil industry spends in North Dakota. All expenditure 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 firm or operation.

The following is a list of general guidelines for the questionnaire.

1. Use information for activities in 2005.

3. If you are unsure of a specific figure please use your best estimate. Remember, your best estimate is going to be better than our best guess!!

4. When answering questions pertaining to spending patterns, please remember that we are only interested in information on expenditures made to businesses, governments, or individuals in North Dakota.

5. If you cannot determine if a particular expense was incurred in North Dakota or if the expense was made to another company or individual in a different state, please indicate this on the form.

6. Please return the questionnaire by December 5, 2006

7. If you have questions, please contact:

Dean Bangsund
701-231-7471
E-mail: bangsund@ndsuext.nodak.edu
or
Larry Leistritz
701-231-7455
E-mail: lleistri@ndsuext.nodak.edu
Department of Agribusiness and Applied Economics
North Dakota State University
Fargo, ND 58105-5636

Part I - - General Information

Business Name: _____

Mailing Address: _____

Contact Person: _____

General Questions About Your Company

1) Did your company work directly in the areas of oil and/or gas exploration and/or extraction in North Dakota at any time in 2005? Yes ___ No ___

2) Did your company provide any services, products, inputs, equipment, consultation, or conduct work in any other capacity for firms that were active in oil and/or gas exploration and/or extraction activities in North Dakota in 2005? Yes ___ No ___

If you answered "**No**" to both questions.	If you answered "**Yes**" to either question.
Please stop here and mail back the questionnaire in the pre-paid envelope **Thank You.** 	Please continue with the questionnaire. 

What percent of your company's overall business comes from the petroleum industry?

a) 1 to 20%
b) 21 to 40 %
c) 41 to 60%
d) 61 to 80%
e) 81 to 100%

Of the revenues your company receives from work in the petroleum industry, what percent of those revenues come from activities in North Dakota?

a) 1 to 20%
b) 21 to 40 %
c) 41 to 60%
d) 61 to 80%
e) 81 to 100%

How many total employees does your business have? _____ full-time equivalents

How many employees work in North Dakota? _____ full-time equivalents

(For part-time, seasonal, or temporary workers, please estimate how many full-time equivalents their jobs would account for. E.g., 4 part-time workers employed for 3 months each would equal 1 full-time job).

Part II. Description of Your Company's Activities and Services

Type of Services Performed for the Petroleum Industry	Did your company provide any of these services in ND in 2005?
General Exploration and Leasing Examples of services include lease arrangements and landowner negotiations, environmental services, seismic testing, geological research, abstract and title research.	*please circle* yes / no
Drill Site Preparation Examples of services include land survey work, excavation, road building, earth moving, construction of drill site, and other drill site preparations such as providing installation of electricity, setting up storage facilities, building retention ponds, or assisting in any other aspects of the developing an oil well drill site.	yes / no
Drilling Activities Examples of services include erecting derrick, mudding operations, spudding operations, wellbore casing, case perforation, logging, fracing services, wellhead placement, pipeline development and construction, and any other services provided that are associated with oil drilling activities. This category of expenses should include all phases of drilling for both primary wells and secondary/tertiary/EOR injection wells.	yes / no
Oil and Gas Extraction and Production Examples of services include pump, well, and storage tank maintenance and servicing; daily & weekly well visits for tank switching, periodic inspections, general monitoring, and other maintenance activities; well stimulations; well workovers; well idling, shutdown, and/or abandonment activities.	yes / no

Type of Services Performed for the Petroleum Industry	Did your company provide any of these services in ND in 2005?
Transportation Includes truck transportation of oil from well site to pipeline collection points (terminal) and truck transportation of other petroleum products and by-products from well site to secondary locations, also includes general transportation of equipment and other supplies for firms engaged in petroleum exploration and extraction.	yes / no
General Repair Work Welding, metal work, fabrication of replacement parts, electrical motor repair, custom light-duty manufacturing, custom painting, and any other general repair work for machinery or equipment used in any capacity within the oil industry.	yes / no
Business and Professional Services Examples include legal representation, tax preparation, accounting and bookkeeping, vocational and safety training, general business consulting, and other business services.	yes / no
Any Other Services or **Activities** related to the petroleum industry provided by your company not listed above: (Please Specify) _____ _____ _____ _____ _____	

Part III. Spending Patterns in North Dakota

The next two sections ask for information on your company's spending patterns in North Dakota.

Section One–Expenditures as a Percentage of Revenues

Please Note:

It is important for our study that we be able to distinguish the difference between revenues earned in North Dakota versus expenditures made in North Dakota. This holds for both firms headquartered out-of-state and firms that are headquartered in North Dakota.

When answering the following question, we want you to think about only your business activities in North Dakota and how much your company spends (expenses and costs) in the state relative to your gross revenues from North Dakota sources.

Please estimate (make an educated guess if needed) what percent of your company's gross revenues associated with the petroleum industry in North Dakota are spent in North Dakota.

_____ percent

Section Two--Expenditure Patterns in North Dakota

Please think about your company's cost of doing business in North Dakota. We would like you to estimate (or guess if needed) the approximate level of business expenses your company had in 2005.

General estimates for these figures are sufficient (e.g., $2,000 in supplies, $100,000 in services).

Types of Expenditures in North Dakota	Expenditures in North Dakota in 2005
Wages and Salaries	
Office expense *(e.g., computers, software, photocopying, paper, postage, other supplies, office rent/lease, office equipment, subscriptions for magazines and periodicals)*	
Interest and Insurance *(examples include bank expenses, loan interest, liability and casualty premiums)*	
Communications and Utilities *(examples include phone, Internet, electricity, water, natural gas, sewer, garbage, etc)*	
Supplies and Equipment *(examples include vehicles, industrial equipment, specialized machinery, fuel, lubricants, tires, tools, hardware, building materials, replacement parts, and miscellaneous inputs)*	
Services *(examples include repairs and maintenance, tax preparation, construction work, legal, meals, lodging, snow removal, shipping and transportation, and any miscellaneous business service)*	
North Dakota Taxes Property taxes	
Other taxes (*income, unemployment)*	
Licenses, Permits, and Government Fees	
Other Expenses (*please specify the expense*)	

Thank You for completing this questionnaire!

Please return the questionnaire in the postpaid envelope.

If you would like a copy of the study results mailed to you, make sure you have provided a mailing address in Part I of the questionnaire. Otherwise, you may contact Carol Jensen in the Department of Agribusiness and Applied Economics at North Dakota State University for more information on our departmental reports. Phone 701-231 7441, fax 701-231-7400, email: cjensen@ndsuext.nodak.edu or visit our departmental listing of research reports on the internet at http://agecon.lib.umn.edu

Study results should be available in the winter of 2007.