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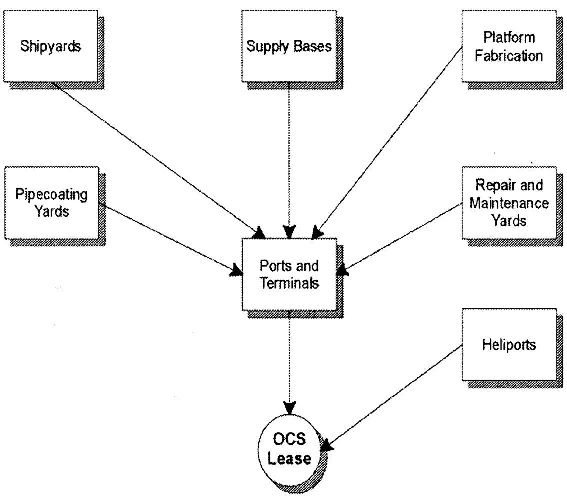
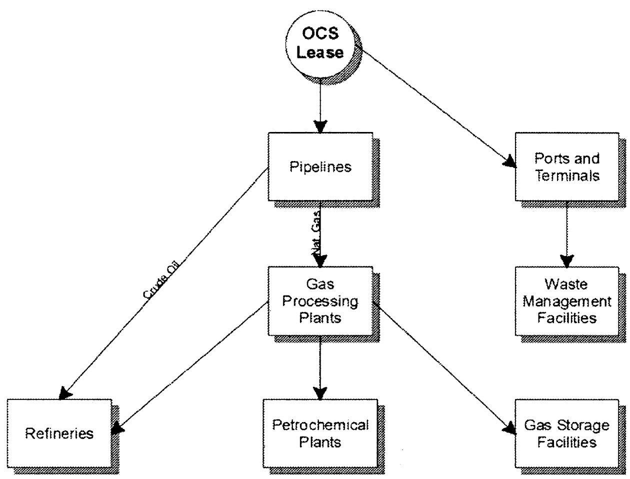
MMS 2003-018

Coastal Marine Institute

Modeling the Economic Impacts of Offshore Oil and Gas Activities in the Gulf of Mexico: Methods and Applications





U.S. Department of the Interior
Minerals Management Service
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ABSTRACT

Recent changes in oil and gas activities on the Gulf of Mexico (GOM or Gulf) Outer Continental Shelf (OCS) have sparked interest in the economic impact that these activities have on coastal regions. Over the past several years, the MMS has initiated a number of different research projects of increasing degrees of sophistication, attempting to examine the relationship between OCS activity and the socioeconomic environment of coastal regions on the GOM. Recent MMS approaches have included the use of a common methodology known as Input-Output (I-O) modeling. I-O models examine relationships between industries and other economic agents within an economy. The mathematical formulae used to construct an I-O allow a researcher to simulate the effects that a change in one or several economic activities has on the entire economy.

A shortcoming with most I-O analysis is that the impact drivers (or multipliers) in the model are typically taken from sampled, nation-wide survey data. One primary driver in these models is the production function (or cost function) matrix that is an industry-specific calculation dividing commodity-specific input expenditures by total commodity input expenditures. These ratios are generally calculated from nationally, rather than regionally, relative production expenditure profiles. Such an approach assumes that industries in any given area will use inputs in the same proportion as the national average. For oil and gas firms operating on the Gulf OCS, this assumes that input expenditures are made in the same proportion as the national oil and gas industry average. Such an approach averages production costs shares from such varied regions as Alaska to the offshore GOM.

This report addresses a number of methodological shortcomings in the application of I-O analysis to the oil and gas industry. Our report presents examples of how the two approaches present differing empirical conclusions and why some modifications are in order. We offer a number of practical and applied alternatives to existing methods, as well as suggestions on improving production function and other standardized input data, to improve the understanding of how the oil and gas industry impacts coastal communities. We use coastal Louisiana as a case study for examining the implications of our work.

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Section 1: Introduction: Why Examine Economic Impacts?

The impact of oil and gas activities on communities surrounding the Gulf of Mexico (GOM) has become increasingly more pervasive since offshore activities began in earnest in 1947. While there have been numerous intermittent studies of the economic impacts these offshore activities have had over the years, no regular, comprehensive approach has been developed by either government, industry, or academia. The purpose of this research has been to assist the MMS in developing a new and inclusive approach for understanding the economic impacts of offshore oil and gas activities on GOM coastal communities.

This research has three goals. First, to compile information on per unit costs associated with a host of different OCS oil and gas activities over a number of different water depths. Second, and most importantly, to develop an industry-specific expenditure profile for a number of different OCS oil and gas activities, over a number of different water depths. Third, to develop a general onshore allocation mapping for expenditures, by industry classification, to various GOM coastal communities. Before discussing the issues associated with industry costs, this introduction will outline the importance and role of the MMS in examining economic impacts of coastal communities. This discussion is followed by an overview of past economic impact studies on offshore activities, followed by a discussion of the methods used to estimate offshore industry cost characteristics and impacts.

1.1 The Role of the Minerals Management Service: The economic impact of offshore activities has become an increasingly important issue to the Department of Interior, Minerals Management Service (MMS). A very large portion of this research is subsumed within the agency's Environmental Studies Program (ESP) and defined in its National Strategic Plan (NSP).

The ESP Strategic Plan addresses a wide variety of environmental concerns and issues on a national scale by identifying emerging and ongoing program areas. It complements and builds upon broader strategic plans that set agency-wide policies and directions. Within these broad issues or themes, multi-disciplined studies will be developed, as budget allocations allow (LTG Associates, Inc., 2000).

The socioeconomic studies component of the program:

- Provides information essential to understanding the consequences of OCS-related activities for the populations, economies, and social and cultural systems in areas where the activities occur;
- Supports the MMS's planning and management processes; and
- Provides information essential for effective interaction with the public about the effects of OCS activities (LTG Associates, Inc., 2000).

MMS' primary legal mandate to analyze the socioeconomic impacts of natural resource management issues is provided in both the Outer Continental Shelf Lands Act, as amended in

1978 (OCSLAA), and the National Environmental Policy Act of 1969 (NEPA). Section 18 of the OCSLAA mandates that MMS management of the OCS shall consider the "economic, social, and environmental values of the renewable and nonrenewable resources contained in the Outer Continental Shelf, and the potential impact of oil and gas exploration on other resource values of the marine, coastal, and human environments" (43 USC 1344). "Human environment" includes "the physical, social, and economic components, conditions, and factors which interactively determine the state, condition, and quality of living conditions, employment, and health of those affected, directly or indirectly, by activities occurring on the Outer Continental Shelf…"(43 USC 1333).

NEPA requires federal agencies engaged in significant land actions to assess impacts, including those on the human environment, through the process of conducting Environmental Impact Statements (EIS) (MMS, 1996). The Council on Environmental Quality's (CEQ) Regulations for Implementing the Procedural Provisions of NEPA state that the human environment is to be "interpreted comprehensively" to include "the natural and physical environment and the relationship of people with that environment" (40 CFR 1508.14). An action's "aesthetic, historic, cultural, economic, social, or health" effects must be assessed, "whether direct, indirect, or cumulative" (40 CFR 1508.8). CEQ regulations state that when "economic or social and natural or physical environmental effects are interrelated, the EIS will discuss all of these effects on the human environment" (40 CFR 1508.14).

Over the past several years, the ESP has become increasingly engaged in the socioeconomic research of coastal communities in support of its EIS mission for the GOM Region (GOMR). In the past 10 years, the quantity of research funded under this program has tripled. While one cannot predict funding levels in years to come, a recent meeting of social scientists and researchers indicated that interest and commitment to these issues will continue to be strong.

Of the three major MMS regions (Alaska, Pacific, and Gulf of Mexico), the Gulf of Mexico appears to have a pressing need for continued socioeconomic impact analyses. The Gulf, in addition to providing a significant number of reserves and production, is also undergoing unique developments in both deepwater activity (900 meters and deeper) and the potential development of frontier areas in the eastern Gulf off the coast of Florida. In addition, drilling moratoria and uncertainties in the Pacific and Alaska make GOMR the only place where significant action is envisioned over the next several years.

1.2 Examination of Past Economic Impact Studies and Methods: As early as the mid-1980s, the GOMR began its efforts to model the implications that offshore development had on coastal communities. For close to 10 years, however, a good portion of these regional modeling initiatives focused more on past consequences of OCS oil and gas development than on predictive or forecasting methods. These initiatives could be broken into two general categories: (1) individual historic "consequences" analyses; and (2) the development of baseline analyses (Luton and Cluck, 2000). Information from both types of studies was regularly used as a basis for understanding economic impacts to local communities for EIS purposes.

This study employs an Input-Output (I-O) modeling framework. Such an approach attempts to shift the direction of analysis away from historical consequences and towards more forward-looking impacts. Over the past several years, there has been a concerted effort by the MMS to develop increasingly more sophisticated modeling approaches that incorporate both quantitative rigor and applied realism. One of the first studies to examine offshore activities from a more rigorous and applied perspective was conducted by Foster Associates (FA Study) for the federal waters off the coast of Alabama (Kelley and Wade, 1999; Wade and Mott, 1998). The FA Study revealed a number of unique expenditure patterns that were required to support production of caustic (high H_2S) natural gas. The results of the FA Study help move MMS in the direction of: (1) employing I-O models as a basis for measuring the economic impact of all offshore activities and (2) incorporating real-world differences in the production characteristics of particular offshore areas.

The FA Study also highlighted one of the major advantages of moving forward with the use of I-O models – their ability to allow a researcher to simulate the effects that a change in one or several economic activities would have on the entire regional economy. It is predictive in the sense that the economic impacts associated with hypothetical events, like the opening of several new offshore blocks in the Gulf of Mexico, can be quantitatively modeled. The approach is also comprehensive since the I-O structure allows researchers to understand how exogenous shocks impact entire regional economic systems, and not just the limited impacts on particular sectors like only oil and gas activities.

In addition to breadth, these studies also provide depth of quantitative information. I-O techniques offer the advantage of measuring the direct, indirect, and induced impacts associated with offshore activities. The indirect and induced impacts are commonly referred to as "multiplier impacts" associated with a direct economic shock. These multiplier impacts quantify the idea that a dollar impact has ripple effects throughout a regional economy.

1.3 Purpose of This Study: As noted earlier, a common shortcoming with most I-O analysis is that the impact drivers (or multipliers) in the model are typically taken from national, as opposed to regional trends and industries. Such an approach assumes, among other things, that industries in any given area will use inputs in the same proportion as the national average. For oil and gas firms operating on the Gulf OCS, this assumes that input expenditures are made in the same proportion as the national oil and gas industry average. Not only does such an approach assume regional similarities, but it also assumes that onshore and offshore production functions are similar. It is this last problem that causes the most difficulty in using existing regional I-O models to examine the economic impacts of offshore activities. The purpose of this research is to discuss methodological and data collection methods that can help remedy this potential problem and results of specialized data collection.

There are a number of methodological issues associated with modeling something as complicated and multifaceted as the offshore oil and gas industry. The research goal here is not to address every methodological issue, but concentrate on four of the more important issues that were identified by MMS. These four research issues include:

(1) Defining unique offshore expenditures, and their relevant industry classifications/sectors, and incorporating these into a standard economic input-output framework;

(2) Defining expenditure profiles for specific offshore activity phases and water depths;
(3) Allocating activity-specific offshore expenditures to onshore areas; and
(4) Identifying the total costs associated with each of the “typical” activities in each respective water depth category.

Over the past several years MMS has moved toward more quantitative, forward looking economic impact models. The purpose of the study is to assist in moving this initiative several steps further. In addition, a case study is developed that examines the implications of offshore activities, using the new methods identified above, for coastal Louisiana.

Section 2: How Are Economic Impacts of Offshore Activities Modeled?

2.1 Defining Offshore Expenditure Profiles: The exploration, development, operation and eventual decommissioning of offshore facilities is a considerable logistic challenge. These challenges are often revealed in the types of expenditures that are made by offshore operators. Thus, the first step in an analysis of this sort is to define a relevant set of expenditure categories taking into account many of the unique offshore oil and gas activities. Some of the expenditure categories that have unique implications for offshore oil and gas activity phases include:

> *Water and Air Transportation:* Modes of transportation that are important in moving both personnel and equipment from onshore supply and staging bases to areas supporting offshore activities;
>
> *Food and Catering Services:* Often food and catering services are contracted by offshore operators to feed crews supporting exploration, development, and production activities;
>
> *Water Supply:* Potable water for drinking, as well as water for certain types of drilling muds, lubricants, and fluids, have to be transported to offshore areas;
>
> *Waste Disposal:* While this activity is important to both onshore and offshore activities, transportation and onsite storage can create a number of unique logistical challenges to offshore activities;
>
> *Turbines and Fuel:* Most offshore platforms have both primary and secondary power generation equipment as well as primary, and in some cases secondary, fuel to operate these generators; and
>
> *Communications, Instrumentation and SCADA (supervisory control and data acquisition) Systems:* Digital and mobile technologies have had a growing importance for offshore activities.

During the course of this research, MMS was provided with a comprehensive listing of the unique expenditure categories, and their IMPLAN sector identifications. The categories used in modeling the economic impacts of offshore activities have been provided in Table 2.1.

Table 2.1: Offshore Expenditure Categories

IMPLAN Sectors	Sector Description	IMPLAN Sectors	Sector Description
38	Oil & Gas Operations	399	Transportation Equipment, NEC
50	New Gas Utility Facilities	401	Lab Equipment
53	Msc Nat Resource Facility Construct	403	Instrumentation
56	Maintenance and Repair, Other Facilities	435	Demurrage & /Motor Freight
57	Other Oil & Gas Field Services	436	Water Transport
160	Office Furniture and Equipment	437	Air Transport
178	Maps and Charts (Msc Publishing)	441	Communications
206	Explosives	443	Electric Services
209	Chemicals, NEC	444	Gas Production/Distribution
210	Petroleum Fuels	445	Water Supply
232	Hydraulic Cement	446	Waste Disposal
258	Steel Pipe and Tubes	454	Eating/Drinking
284	Fabricated Plate Work	455	Msc Retail
290	Iron and Steel Forgings	459	Insurance
307	Turbines	462	Real Estate
311	Construction Machinery & Equipment	469	Advertisement
313	O&G Field Machinery	470	Other Business Services
331	Special Industrial Machinery	473	Msc. Equipment Rental and Leasing
332	Pumps & Compressors	490	Doctors & Veterinarian Services
354	Industrial Machines, NEC	494	Legal Services
356	Switchgear	506	Environmental/Engineering Services
374	Communication Equipment, NEC	507	Acct/Msc Business Services
392	Shipbuilding and Ship Repair	508	Management/Consulting Services
		509	Testing/Research Facilities

<u>2.2 Defining Offshore Activity Phases:</u> Another important area of examination is defining the relevant offshore activity phases. Most I-O models, as well as National Income and Product Accounts (NIPA), treat oil and gas activities in a highly aggregated manner. As noted before, onshore and offshore activities are rarely separated, and even then, are aggregated into either drilling or production activities. MMS, however, must consider a range of offshore oil and gas activity phases over relatively long periods of time.

The activity phases that were defined by MMS as being important for socioeconomic modeling purposes include: Exploratory Drilling; Development Drilling; Platform Fabrication and Installation; Pipeline Fabrication and Installation; Pipeline Operation and Maintenance (O & M); Gas Processing Installation O & M; Production; Workovers; Oil Spills; and Platform Removal & Abandonment.

For typical EIS analyses, socioeconomic analyses will begin with a forecast of activities (in units) for each of the above activity phases. These forecasts are developed independently by the GOMR Office of Resource Evaluation Division within MMS. These units, when multiplied by total costs, yield the total potential economic shock resulting from that activity. Thus, if a given potential lease sale is forecasted to yield five (5) new exploratory wells at an average total cost of

$4 million per well, then the total direct economic shock would be $20 million. The next step in the process is to allocate this $20 million impact by the expenditure profile developed for exploratory drilling.

It is important for impact modeling to develop different expenditure profiles by activity phase given their tendency for variability and substantial compositional differences. In addition, there is a tendency for expenditure patterns, and their relative compositions, to shift as the development of a potential lease matures. This has implications for economic impacts since many expenditures can move from more capital intensive, construction-oriented activities in the exploration, development, pipeline, and gas processing construction phase, to more labor intensive, maintenance oriented activities in the production, workover, gas processing and transportation activities.

For instance, steel pipe expenditures can represent anywhere between 35 to 59 percent of total expenditures during platform fabrication activities yet represent only three percent of total expenditures during the production phase. Likewise, instrumentation costs can represent close to three percent of total expenditures during production but could be a relatively insignificant cost during all other offshore activity phases.

2.3 Defining Relevant Water Depths: Another methodological challenge rests with modeling variations in expenditure profiles across water depths. For instance, should, or do, expenditure profiles change as offshore activities move into deeper waters? One might think that there is a positive relationship between certain relative costs and water depth. Water transportation costs comes to mind as being a relative cost that should increase as water depth, and hence distance, increases. However, the unique realities of offshore activities, coupled with inconsistencies in data collection and (internal) reporting, can lead to significant challenges in what should appear to be an obvious conclusion. Table 2.2 presents an example of expenditures for development drilling where shifts in expenditure trends are obvious for Sector 38 (oil and gas operations).

Table 2.2: Expenditure Profiles for Development Drilling by Water Depth

Sectors	Sector Description	0-60 Meters	60-200 Meters	200-900 Meters	900 + Meters
38	Oil & Gas Ops	0.65341	0.52344	0.64192	0.69198
57	Other Oil & Gas Svc	0.03447	0.02107	0.04069	0.03348
210	Petroleum Fuels	0.02746	0.03349	0.03049	0.02664
232	Hydraulic Cement	0.06566	0.11871	0.07490	0.06410
258	Steel Pipe and Tubes	0.07104	0.15527	0.06077	0.05149
313	O&G Field Machinery	0.01545	0.01524	0.01039	0.00947
403	Instrumentation	0.04110	0.04222	0.04375	0.03817
436	Water Transport	0.08355	0.08276	0.08873	0.07739
437	Air Transport	0.00787	0.00780	0.00836	0.00729
Total		1.00000	1.00000	1.00000	1.00000

2.4 Defining the Onshore Allocation of Offshore Activities: The allocation of expenditures to onshore areas is probably one of the more important factors for determining the region-specific economic impacts associated with offshore activities. These break-outs are important because they define the localities that are most affected by what happens offshore. There are historic tendencies for certain onshore support activities to be concentrated in particular geographic areas. This concentration has historically been primarily in Louisiana and Texas, and has continued despite the movement of offshore activities into deeper water and into the Central-Eastern portions of the Gulf of Mexico.

Part of this research included the development of allocations for offshore expenditures, by commodity categories outlined in Table 2.1, to the 10 major onshore regions defined by MMS that has been presented in Figure 2.1. Additional areas included in the analysis include the non-coastal Gulf of Mexico, and Rest of US/World (ROW).

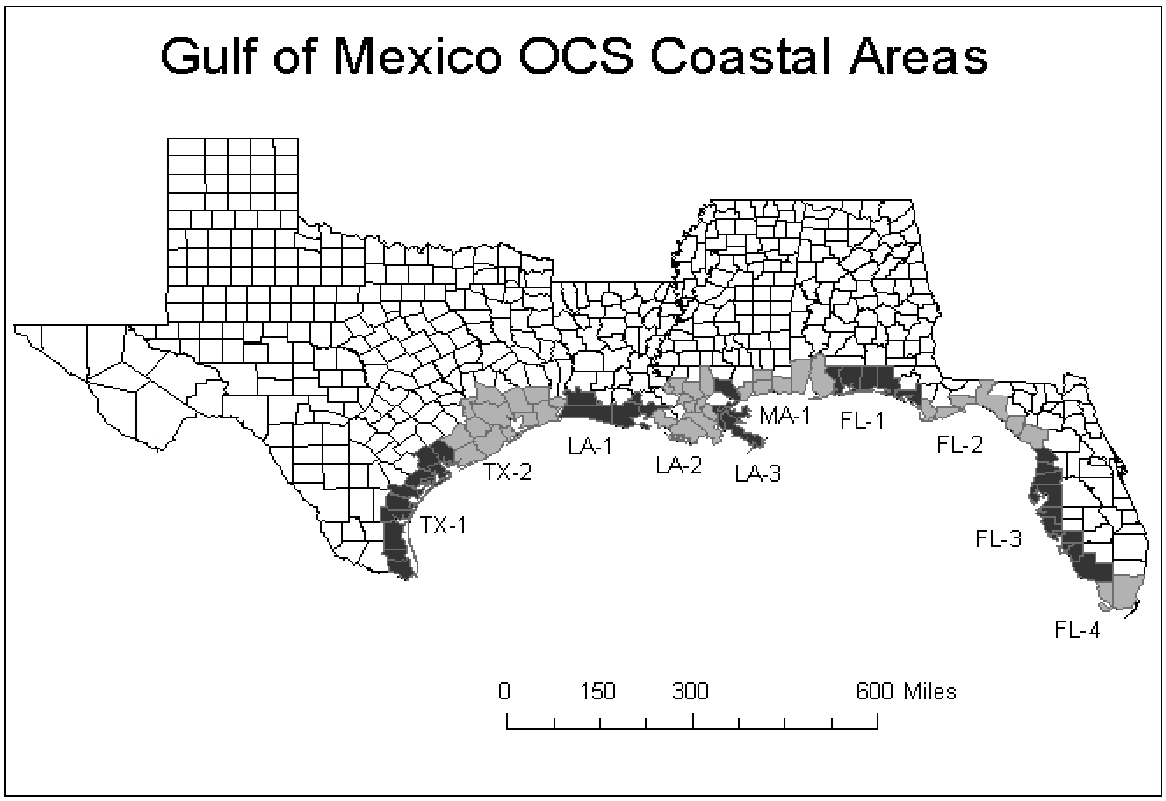

Figure 2.1: MMS Gulf of Mexico Coastal Areas.

2.5 Data Collection Issues and Challenges: During the course of this analysis, two data collection issues became particularly important:

(1) How to identify, locate, and secure reliable sources of information that did not require the use of survey instruments; and

(2) How to reconcile reported accounting information to economic factors examined in traditional input-output modeling.

The first issue was the more problematic of the two and one that can confound time-sensitive MMS social science research. This research needed to find a way to collect information that did not use survey or survey-type instruments. Therefore, mailing survey questionnaires to numerous companies operating offshore was not allowed. This restriction on data collection is placed on MMS, and other federal agencies by the Paper Work Reduction Act of 1980, which was reauthorized in 1995.

This purpose of the Act is to minimize the paperwork burden the federal government places on the public and to improve the quality and use of federal information (Lauterbach, 2000). The Act also requires each federal agency to seek and obtain approval from the Office of Management and Budget (OMB) before requesting information from ten or more persons. Furthermore, any reporting, record-keeping, or disclosure requirement contained in a rule is deemed to involve ten or more persons. OMB approval is also needed to continue a collection for which OMB's approval and the validity of the OMB Control Number are about to expire. OMB usually approves a collection for a maximum of three years.

In order to use a survey-based approach for this research project, a survey instrument review process would have been initiated that, under the best of situations, would have taken six to eight months. Another four to six months probably would have been required to execute the survey, assuming the best of luck on survey responses and data collection. This project, like many MMS-funded research projects, was time sensitive, and needed for immediate use. OMB survey requirements, in this instance, seemed too onerous to use as a vehicle for collecting this type of information.

An alternative approach was to compile the required information from a variety of different sources, which varied by offshore activity phase. In general, secondary source information was scoured. This included a review of all relevant government, industry, trade, and academic publications, periodicals, and databases. Some of these publications were readily available and straightforward. For instance, there is considerable information on drilling expenditures and patterns in the *Joint Association Survey of the U.S. Oil and Gas Producing Industry* compiled annually and published (jointly) by the American Petroleum Institute (API), the Independent Petroleum Association of America (IPAA), and the Mid-Continent Oil and Gas Association. Likewise, there is considerable information on pipeline construction costs and expenditures that are required filings regularly made before the Federal Energy Regulatory Commission (FERC).

When direct "secondary" sources of published information were unavailable, the research was forced to turn to information requests from industry, or to rely on trade association information and surveys previously (and independently) compiled. These requests were limited and did not violate the spirit or intent of the Paperwork Reduction Act. Information gathered in this process was simply used to "fill-in-the-blanks" from the search of secondary sources of information.

An additional data issue associated with this project was reconciling disparate documents and information, most of which were provided in accounting-based formats, into economic information for modeling purposes. Accounting information, for instance, rarely makes distinctions between fixed and variable costs or clear cut differentiations between capital and labor. Likewise, expenditures are made by types which may not have a readily apparent or even mixed-industry classification. Thus, a painstaking process of reviewing accounting information on a line by line basis was required. Because both accounting entries and the economic classifications included in Appendix Table B.5 are limited, judgment calls were required to separate a limited amount of information into limited classifications.

The process of utilizing judgment on some classifications was most apparent in dealing with contracted services. Many costs associated with offshore activities would appear as contracted services from one firm to another, although both were engaged in the same activity. For instance, a company developing an exploratory well(s) would often, particularly in shallow water, contract drilling services out to a separate company. This company, in turn, would have direct expenditures for labor, materials, equipment, and other items that would "escape" the data collection process. The data received for this research, usually from the E & P Company initiating a drilling project, recognized a drilling contractor was utilized, but was unable, from that point, to identify subsequent expenditure allocation. Admittedly, this has led to slight biases (overstatements) in general categories such as IMPLAN sector 38 (oil and gas operations) or Implan sector 57 (other oil and gas field services).

Section 3: Alternative Methods and Approaches to Modeling Economic Impacts

The previous section of this report outlined the main methodological issues associated with developing unique offshore production function, total cost, and allocation information. This section, divided into two parts, will discuss the actual mechanics of compiling information in each area. First, the production function and total cost information analysis, per activity phase, is discussed. Second, the collection and results from the onshore allocation analysis is described.

3.1 Exploratory Drilling: The first task undertaken was a comprehensive search for information that decomposed costs into specific cost categories for exploratory drilling activities. Such information would facilitate the development of an expenditure profile. This research canvassed a number of areas that included trade journals and magazines, technical reports, government research and analysis, and the academic literature. The research revealed little to no publicly available information. The only source identified was a drilling cost survey conducted by the Independent Petroleum Association of America (IPAA) in the early 1990s. The purpose of this IPAA survey was twofold: it examined cost allocations (expenditure profiles) for typical drilling activities, and it attempted to track cost inflation, by component, across time. This survey, unfortunately, suffered from two shortcomings. First, it examined only onshore drilling and equipping wells. Second, the survey was discontinued for cost reasons in 1994, and even here was aggregate continental United States data.

Given the lack of available information, the research turned to alternative information sources. The first alternative source of information that was relied upon came from industry. A number of industry sources offered accounting information on booked annual expenditures for exploratory wells. These accounting reports are referred to as either Allowances for Expenditures (AFE) or "Post Well Critiques." The information is provided in an accounting format, and more specifically, in the accounting format of any given company providing the information. The challenge in using this data was to take identified expenditure categories and reconcile them to standard Implan codes.

The second source of information relied upon was a type of engineering project cost estimation software known as Fieldplan Pro. This software, developed by Brown and Root, is regularly used by the MMS GOMR Office of Resource Evaluation for a variety of purposes. This software is developed in a manner that allows users to "price-out" a particular oil and gas project under different drilling and/or production configurations in the Gulf of Mexico. In this portion of the analysis, a number of hypothetical projects in the Gulf were developed and run through the Fieldplan Pro software. The Fieldplan output was then compared to expenditure profiles that were provided by industry. The output from Fieldplan served as both a data input, and "sanity check" for industry provided information. Other studies of offshore activities have facilitated a similar approach.[1]

The use of the Fieldplan software was instrumental for three reasons. First, and foremost, the Fieldplan software can provide information on a number of "blanks" when publicly available information was missing. Second, Fieldplan provides a different engineering-oriented

[1] See MMS Royalty Relief Study (p. 10). The approach is similar in many respects to that taken in a recent National Energy Technology Lab (NETL) study on marginal properties in the GOM.

perspective in understanding the difference in cost and expenditure allocations. Third, Fieldplan breaks costs into categories without any assumption on who performs those functions. This helps avoid the problem associated with contracting services. All costs are "internalized."

Appendix Table A.1 presents a breakout of the estimated exploratory drilling expenditure profiles. Expenditure profiles for each water depth have been presented in a column. The far right column presents a simple average across all water depths. The overwhelming proportion of expenditures for exploratory drilling falls into Implan Sector 38: Oil & Gas Operations. This sector classification is essentially a "catch-all" category for a number of different activities that includes technical engineering work, drilling work, mobilization, site preparation, rig moving expenses, among others. After consultation with industry sources, it was concluded that a large portion of shallow water drilling costs were allocated to contractor services. As operations moved into deeper waters, more of these activities tended to be performed by more in-house personnel, hence the relative decrease in Implan Sector 38 activities. The remaining expenditure categories include: oil and gas field services; instrumentation; and transportation (air and water).

Deviations across water depth were relatively minimal since the output from Fieldplan Pro was relied upon quite heavily. This is particularly true for Implan Sector 38 expenditures, which is the main cost driver. Such trends were not true with our industry-specific data, which showed considerable leaps across water depths. For instance, the information that was provided by industry data showed higher percentages, 72.5 percent for sector 38 expenditures in the lower water depth category (0-60 meters) as opposed to deeper water depths (900 meters and deeper) where expenditures were only 51.7 percent. Clearly this was a problem of both cost/accounting categorization, as well as the fact that the "sample" of companies, from which actually information was collected, was limited.

The next major task was to gather estimates of the total costs for exploratory drilling on a per well basis. Total cost estimates serve as the mechanism for creating the direct shock associated with exploratory drilling. Thus, if the cost for any given exploratory well is $4 million, then the addition of 4 new exploratory wells will generate a $16 million direct shock or impact on coastal economies.

Total cost information comes from total cost survey data generated through the American Petroleum Institute's (API) Joint Industry Association Survey for the year 1999. API made total annual costs, associated offshore drilling, available to our project. The next step in examining these total costs was to reconcile water depths associated with the survey to those used by MMS. As seen in Appendix Table A.13 there is a minor anomaly associated with drilling costs in the 60-200 meter category. Costs per well fell from $4.2 million in 0-60 meters to $3.2 million in 60-200 meters. Such a trend is counter to the expectation that drilling costs should increase as water depth increases.

There may be a reasonable explanation for this result. First, this information is collected from survey data, and the number of wells in the 60-200 category is substantially lower than any of the other sample categories. Second, and more importantly, the average total drilling depth (sub surface) is much shallower for wells located in 60-200 meters of water than in other water depth categories. These drilling depths, and their associated water depth categories are presented below.

Table 3.1: Comparison of Water Depth and Exploratory Drilling Depth

Water Depth (Meters)	Survey Number (Wells)	Total Drilling Depth (Feet)
0-60	36	9,898
60-200	21	7,705
200-900	48	10,846
900 and deeper	88	13,031

<u>3.2 Development Drilling:</u> Research associated with development drilling proceeded along virtually the same lines as that was discussed in exploratory drilling. Publicly available information was queried yielding no sources that separated offshore development spending profiles. The estimation, therefore, turned to the use of a combination of informally provided industry sources and Fieldplan Pro simulations. Industry sources, in development drilling activity, were comprised of one major oil company and one independent (for shallower water depths).

The results from the estimated expenditure profile are presented in Appendix Table A.2. The results, like exploratory drilling, are relatively stable, however there are a few areas of interest that should be pointed out. The first is that there is a noticeable drop in expenditure percentages corresponding to the more generalized oil and gas activity sectors (Sector 38 and Sector 57) in the 60-200 meter water depth category. This shift is offset by relative increases in mud (Sector 232) and piping (Sector 258). This shift could be a reflection of changes in total drilling depth that are substantially more noticeable in development drilling than in exploratory drilling.

Another noticeable development is the expected shift in expenditures, from exploratory to development drilling, as wells are prepared for production activities. There is a noticeable shift, for instance, towards greater relative expenditures in mud (Sector 232), piping and tubes (Sector 258), and oil and gas field machinery (Sector 313).

Total development drilling costs also came from the 1999 API Joint Industry Association Survey. These costs have been provided in Appendix Table A.13. Like exploratory drilling, there is a noticeable drop in unit costs at the 60-200 meter water depth level. The rationale for these decreases are similar in nature to the ones identified in exploratory drilling. In addition to the smaller sample sizes in the 60-200 meter category, there were significant differences in total drilling depth associated with development wells in the 60-200 meter water depth. Development drilling depths fall in the 60-200 meter category, relative to other water depths: hence, the paradoxical shift in drilling costs for this water depth category. Both of these statistics have been presented below.

Table 3.2: Comparison of Water Depth and Development Drilling Depth

Water Depth (Meters)	Survey Number (Wells)	Total Drilling Depth (Feet)
0-60	86	8,868
60-200	72	5,438
200-900	117	11,128
900 and deeper	137	15,255

3.3 Production Costs: The analysis of offshore oil and gas production costs started with a survey of publicly available information. The API Joint Industry Association Survey is perhaps the most readily available and recognized source of information on total cost. However, there is little recognized work that examines production expenditure profiles. In this investigation, however, an existing source of information was available. This source, published by the U.S. Department of Energy, Energy Information Administration (EIA), is entitled *Cost and Indices for Domestic Oil and Gas Field Equipment and Production Operations*. As noted in the publication, several past efforts in measuring production cost (by component) no longer exist. The annual DOE report represents the sole source of information on oil and gas production cost components. During the course of this research, EIA made a number of the detailed workpapers associated with calculating production costs available.

The EIA approach in estimating production costs is based upon a “price-out” approach to production at an offshore lease. In order to “price-out” a typical operation, EIA analysts spend the better part of 12 months collecting cost information from vendors supporting all types of activities from workovers to communications to catering. These surveys are conducted annually prior to report publication. In addition to vendor information, other service and equipment costs are collected and tabulated. EIA engineers then use a typical offshore configuration to add-up all equipment and service costs. These cost components are relatively constant over time allowing for cost indices to be developed.

EIA workpapers made available to this research were decomposed in a number of different ways. First, EIA cost information was to match the existing Implan Sector codes. Data was adjusted to remove the costs associated with well workovers, that were examined separately, and will be discussed in a later section of this report. The second step in the analysis was to take the adjusted EIA expenditure profile and calculate the relative percentages associated with the remaining cost data.

Appendix Table A.3 provides the breakout of the estimated expenditure profile for oil and gas production. The relative breakouts are stable enough to not warrant any considerable alarm, yet there are some differences worthy of note. First, Sector 38: Oil & Gas Field Operations, which consists primarily of engineering functions, is stable in absolute value across water depths. On a relative basis, however, these activities decrease in the deep-water categories since a number of other activities are strongly influenced by water depth. This is most notable in both air (water decreases as a percentage) transportation and insurance costs, which increase dramatically as operating water depth is increased.

Clearly, transportation costs increasing as water depth, and hence, distance, increases probably comes as no surprise. What is interesting, however, is the increase in insurance costs. Theory suggests that insurance premiums should increase as the net expected value of a loss increases. This can change by either higher probabilities of a loss, or increased value of lost equipment, production, property, and life associated with deeper water activities, ceteris paribus.

Total costs were developed using the EIA price-out approach. These total (annual) costs have been presented in Appendix Table A.13. These costs appear to be reasonable and follow relatively stable trends. Costs are increasing over water depth, but in a fashion that seems to account for strictly depth-specific costs such a transportation (deeper water translates roughly to further distances) and insurance (deeper water translates into higher expected value of a loss associated with an offshore accident).

3.4 Platform Fabrication: Publicly available information on platform fabrication is sparse. Some recent media reports, for instance, have been known to cite total cost estimates for constructing platforms, yet these reports are usually sporadic, isolated, and focus on the more recent (deepwater) projects. In addition, these reported figures can often clutter total project cost information with total platform-specific costs.

Early in the project, some generalized, but highly subjective information, from the University of New Orleans School of Naval Architecture was secured. The opinion oriented nature of the information, along with the lack of breadth in its scope led to searches for supplementary and corroborating information. Given the lack of published alternative information, this research turned to the Fieldplan simulation tool as a source for verification and to supplement the information provided by UNO.[2]

Fieldplan runs examined three different construction options within each different water depth. Each option, however, was limited to a "typical" type of platform/offshore structure. In the 0-60 meter water depth, for instance, three different fixed platform structure configurations were examined. The 60-200 meter category also examined fixed structures of a much larger scope than those employed in shallow water. In the 200-900 meter category, the fabrication/installation of three different types of tension leg platforms (TLP) were examined. In the 900 meter and deeper category, three different configurations of a Spar were used as the typical platform technology.

The next step in the analysis was to classify each of the engineering cost components to Implan codes. Subsequently, a set of blended estimates was developed based upon the three simulations.

[2] UNO was sent a table of likely platform fabrication cost components and asked to "populate" the table based upon subject matter expertise across various water depths.

The blended estimates from Fieldplan were compared to those provided by UNO. Fieldplan estimates were selected over the UNO estimates since these estimates tended to be more detailed, and appeared to have less of a subjective composition.

The production function for platform fabrication has been included in Appendix Table A.4. An examination of this table shows a number of interesting trends as water depths are increased. Most noticeable is the fact that the percentage of expenditures in shipbuilding and ship repair (Sector 392) falls as depth increases. This suggests that a good amount of shipbuilding and ship repair is increasing at a rate that is less than other components as operations move across deeper water depth categories.

The relative cost share of steel pipe and tubes (Sector 258) increases. Unsurprisingly, transportation costs associated with placing the structures (air and water) increase with water depth, and hence distance, increases. Most of the other remaining categories, reflecting expenditures on equipment, machinery, pumps and turbines, are relatively constant.

For consistency purposes, total platform fabrication costs were developed from the Fieldplan simulation tool. These total cost estimates were generated by blending (or averaging) the three different platform configurations for each water depth category. This is a reasonable approach in developing total platform fabrication costs since total cost simulation is ultimately one of the primary purposes of the Fieldplan software.

3.5 Pipeline Construction and Operation: The original research design for this project anticipated having one category for all pipeline activities. However, early in the process, it became apparent that there should be some differentiation between construction-oriented activities and operation-oriented activities associated with pipelines. Construction-oriented activities, for instance, tend to have relatively larger, but one-time, economic impacts on local communities. Impacts associated with operations, while longer term in nature, have minimal employment and direct economic impacts. Thus it is important to separate pipeline activities, so that future MMS modeling would be able to minimize potential modeling errors and biases on a forward going basis. This could become an increasingly important problem as MMS EIS' focus on the impacts of deeper water development where there is less developed pipeline infrastructure.

Offshore pipelines that are not gathering systems are regulated by the Federal Energy Regulatory Commission (FERC), under the Natural Gas Act (NGA), as well as the Outer Continental Shelf Lands Act (OCSLA). Because of their regulated status, offshore pipelines are required to file annual reports with the FERC. The FERC requires all cost and capital expenditure information to be reported in a consistent manner. For natural gas pipelines, this information is required to be filed in what is referred to as the FERC Form 6.

Given the detailed and highly reliable nature of the FERC Form 6 data, we used this information as the basis of the analysis of pipeline construction and operation expenditure. However, before discussing how this information is utilized, it should be noted that FERC information is not without its potential limitations as well. First, like other information collected in this project, FERC data is accounting oriented by nature and was not collected with economic impact modeling in mind. Second, FERC information could have certain biases since major transportation companies, that have both onshore and offshore operations, will dominate the sample.

In terms of using the FERC information, the initial challenge was to separate the important from unimportant information. The first report examined was the balance sheet, or capital asset composition, for each offshore pipeline company. In examining this information, the analysis concentrated on only those companies with offshore assets that file a FERC Form 6. The second report we examined was the income statement, that highlights major annual expenditures associated with output, or in this case, through-put.

The first task was to remove companies from both reports (balance sheet and income statement) that did not have offshore assets. The second step was to segregate companies by the primary water depths in which they operate. This was a required step since data is filed with the FERC on a "per-company," as opposed to a "per-pipeline," basis. Companies were assigned to water depths based upon the miles of pipeline segments they owned/operated within certain water depths. Pipeline segment ownership statistics were compiled from the Foster Associates survey on offshore pipelines, that is actually generated from data collected by the MMS.

The next step in the analysis was to map the cost and asset categories into Implan sectors. Fortunately, costs for all offshore pipeline companies are required to be filed under a FERC-defined Uniform System of Accounts (USOA). Our job was to map these USOAs into Implan Codes. After the relevant sectors were identified, two sets of allocations/profiles were developed: one associated with capital expenditures, and the other associated with operational expenditures.

The capital and operation expenditure profiles can be found on Appendix Table A.5 and Appendix Table A.6, respectively. Both of these profiles tend to be more erratic than most all of the other expenditure profiles developed during the course of this project. For the pipeline capital expenditures, a good portion of the allocation was concentrated in Sector 50 (New Natural Gas Facilities). The next most significant category was in Sector 313 (Oil and Gas Machinery).

The operational expenditures were concentrated heavily in Implan Sector 444 (Natural Gas Utility Operations). The next closest expenditure percentage was concentrated in Sector 56 that represents maintenance and repair of generally unclassified infrastructure investments. In general, both Sector 444 and Sector 56 are generalized "catch-all" categories for utility activities. This seemed to be the appropriate delegation of costs since these assets are primarily utility-oriented in nature.

Total costs for pipeline construction and operation were developed from two different sources. Construction costs were taken from the annual survey of pipeline construction costs reported in the *Oil and Gas Journal*. These construction costs are summaries of reported costs provided to the FERC in the *Certificate of Need and Convenience* filings that are required to certify pipeline construction operations. Operational costs, however, were developed from the FERC Form 6. The same method of allocating offshore pipeline companies to water depth, and then calculating costs, was facilitated.

3.6 Gas Processing and Storage Construction and Operation: The process of estimating gas processing costs followed lines that were similar to that utilized in examining gas pipelines. Gas processing costs for pipeline companies are reported in the FERC Form 6. This analysis essentially separated these gas processing costs from other pipeline-related costs, to estimate expenditure profiles for both capital (construction) and gas processing and storage operations. The unique difference in the analysis of gas processing costs, as opposed to gas transportation costs, is that construction and operation of these facilities occurs completely onshore. Construction and operation are a function of processing capacity, and technology, not water depth. Thus, total cost estimates and operating cost expenditure profiles are constant across water depths. These estimates have been presented on Appendix Table A.7.

Total costs for gas processing were developed from two different sources. Total gas processing construction costs were gathered from recently announced projects published in the *Oil and Gas Journal*. Total gas processing operation costs were calculated from information provided by gas transportation companies that provide gas processing services and report such costs in their respective FERC Form 6 annual reports. Estimated production functions for gas processing O&M have been presented on Appendix Table A.8.

3.7 Workovers: Estimates of both workover costs expenditure profiles and total costs were taken from the DOE-EIA publication of production and equipment costs and indices. These publications included costs associated with workovers, and were developed on a similar "price-out" approach discussed in our section on production costs. These price-outs included estimates from three major types of workovers: recompletions; major workovers; and wireline. Our estimates of workovers are based on an expected value approach. Expected values are determined by the probability of a well having to undergo each of the three types of workovers we discussed above. These probabilities are: 20 percent per well per year for recompletion; 10 percent per well per year for a major workover; and 40 percent per well per year for wireline service. Our workover costs are the average of each of these expected workover types.

There is very little relative variation in expenditure profiles for workovers. About half of the costs associated in this function are in oil and gas operations (Sector 38) and oil and gas field services (Sector 57). Equipment costs (Sector 313) are about 5 percent of total costs. Transportation of work crews for this function is another important cost component. Production functions for workovers are presented on Appendix Table A.9.

Total costs for workovers were also developed using the expected value approach. Most of the costs for workovers were relatively constant over water depth. Transportation costs were one of the more significant drivers of these total costs as water depth was increased. The source for workover-related costs came from the price-out estimates produced in the annual DOE-EIA survey. These total costs are included in Appendix Table A.13.

3.8 Oil Spills: There is a paucity of information expenditure profiles for oil spills. This is because oil spill costs are affected by so many factors that include size, location, weather, and type of spill. Thus, developing a "typical" cost or expenditure profile, is a difficult task and requires a number of assumptions. Nevertheless, we were able to generate some reflective estimates of typical spill costs and expenditure profiles based upon past spill information that has been collected for the Gulf of Mexico.

Three main sources of information were consulted in the development of total oil spill costs and cost expenditure profiles. These included: the *Oil Spills Intelligence Report* (1998); the *Oil Spills Analysis: Destin Dome Development and Production Plans* (1998); and the *U.S. Coast Guard* (Etkin, 1998).

The strategies to develop a usable expenditure profile for oil spills were based upon a three step process. First, major cost categories for expenditures in a typical oil spill were matched to Implan sector codes. Second, recently reported cost information from near-shore and offshore oil spills in the Gulf were examined. Third, the size, location, and cost structure for each of the spills were examined to determine average costs and relative differences in cost distributions. Using information from the *Oil Spills Intelligence Report*, the expenditure breakout for our estimated "typical" oil spill was developed and has been presented in Appendix Table A.10.

One of the more difficult parts of the analysis was estimating the costs of oil spills by water depth. This is problematic since there are no well-established estimates of clean-up costs by water depth. Therefore, estimates were developed based on (1) limited information from published work cited above and (2) some judgment based upon the cited information about the more common types of methods that would be used in different water depth/shore distance combinations.

3.9 Abandonment: Like workovers, there are a number of different types of processes that can be facilitated for abandoning a platform. We examined four major methods of removing platform structures: bulk explosives (standard practice); bulk explosives topple in place; abrasive cutting; and mechanical cutting. We developed a weighted average for overall abandonment costs based on the probability of the given technique being implemented in any given water depth. In general, explosives tend to be the preferred method as water depth increases. We assumed that the explosive method would be facilitated in the very deep (900 meters and deeper) water depth.

Our total costs and production functions were developed from previous work compiled by the LSU Center for Energy Studies on platform abandonment. This work can be found in two different sources. One published by National Research Council (National Research Council, 1996) and the other by the LSU Center for Energy Studies (Pulsipher, 1996). This work examined a number of issues associated with platform abandonment methods including the costs associated with different abandonment techniques.

The estimated expenditure profiles for platform abandonment have been provided in Appendix Table A.11. The changes in costs across water depth show how the increasing complexities of abandonment methods change. Overall costs associated with oil and gas operations (Sector 38) increase across water depth and represent between 16 percent and 20 percent. A number of disposal oriented activities are classified into the miscellaneous natural resources facility construction category (Sector 53). These costs, in relative terms, are higher in shallow waters than in the deeper water categories. One of the most significant cost categories, however, is water transportation. Transportation is needed not only for moving crews in and out of the Gulf to remove structures, but also for removing the structure themselves.

Total costs were taken directly from sources provided in the CES-LSU report. These costs come from surveys of actual industry experience, and expectations for the types of costs that will be increased in the future. We extrapolated some of the past experiences, for instance, to develop very deep-water costs. This extrapolation was developed using a statistical estimation of the relationship between costs and water depth for past industry abandonment experiences. Given the lack of experience in deepwater abandonment, this was our only objective means for estimation.

3.10 Onshore Allocations of Cost: Our on-shore allocation of costs to various regions in the GOM was done in aggregate. Aggregate, in this context, entails that the allocation is by all expenditures, across all offshore activities, and across all water depths. Developing allocations that were disaggregated by either water depth or activity phase would have been a research project of similar size and scope to our current investigation. Our research examined all publicly available information in order to examine the onshore allocation of costs associated with offshore activities. We were unable to secure any source of publically available information regarding onshore allocations comparable to the format needed in this research.

Despite the lack of publicly available surveys, there was one private survey, conducted by the Louisiana Mid-Continent Oil and Gas Association (LMOGA) that was made available to this study. This survey examined all of the onshore businesses that were supporting offshore activities. This survey was developed from vendor lists of several LMOGA member companies, that include most offshore major oil and gas companies. This vendor list included company name and physical location. A limited, redacted version of this survey information was provided to our project by LMOGA. Companies in this survey were matched to Implan sectors to develop sectoral allocations. These companies were matched to Implan codes by using a combination of descriptive information in the survey database, or through matching companies to the *Gulf Coast Oil and Gas Directory* and identifying their activities as listed in the directory. The onshore allocations have been presented on Appendix Table A.12. Each onshore area is defined as a MMS region. We have also identified allocations made within the Gulf States, but not onshore (Gulf-Other), as well as the US and rest of the world (US-Other). This table identifies the concentration of activities in each region by Implan Sector.

Section 4: An Application: Modeling the Impacts of Offshore Activities on Coastal Louisiana

4.1 Introduction: The primary purpose of our work has been to develop estimates for the cost characteristics of offshore oil and gas operations. Our secondary objective has been to develop estimates of the economic impacts of offshore activities on coastal Louisiana. This analysis will serve as a case study, and test for reasonableness, for our estimates of offshore expenditure profiles, activity costs, and onshore allocations.

The impacts that have been simulated in this study are based on the MMS proposed lease program for oil and gas well developments in the Gulf of Mexico regions for the period 1997-2031. Our analysis was limited to an investigation of the economic impacts associated with exploration, development, and production activities. Exploration wells are wells drilled in search of new oil and/or gas resources usually to find and produce oil or gas in an unproved area; find a new reservoir in a previously productive field in another reservoir; or expand the limit of an existing reservoir. Development wells are drilled within the proved area of an oil or gas reservoir to the depth of a productive stratigraphic horizon, and they are used for potential production or to increase the production of a hydrocarbon accumulation discovered and delineated by previous drilling. Production wells are successful and completed wells that currently produce oil and/or gas. Important indicators of levels of economic and social aspect development in the designated coastal communities are presented below.

Table 4.1 Demographic, Social, and Economic Indicators of Louisiana Coastal Areas (1996)

Region	Area (sq miles)	Population	Employment	Number of Households	Total Personal Income ($000)	Income per Household ($)
LA1	4,403	492,449	284,040	177,916	9,833,829	55,272
LA2	6,078	1,019,205	565,810	368,226	20,269,121	55,045
LA3	2,821	1,202,640	705,545	434,499	26,933,920	61,988
All LA	43,567	4,350,579	2,304,531	1,571,810	85,552,280	54,429

Table 4.1 provides overview statistics for each of the major Louisiana coastal regions. In terms of geographic area, LA2 is the largest area followed by LA1 and LA3, respectively. While the combined areas encompass only about 30 percent of the landmass of the entire state, these areas account for close to 62 percent of the state's total population, 67 percent of its total employment, and 62 percent of its total households. The average income per household in these communities is between $616 and $7,600 above the statewide average. More detailed socioeconomic information on these areas and the entire state is provided in Appendix B. The above average household income levels are in part due to the higher concentration of higher paying oil and gas industry jobs in these communities. Appendix Tables B.1 and B.2 show that mining employment forms a relatively high percentage of total employment in these economies.

4.2 Review of Impact Analysis Methodologies: Impact analysis in a region focuses on the interaction between economic policy changes and the implications that these changes have on the local economy. This type of analysis can estimate the effect that a change in economic policy, or shift in major industry decision, can have on a variety of agents within the local economy, such as specific socioeconomic groups, specific sectors, or specific locations. Changes in the level and distribution of local employment, income, sales, and wealth are often the target of analysis in the context of regional planning (Shaffer, 1989). The academic literature is filled with numerous models that have been developed for impact analysis at the regional level. The most common among these models includes econometric, export-base, benefit-cost analysis, and inter-industry models.

Export-base models (EBM) are based on the premise that regional income is determined by exports (i.e. sales of goods and services both foreign and domestic) outside the region. The economy is conceptualized as comprising two sectors, export industries and local service industries. The export sector is comprised of local firms that bring funds into the community by meeting external demand for their goods and services. The other sector (the non-export, non-basic, or residentiary sector) sells its products within the boundaries of the region and exists to support the export sector (Shaffer, 1989). EBM's strong limitation lies in its emphasis on export only as the sources of regional development and the fact that it is a very restrictive theory more appropriate for smaller, less complex economies.

Benefit-Cost models (BCM) represent an alternative approach in estimating the economic impacts of public policy proposals. BCM models are premised on the concept of potential Pareto improvement. This concept applies to the premise that resources in a society may be re-allocated such that the resulting gains make everyone better off. Based on Kaldor-Hicks compensation principle, gainers are able to compensate losers at least to the full extent of their losses. BCM derives the net economic benefits or ratio of benefits to costs of proposal, policy, program, or project alternatives. BCM has the disadvantage of reliance on a single criterion to determine choice that limits its usefulness as an economy-wide analytic tool.

Regional econometric models are similar to economic base models in that such models are usually based on a Keynesian (demand-driven) picture of an economy. However, regional econometrics models employ a different approach to implement and measure structural relationships in a regional economy. Regression analysis is applied to time series data to estimate the assumed relationship. Regional econometrics models are used to forecast future levels of activity in the regional economy as a whole with model dependent variables as output, employment and endogenous prices. The limitation of econometric models is typically associated with their data-intensive nature, and a number of potential statistical problems associated with endogeneity and parameter instability problems.

Although many of these regional analysis tools have been constructed to examine only the effects of changes in demand, others are more encompassing in formulation and use. However, most of these models are limited to examining the effect of change on a particular sector only. As a result, these models can be thought of as "partial-equilibrium" models that hold changes in other sectors of the economy constant when examining a direct economic shock in a particular sector.

Models that can be used to examine direct, indirect and feedback effects of exogenous policy shocks are more useful for forecasting change and making policy decisions than are models that can only show direct impacts. This is because, in reality, the workings of a local economy shows inter-sectoral linkages, implying that the effects of a particular policy will not only be felt by the sectors directly impacted but also by other sectors directly or indirectly linked to that sector (Shaffer, 1989). Examples of such encompassing models constitute the class of inter-industry models. It is this type of model that is employed here. Hence, the choice in this model is to use inter-industry analysis models because of their general equilibrium holistic treatment of the economy.

4.3 Inter-Industry Economy Wide Models: Most of the sectoral, partial equilibrium models previously discussed have a number of limitations for long-run regional economic impact analysis. Model use may also be limited due to a lack of detail when accounting for linkages in the local economy. For example, in most open economies, investment dollars from outside the region may be far more important than basic industries. Also, in open economies, inter-industry transactions, household incomes, and spending patterns, as well as government transfer payments and expenditures are becoming increasingly more important than single-industry transactions. Specifically, the level of aggregation in sectoral models may limit their usefulness in policy decision-making. Perhaps the most conceptual limitation is the implicit capacity constraints imposed by most sectoral models as an underlying feature of the local economy. While capacity constraint may be relevant in some cases, in broader perspective, a local economy is often more open than closed.

Input-output or I-O analysis, however, is an empirical analytical framework formalized by Wassily Leontief in the late 1930s that collects, categorizes, and analyzes data on the inter-industry structure and examines interdependencies of the economic activity of a country, region, or state (Miller and Blair, 1985; Shaffer, 1989). The models focus on interrelationships of the producing and consuming units in an economy. In addition, it depicts the interrelations among different sectors that purchase goods and services from different sectors within a regional economy.

Recent extensions of I-O models have included the Social Accounting Matrix (SAM) model and the Competitive General Equilibrium (CGE) model. Our economic impact analysis of coastal Louisiana will employ a SAM model. The SAM model, originally developed in 1961 by Stone, was developed to reflect a snapshot of a regional economy that included the traditional circular flow of commodities and money during a given time period (the base year) in a balanced fashion. It is essentially an accounting record for a whole economy, and not just transactions among producers like a traditional I-O model (Bulmer-Thomas, 1982). Thus, a SAM extends beyond producer-producer, producer-consumer and producer-factor relationships to include a broader realm of institutions in a regional economy. These institutions are defined as entities having the legal right of ownership and as a consequence, are able to accumulate and provide services (Pyatt and Roe 1977).

Similar to I-O, institutions in a SAM usually include households, enterprises (firms), and government. However, unlike an I-O, SAM generally accounts for all market flows and for nonmarket income and transfers, and SAM explicitly accounts for all monetary flows in the economy. Therefore, SAM provides a consistent picture of the flow-of-funds accounts of the separate institutions or "actors" in the economy that one may wish to distinguish. The SAM is a square matrix with each row and column reflecting separate accounts for a given entity. Expenditures represented by matrix columns, and receipts represented matrix rows, must balance. The SAM models are therefore part of the general equilibrium framework of economic analysis. Within this general approach, fixed-price models are seen to be systems in which supply prices are independent of the scale of production. With regard to prices, the circular flow of income within the macroeconomy can be interpreted in terms of fixed-price multiplier effects (Pyatt, 1988).

Since the SAM model includes a more comprehensive view of the circular flow of income than does the standard I-O model, it requires the extension of the fixed coefficients assumption to the coefficients of all endogenous accounts.[3] The fixed coefficient assumption, which in I-O models is a fixed technology assumption, now must include the assumption that various expenditure coefficients are fixed once those sectoral variables are treated as endogenous (Holland and Wyeth, 1993). For example, if households' variables are treated as endogenous, then the various household expenditure coefficients are fixed. Within an I-O there is an explicit specification of the linkages between household income and household spending, whereas the linkage between government revenue and expenditure of these sectors may be endogenous in a SAM.

A SAM is particularly suitable for assessing impacts of programs and policies such as exogenous changes resulting from oil industry's activities in a region because of the SAM's relative flexibility. For example, the distributional effects of a change in final demand across income groups can be assessed. Analysis of an income redistribution policy may include the disaggregation of income groups into high, medium and low-income classes, and the government sector may be broken down to the three layers of governments.

4.4 Data Methods: The construction of regional impact models, regardless of methods, requires that a choice be made as to how data on some or all of the component elements of the models are to be secured and utilized. The three methods of underlying data for regional models are the survey, ready-made, and hybrid approaches (Jensen, 1980; Brucker et. al., 1987).

Construction of a model based on survey data involves obtaining information on the sectoral distribution of regional purchases and sales to final demand of every modeled sector of the economy and on the imports purchased and exports sold by each sector. Survey approaches rely heavily on data availability in the individual establishments, industrial censuses, regulatory commissions, tax authorities, trade associations, and expert opinions. National coefficients are rarely used and only used when regional data resources are unavailable (Bourque, 1990). The amount of data needed to construct a survey-based table and the associated time, cost, and technical skill requirements are thus, considerable.

[3]Endogenous accounts refer to those accounts that hold variables that are determined within the model and in the I-O tables and to those accounts that are made part of the inter-industry matrix. Those accounts that are not part of the A-matrix are exogenous.

Regional impact models based upon survey methods are sparse given the significant costs associated with their creation. In contrast to the survey-based models, there are non-survey-based models, or the so-called "ready-made" approaches. Strictly non-survey techniques attempt to depict regional transactions without recourse to detailed primary data, using procedures that have been described as essentially mechanical. In non-survey models, national coefficients, a region's share of national production of goods and services, are modified based on aggregate regional data to produce estimates of regional coefficients using a variety of approaches including RAS, location quotients, supply-demand pool, or some other statistical methods (West, 1990).

These types of non-survey based models are very common, particularly in the U.S. Some of the popular ones include ADOTMATR, RIMS, RSRI, GRIT (for Australia), and Professional (IMPLAN). The IMPLAN modeling system, originally developed by the U.S. Forest Service, is by far the most popular of the ready-made approaches. These models are very tractable in cost and time to utilize, especially with rapid advances in computer technology. Evaluation of the impact studies' results using these models seems to suggest no significant differences in aggregate estimates obtained for output and income, but large differences were observed with respect to employment (Brucker, et al., 1987).

Between the extremes of survey and non-survey models lie those models that combine survey and non-survey data to depict regional economic structures. These are called the regional hybrid models, and they combine information from a field survey with a ready-made format such as the IMPLAN. Econometrics, linear programming, published data, or budget approaches may be used to generate the required coefficient from data collected from surveys. These coefficients are incorporated into the standard models in existence to simulate policy impacts in the region(s) concerned. In current practice, especially in the U.S, ready-made models are the preferred approach by regional analysts, because they seem to combine the advantage of cost-effectiveness with timeliness desired by decision makers (West and Jensen, 1993).

This study relies on IMPLAN for our basic model construction. However, our study can be described as a hybrid approach to economic impact modeling since we have incorporated industry-specific information on offshore oil and gas activities, by water depth, into the IMPLAN framework. Such an approach allows us to specifically model those sectors of the coastal Louisiana economy for which we are most interested. For other sectors, we will facilitate the more generalized default information provided within the IMPLAN model.

4.5 Regional Multipliers and Impact Analysis: The concept of multipliers is central in the understanding of regional economic models, because it defines and forms the basis of impact analysis. Multipliers are based on the fundamental notion that one person's expenditure is another's income, and since consumption usually increases when income increases, any extra expenditure feeds through into further expenditure. These effects become smaller and smaller through each spending round due to leakages.

The idea of multipliers hinges upon the difference between the initial effect of an exogenous (final demand) change and the total effects of the change. The total effects can either be captured in terms of direct, indirect, and induced effects. Direct effects are the changes in the industries to which a final demand change was affected; indirect effects measure the changes in inter-industry purchases resulting from the new demands of the directly affected industries. Induced effects are those changes in spending from households as income or population increases or decreases due to changes in production (Miller and Blair, 1985).

Multipliers can be constructed in terms of output, income, employment, or value-added with different policy implications. There are four different multipliers commonly used in predictive modeling: Type I, Type II, Type III, and Type IV. Type I multipliers measure the direct and indirect effects of a change in economic activity. Type II captures both direct and indirect effects while taking into account the income and expenditures of households in addition to the inter-industry effects. Type III uses the Type I results to generate further economic activity by focusing the effect of the change on employment. Type IV (Madden and Batey, 1983) is based on patterns of spending between local residents and currently unemployed local residents.

4.6 The Coastal Louisiana Economic Impact Model: A typical non-survey or ready-made regional model such as IMPLAN is, in effect, a stepped-down national model. As explained previously, in such models available regional data can be used to improve model accuracy and validity. The basic foundation of the SAM models of the Louisiana economy is the IMPLAN database. In keeping with general practice, modifications have been made to this IMPLAN data to ensure a more realistic picture of the region's economy. These include modifications of regional purchase coefficients (RPC), regional supply-demand pool (SDP), transportation and marketing margins, and production functions based on primary or secondary data. Also, the production sectors in the basic IMPLAN-based models were aggregated into major industry groups. Aggregation may be justified on the grounds of resource limitation such as computational time. This consideration is important when the loss of additional information due to aggregation is not critical to the problem under consideration.

4.7 Regional Purchasing Coefficient: A regional purchase coefficient (RPC) represents the proportion of a region's total supply of a given commodity used to meet regional intermediate (industry) and final demand for that commodity. For example, an RPC of 0.25 for the natural gas sector means that local producers meet 25 percent of all demand for natural gas. Hence, 75 percent of regional natural gas demand is satisfied by regional imports.

RPCs are important in regional models since they represent the direction and magnitude of regional trade flows. Another potential measure for regional trade flows can be calculated through the use of SDPs, or supply-demand percentages. An SDP is the maximum amount of a regional supply that is available to meet regional demand. It is the ratio of regionally produced net commodity supply to gross regional demand. An SDP of less than one implies that the commodity will have to be imported even if none of the regional supply is exported domestically (Hughes and Litz, 1996).

RPCs, however, are more productive than SDP because they allow for cross-hauling (the simultaneous important export of the same commodity), which may result from such factors as brand differentiation. Ignoring cross-hauling in an I-O/SAM model may result in a bias of regional impacts resulting from an exogenous change in final demand. The use of RPC represents one way to reduce the possible bias in using ready-made national models in a regional context. In addition to issues associated with cross-hauling, the use of RPCs has the added advantage of improving the accuracy of multiplier impacts. The 59 selected commodities with modified RPCs that have been used in our model have been presented in Appendix Table B.3. The modifications to these RPCs have been based upon expert opinions and available regional data used in other studies of the Louisiana economy (Olatubi, 1998). Attempting to reconcile biases in RPCs is an important issue in economic impact modeling.

Like production expenditure profiles, an RPC can be biased given that its primary base is from stepped-down national information. This bias can be important because RPCs, to a very large extent, condition the leakages in a regional model. The greater the RPC, the less the leakage from the local economy, and the greater the indirect and induced effects associated with an exogenous shock. An example of why it is important to consider adjustments to the RPCs can be discerned from an analysis of the default RPC for Petroleum Refining (Sector 210). The original default RPC for this sector is 0.8543, indicating that about 15 percent of petroleum refining demand in Louisiana is met by imports. Given the large amount of petroleum refining that is currently within the state, a 15 percent import level seems high. In addition, since this is a sector related to the overall Louisiana energy economy, it would be prudent to make the appropriate adjustments where possible.

4.8 Sectoral Aggregation: Sectoral Aggregation is the process by which two or more industrial sectors in IMPLAN, or any I-O model, are re-grouped into fewer industrial sectors for the purpose of impact analysis. The choice of sectors to aggregate depends on the particular study and sectoral compatibility (a function of underlying production technology), size of the industries in question, other factors such as computational expense and feasibility, and availability of data. However, since aggregation bias may result in biased multiplier estimates, care must be taken in aggregating industrial sectors. There are 27 aggregated sectors used in this study from the original 528 sectors in IMPLAN for each of the three Louisiana area models. These 27 sectors were considered to meet the goals of this study in terms of its focus on oil and gas related industries and in terms of presenting a valid broad representation of the Louisiana regional economies. Our emphasis of the oil and gas industry has resulted in more detailed, disaggregated sectors. The 27 aggregated sectors and the sectors that were combined to form those aggregates are indicated in Table 4.2. The SDP and RPC values resulting from the 27-sector aggregation are shown in Table 4.3.

Table 4.2: Louisiana Model Aggregation Industry and IMPLAN Included Sectors

Industry Code	Industry Description	IMPLAN Sectors Included
1	Farming	1--27
38	Natural Gas &Crude Petroleum	38
39	Natural Gas Liquids	39
28	Other Mining	28--37,40--47
50	New Utility Structures	50
53	New Mineral Extraction Facility	53
48	Other Construction	48,49, 51, 52,54--56
57	Maintenance &Repair: Oil & Gas wells	57
82	Food Processing	58--103
104	Natural Resource Processing	104--173
174	Printing & Publishing	174--185
186	Chemical & Allied Products	186--209
210	Petroleum Refining	210
211	Other Refining & Coal Products	211--214
215	Rubber and Misc. Plastics	215--220
313	Oil and Field Machinery	313
393	Transportation Equipment	384--399
221	Other Manufacturing	221--312, 314--383,400--432,528
436	Water Transportation	436
444	Gas Production & Distribution	444
433	Other Transportation & Public Utilities	433--435, 437--443,445,446
447	Wholesale Trade	447
451	Automotive Dealers & Service Stations	451
448	Other Retail Trade	448--450,452--455
456	FIRE	456--462
473	Services	463--509, 525
510	Government	510--524, 526,527

Table 4.3: Aggregated RPCs and SDPs

Sector	Description	LA1		LA2		LA3	
		SDP	RPC	SDP	RPC	SDP	RPC
1	Farming	0.5440	0.1592	0.4424	0.1892	0.2631	0.0188
28	Other Mining	0.5318	0.5000	0.1264	0.0002	1.0000	0.0009
38	Natural Gas & Crude Petroleum	0.5924	0.3669	0.1952	0.1952	1.0000	0.3524
39	Natural Gas Liquids	0.5803	0.3559	0.1938	0.1938	1.0000	0.5000
48	Other Construction	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50	New Utility Structures	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
53	New Mineral Extraction Facilities	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
57	Maintenance and Repair Oil and Gas Wells	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
82	Food Processing	0.7964	0.0479	0.7954	0.1236	0.7067	0.3415
104	Natural Resource Processing	0.2124	0.2124	0.2804	0.0326	0.2181	0.2181
174	Printing & Publishing	0.2899	0.1173	0.3515	0.1323	0.4887	0.1452
186	Chemical & Allied Products	1.0000	0.8465	1.0000	0.8227	0.5650	0.5650
210	Petroleum Refining	1.0000	0.8543	1.0000	0.8543	1.0000	0.8543
211	Other Refining & Coal Products	1.0000	0.9210	1.0000	0.8842	1.0000	0.9702
215	Rubber & Misc. Plastics	0.2858	0.0011	0.2606	0.0008	0.2466	0.0012
221	Other Manufacturing	0.3559	0.0036	0.4188	0.0029	0.2955	0.0045
313	Oil Field Machinery	0.6321	0.6216	0.6423	0.4447	0.6262	0.2780
393	Transportation Equipment Manufacturing	0.3670	0.0164	0.4516	0.0108	0.5964	0.0004
433	Other Transportation & Public Utilities	0.7698	0.6737	0.7283	0.7283	1.0000	0.6895
436	Water Transportation	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
444	Gas Production and Distribution	0.8091	0.8091	0.3965	0.3965	0.6931	0.6931
447	Wholesale Trade	0.8818	0.6114	0.8185	0.6114	1.0000	0.6114
448	Other Retail Trade	1.0000	0.9067	0.9318	0.9083	1.0000	0.9043
451	Automotive Dealers & Service Stations	1.0000	0.9487	0.9530	0.9487	1.0000	0.9487
456	FIRE	0.5418	0.5418	0.6386	0.6204	0.7622	0.6344
473	Services	0.9363	0.8074	0.7909	0.7909	1.0000	0.8159
510	Government	0.8363	0.8363	0.7811	0.7811	0.8652	0.8652

4.9 Empirical Results for the Base Model Scenario: In Table 4.10, column 1, we present the general results of IMPLAN's run for the empirical structure of the coastal communities' economies based on IMPLAN data for 1996.[4] The results indicate that the total size of the LA1's economy is about $92.6 billion. Of these, industry output accounts for 29.6 percent or $27.4 billion, factor incomes represent 15 percent, or $13.5 billion, and household income is 12 percent, or $11.3 billion. The size of the federal government is estimated at 3 percent or $2.9 billion, and state and local governments are 3 percent or $2.8 billion. Businesses and enterprises also account for 2 percent or $1.7 billion, while capital investment and trade account for 5 percent or $4.9 billion and 13 percent and $11.7 billion, respectively.

For LA2, the results indicate the total size of the economy is approximately $180.6 billion. This total is comprised of industry output of 29 percent or $52.2 billion, factor incomes of 14 percent, or $25.6 billion, and household income of 13 percent or $23.3 billion. In addition, the federal government accounts for 3 percent or $6.2 billion, and state and local governments account for 4 percent, or $6.4 billion of economic activity. Businesses and enterprises contribute 2 percent or $2.9 billion, capital investment accounts for 6 percent, or $10.1 billion, and trade accounts for 11 percent, or $20.6 billion of regional economic activity.

Similarly for LA3, the results estimate a 1996 economy of $213.6 billion. The economy is composed of industry output of $54.2 billion (25 percent), factor incomes, $32.2 billion (15 percent), and household income of $29.6 billion (14 percent). The size of federal government economic activity is estimated to be $13.3 billion (6 percent), and the state and local governments are $8.2 billion (4 percent). Businesses and enterprises also account for $3.5 billion (2 percent), while capital investment and or $13.3 billion (11 percent) and trade amounts to $23.4 billion (6 percent).

Having established the base year structure of the respective LA economies, a vector of the potential exogenous changes or shocks must be determined. However, available data for subsequent simulation purposes as provided by the MMS are usually aggregated for larger planning areas indicated in Figure 2.1. Hence, onshore allocation of these offshore activities is necessary. The allocation of activities or expenditures to onshore areas is probably one of the more important factors for determining the region-specific economic impacts associated with offshore activities. These breakouts are important, because there are tendencies for certain onshore support activities to be concentrated in particular geographic areas. This concentration has tended to occur in Louisiana and Texas and has continued despite the movement of offshore activities into deeper water and into the Central-Eastern portions of the Gulf of Mexico. The allocated ratios used for the relevant sectors and regions are as given in Appendix Table B.5.

In addition to determining onshore allocations, we needed to identify specific expenditure allocations for the direct shocks we were going to examine in our economic impact analysis. The expenditure profiles for exploratory and development drilling, as well as production, that were developed in the first phase of our investigation, are facilitated. Direct costs that were developed for these activities were also used to estimate a direct shock associated with new offshore oil and gas activities.

[4] Minnesota IMPLAN group, the owners of IMPLAN, update their database annually. 1996 data was the most recent at the beginning of this study.

4.10 Empirical Results for New Offshore Oil and Gas Activities: In Table 4.4 we present the results of the impact simulation for LA1. Detailed impacts by water depth, sectors, and activity phase have been presented in Appendix Table B.7. Subtables have been created to examine each subregional impact by water depth. In general, the results show that whether we consider direct, indirect, induced, or even total impact for output, labor income, value-added and taxes, the effect of the proposed exploratory wells development on LA1 economy is greater than development wells, which, in turn, is smaller than production wells. In terms of employment, both exploratory and development wells have similar impacts in LA1, with only three additional jobs per well. The employment effects of production wells are far less with about 0.328 jobs created per well, annually. Hence, as the industry adage notes, "it's the drill-bit that creates the jobs." It is noted that out of the components of value-added (TVA), labor income represents less than half of TVA for exploratory and development well activities, whereas it is greater than half of TVA for production wells.

A similar analysis for the LA2 economy is presented in Table 4.5. In total, probably due to the greater leakage in LA2 or greater linkage in LA1's economy compared to LA2, the levels of impact are generally lower in LA2. This is in spite of the fact that LA2 economy is quite larger than LA1's. Following similar trends as in LA1, the results show that direct, indirect, induced, or even total impact for output, labor income, value-added and taxes, the effect of the proposed exploratory wells development on LA2 economy is greater than development wells, which is also greater than production wells. In terms of employment both exploratory and development wells have similar impact to LA1 but slightly smaller per well impact of only 2 jobs per well drilled, and for production wells of 0.320 jobs per well.

The results in Table 4.6 show the impact effects in LA3 economy. In terms of trends among exploratory, development, and production wells, the distribution of impacts are similar to LA1 and LA2. However, the levels of impacts are quite close to LA1 even though LA1 economy is smaller in size to LA3. This result might be due to the extent of sectoral linkages in the economy, as well as potential leakage levels out of the economy. Employment levels are the same for LA1 and LA3 for exploratory and development wells activity but slightly lower for LA3 production wells' effects–0.314 jobs per well, annually. It is also noted that total tax impact in LA3 is higher than LA2 or LA1, probably due in part to the fact that LA3 workers earn a higher average wage than the other regions.

One of the key advantages of extending an I-O framework is to examine potential distributional effects of a proposed activity or project. Income distribution effect is particularly important for rural communities, or frontier areas where oil and gas development is envisaged because of the potential negative effects of disrupting current income patterns, and hence the existing social milieu. In Tables 4.7-4.9, we present the income distribution pattern resulting from oil and gas wells development in these three regions.

Table 4.4: Economic Impact Results of Oil and Gas Development in the Gulf of Mexico 1997-2031: LA1 Annual per Well Impacts

	Exploratory				Development				Production			
Impact Item	**Direct**	**Indirect**	**Induced**	**Total**	**Direct**	**Indirect**	**Induced**	**Total**	**Direct**	**Indirect**	**Induced**	**Total**
Output ($)	714,423	101,698	53,234	869,355	623,045	94,511	50,095	767,651	28,701	9,713	4,703	43,118
Labor Income ($)	57,627	30,283	19,944	107,854	53,743	29,010	18,768	101,522	4,169	3,573	1,762	9,504
Total Value Added ($)	170,751	54,004	32,364	257,119	147,895	50,586	30,455	228,936	8,610	5,313	2,859	16,783
Employment (Jobs)	1	1	1	3	1	1	1	3	0.128	0.124	0.076	0.328
Taxes ($)	N/A	N/A	N/A	60,773	N/A	N/A	N/A	54,461	N/A	N/A	N/A.	4,303

Table 4.5: Economic Impact Results of Oil and Gas Development in the Gulf of Mexico 1997-2031: LA2 Annual per Well Impacts

	Exploratory				Development				Production			
Impact Item	**Direct**	**Indirect**	**Induced**	**Total**	**Direct**	**Indirect**	**Induced**	**Total**	**Direct**	**Indirect**	**Induced**	**Total**
Output ($)	716,297	73,474	37,625	827,395	623,569	67,773	34,568	725,911	28,615	9,238	4,618	42,472
Labor Income ($)	37,825	23,706	14,094	75,625	51,422	33,382	19,424	104,227	4,098	3,443	1,730	9,271
Total Value Added ($)	103,906	39,436	23,021	166,364	89,014	36,528	21,151	146,693	8,500	5,140	2,825	16,466
Employment	1	1	1	2	1	1	1	2	0.128	0.119	0.073	0.320
Taxes ($)	N/A	N/A	N/A	42,826	N/A	N/A	N/A	37,946	N/A	N/A	N/A	4,470

Table 4.6: Economic Impact Results of Oil and Gas Development in the Gulf of Mexico 1997-2031: LA3 Annual per Well Impacts

	Exploratory				Development				Production			
Impact Item	**Direct**	**Indirect**	**Induced**	**Total**	**Direct**	**Indirect**	**Induced**	**Total**	**Direct**	**Indirect**	**Induced**	**Total**
Output ($)	715,396	93,816	55,308	864,520	623,501	84,324	49,160	756,985	28,682	9,296	5,059	43,038
Labor Income ($)	57,314	29,136	21,237	107,687	50,057	26,774	18,876	95,707	4,357	3,529	1,942	9,829
Total Value Added ($)	168,392	52,081	34,619	255,093	140,720	47,041	30,771	218,532	9,035	5,316	3,166	17,518
Employment	1	1	1	3	1	1	1	3	0.121	0.114	0.079	0.314
Taxes ($)	N/A	N/A	N/A	66,731	N/A	N/A	N/A	57,430	N/A	N/A	N/A	4,876

Table 4.7: Income Distribution Impacts: LA1 Area

Household Income Category	Annual Impact Per Well ($)		
	Exploratory	Development	Production
< $5,000	199	188	17
$5,000---$10,000	1,024	964	90
$10,000---$15,000	2,767	2,605	243
$15,000---$20,000	4,024	3,788	354
$20,000---$30,000	13,416	12,628	1,182
$30,000---$40,000	16,986	15,988	1,496
$40,000---$50,000	17,006	16,007	1,498
$50,000---$70,000	26,126	24,592	2,302
> $70,000	26,306	24,762	2,318

Table 4.8: Income Distribution: LA2 Area

Household Income Category	Annual Impact Per Well ($)		
	Exploratory	Development	Production
< $5,000	172	237	21
$5,000---$10,000	612	844	75
$10,000---$15,000	1,702	2,346	208
$15,000---$20,000	2,682	3,696	328
$20,000---$30,000	8,961	12,350	1,098
$30,000---$40,000	11,867	16,355	1,454
$40,000---$50,000	11,766	16,216	1,442
$50,000---$70,000	19,892	27,415	2,438
> $70,000	17,971	24,768	2,203

Table 4.9: Income Distribution: LA3 Area

Household Income Category	Annual Impact Per Well ($)		
	Exploratory	Development	Production
< $5,000	248	220	22
$5,000---$10,000	832	739	75
$10,000---$15,000	2,371	2,107	216
$15,000---$20,000	3,675	3,266	335
$20,000---$30,000	12,730	11,314	1,162
$30,000---$40,000	15,616	13,878	1,425
$40,000---$50,000	15,170	13,482	1,384
$50,000---$70,000	26,489	23,542	2,417
> $70,000	30,556	27,157	2,789

Generally, to provide more detail we use a 9-income category version of the U.S. Bureau of Economic Analysis (BEA) Consumption Expenditure Survey (CES) income group. In terms of the previously used three income groups of low (< $20,000), medium ($20,000-$50,000), and high income (>$50,000), the medium and higher income household benefits the most from oil and gas development in the three regional economies.

Our results indicate that the distribution of the economic benefits of offshore activities is relatively balanced between high income and low income households. Within the three groups we have examined, about 50 percent goes to those households with incomes that are greater than $50,000 per year. The other 50 percent is strongly distributed towards medium income households, with between 6 to 8 percent going to the poorest households.

The relative potential contribution of each oil and gas well type to their respective regional coastal economies is depicted in Table 4.10. In each case, we examined the proportional contribution of the impact of a well relative to the total size of the economy with regard to output, value-added, and employment.

Table 4.10: Impact Result versus Base Model Result (Annual Per Well Basis)

Item	Total Base	Annual Total Per Well Impact	Per Well Impact as a Percent of Regional Economy
LA1			
Output ($000)	27,393,500	44	0.00163379
Value Added ($000)	13,482,700	17	0.00128084
Employment Number	284,040	3.34	0.00117589
LA2			
Output ($000)	52,183,200	44	0.00084368
Value Added ($000)	25,565,600	16	0.00065633
Employment Number	565,810	3.24	0.00057263
LA3			
Output ($000)	54,181,200	44	0.00082427
Value Added ($000)	32,172,600	17	0.00055924
Employment Number	705,545	3.20	0.00045355
All Areas			
Output ($000)	133,757,900	133	0.00099763
Value Added ($000)	71,220,900	52	0.00073069
Employment Number	1,555,395	9.78	0.00062878

The results show that oil and gas development has more impact in the LA1 economy than the other two economies, which share similar relative impacts. Exploratory, development, and producing wells contribute about twice as much (on a per well basis) more than the contribution to the economies in LA2 and LA3. In addition, exploratory and development drilling create the biggest impact in all three regional economies.

<u>4.11 Summary and Conclusion of Impact Analysis:</u> The purpose of this section of our report has been to examine the economic impacts of offshore activities by incorporating two new methodological approaches. The first is the use of a Social Accounting Matrix, or SAM, to look at the full range of economic impacts across all regional economic agents and institutions. The second was to incorporate our considerable work in developing offshore industry cost drivers for economic impact modeling purpose. These cost drivers included offshore industry activity expenditure profiles, total unit costs, and onshore cost allocation factors.

Although there are varieties of economic activities undertaken by oil and gas industries in the Gulf of Mexico OCS region, our simulation was based on the basic industry activities of exploration, development, and production wells spanning the period 1997-2031 as forecast by the MMS. Our results show that in terms of aggregate output, labor income, value added, employment, and tax base in all three economies, production activities add the most value to these onshore regional economies. Exploration and development, or overall drilling activities, tend to have a less substantial impact. Exploration and development activities add about 3 jobs per drilled well annually. Production activities, however, increase total local employment by 200 jobs for every production well in operation.

Although these regional economies are of varying sizes, our analysis reveals that the impacts of offshore activities are not directly correlated with size. For example, while LA1 economy is clearly smaller than LA2, the relative impact of offshore activities in LA1 is considerably higher than in LA2. Likewise, our analysis shows that the relative impact on the LA2 and LA3 economies are very similar despite the fact that the LA3 economy is much larger. Thus, it is important to recognize the importance of the structure of the economy in terms of inter-industry linkages and potential levels of leakages out of the economy when examining the economic impacts of large construction and infrastructure projects or any type of major public policy initiative.

Income distribution effects are an additionally important consideration in the policy analysis of how industries impact local communities. Our analysis shows that while all income groups benefit from an increase in offshore activities, the benefits are skewed more toward the upper income households. In all three coastal Louisiana economies, we found that as much as 50 percent of the income gains that are created by increased offshore activities accrues to households with annual incomes greater than $50,000, while another 50 percent goes to those under $50,000. Such a result would tend to support the fact that the distribution of benefits associated with offshore activities is relatively balanced.

Section 5: Conclusions and Suggestions for Future Research

The research encompassed in this report has expanded the opportunities for a more detailed and industry-specific approach to modeling the economic impacts of offshore activities. However, it would be a display of hubris to suggest that we have come even close to developing a comprehensive approach of understanding the complete economic impact of these oil and gas industry activities. At best, this work can claim to have at least successfully developed a framework upon which future research can move forward.

There are at least five generalized areas where these approaches could be expanded and improved:

(1) Customizing onshore allocations

(2) Developing cost functions for specific technologies

(3) Developing labor and value added implications

(4) Understanding the implications of activities on public finance

(5) Developing a model that incorporates interregional linkages

5.1 Onshore Allocations: The onshore allocations used in our report were generalized across all offshore activities and water depths. This aggregation however, can generalize economic impacts. Further disaggregation could result in a more refined understanding of how those impacts accrue across specific (county/parish) coastal regions. There are a number of ways these onshore allocations could be improved, however, the two most readily available opportunities for disaggregation includes: (a) developing specific onshore allocations for each activity type and (b) developing on-shore allocations for each water depth.

As noted earlier in this report, each offshore activity phase is unique. Not only are the expenditure patterns of these activities unique, but in many instances, particular areas supporting these activities can be concentrated in a certain locale. For instance, as the industry has become more consolidated, certain activities can also become more consolidated in particular regions as the number of firms becomes more concentrated. For instance, there has been a notable tendency for platform fabrication and shipbuilding to become concentrated in particular areas. While our current allocations reflect some of this concentration – the current framework does not provide a dynamic approach of how these concentrations are changing.

Another area of improvement within the allocation process is related to water depth. In particular, attempting to understand if there are unique onshore allocations associated with offshore production in varying water depths. Do deepwater activities tend to have different onshore allocations than shallow water activities? There is at least some anecdotal evidence that would suggest there is a greater out-of-area impact associated with deepwater activity than shallow water. In particular, deepwater activity has often been characterized as more “global” in nature, and as such, deepwater activities in the Gulf more than likely pull resources from deepwater producing basins around the world.

5.2 Cost Functions By Technology: One of the other limitations of the current approach is that there has been an aggregation of cost functions across technologies used in each activity phase. This analysis assumed that within each activity phase, and within each water depth, there was a "typical" technology that was being facilitated. Thus, in the pipeline construction phase, a "typical" pipeline diameter is assumed, over a typical area, facilitating a particular pipeline laying process. However, one of the first points many offshore professionals would make today is that there is no such thing as a "typical" offshore approach – this is particularly true with deepwater activities.

Thus, this lane of research could be improved by disaggregating offshore activities by a range of feasible technologies. The advantage of conducting such methods in a straightforward, disaggregated manner will hopefully provide more accurate understanding of the impacts of changing technology on local communities. For instance, conventional wisdom would tend to support the notion that technological innovation, with its greater reliance on computer-driven automation and remote applications, can only be bad for labor – it results in less labor demand, higher unemployment, and a lower quality of living for households directly associated with offshore activities.

Furthermore, consider the offsetting impacts that these technologies can also have. Recent emphasis on computer applications and SCADA systems are changing a number of production processes. These are streamlining communications and creating greater emphasis on communications related expenditures, fiber optic cable installation, switching equipment, broadband wireless equipment, to name a few. This has the direct effect of increasing and changing our allocations.

Another interesting aspect of incorporating technology-specific approach is that, on a forward going basis, it will allow for the direct economic modeling of a shift in technologies that will require MMS approval. Consider, for instance, the recent approval process for Floating Production, Storage and Offloading (FPSO) vessels. Using a direct technology allocation and production function would allow for the direct economic impact modeling of this technology and an understanding of the economic impacts that this shift in technology would have on community relative to other types of technology use – for instance, what are the relative economic impacts of using FPSO versus constructing and operating a major pipeline?

5.3 Contractor Expenditure Profiles: As alluded to earlier, a good deal of activities over time have become offered out to subcontractors. This is especially true in shallow water activities.

The problem with the presence of contractor information for this project was that it has the tendency to aggregate a considerable amount of expenditures into one economic sector category. For instance, in both the exploratory and development drilling activities, owners relied heavily upon drilling contractors. These expenditure entries, presented in accounting format, were allocated to one general category for oil and gas sector work (there are no separate accounts for drilling as opposed to other activities). This is problematic because: (1) the approach treated all contractor expenditures as a lump sum, or as one contractor, when many could have been used, in different places on the Gulf; and (2) these contractors hire labor and purchase equipment, tools, services and other things that have unique expenditure profiles of their own. One important limitation with the current work is that these types of expenditures are missing.

In the future, in order to gain a more accurate representation of these allocations, a contractor allocation profile will need to be developed. Such an approach will require two things. First, to determine the typical types of activities that tend to be contracted – for instance, what are the common types of contractor services that are employed and do these vary by activity or by water depth. Second, after identifying the types of activities that are contracted, a survey of contractors will need to be developed on the types of expenditures they make related to internal operators.

An alternative to this approach, however, could consist of a more "whole-phase" nature. Such an approach would consider all types of expenditures within an activity based upon the nature of the activity, and not the party engaged in the process. Such an approach, however, while appealing, is clearly more difficult.

5.4 Public Finance: An additional area of investigation that would be important for future economic impact analyses is understanding the public expenditure profile. This analysis did not consider the impact that offshore activities have on public expenditures, and how the public sector reacts to changes in offshore activities. Clearly, the composition of these public expenditures will change given overall changes in the types of offshore activities that are occurring across different water depths. This is a complicated area of inquiry that to date has been explored in little quantitative depth.

The issues associated with public sector activities abound:

(1) Do public expenditures vary by activity type? In other words, do particular types of offshore activities have unique impacts on public sector economics. An interesting question to consider is whether construction oriented activities tend to have bigger public sector impacts than traditional operations/production activities.

(2) What are the expenditure profiles of public sector activities that arise in response to offshore oil and gas activities? The government sector, like others, is a consuming unit in regional economies. It is an interesting research question to understand how public sector expenditures evolve and the impacts they have on regional economies. A recent study funded by the MMS examined the impacts that overall offshore activities have had on one particular community (Port Fourchon). This study interestingly noted that offshore activities generated more revenues for this local community than it required in expenditures on public infrastructure.

(3) How are offshore royalty revenues (benefits) distributed across onshore communities? While the MMS develops an equitable sharing approach, it is not entirely clear how royalty revenues are distributed within coastal states, and in turn, how different economic impacts arise from those differing distributions.

5.5 Interregional Analysis: Another limitation of the current research, and in the more recent approaches of modeling the economic impacts of offshore activities, is the lack of linkages between offshore areas. The economic impact framework used in this study examines onshore communities in aggregate blocks across an expansive area in the Gulf. There may be, however, substantial linkages between the areas in terms of their potential mutual support for differing activities. Future analysis should examine the degree of linkages between these defined areas. One might anticipate, for instance, that expenditures in localized areas may spill over into neighboring regions to help support offshore activities. Conventional wisdom might lead one to expect that these linkages may become stronger during boom periods when some local economics could become saturated. In addition, there is some evidence that particular activities, particularly those associated with deepwater activities, have highly specialized functions that are "pulled-together" from throughout the Gulf region. Future research should explore the magnitude and extent of such potential spill-over effects.

5.6 Project Summary and Conclusions: This study is the first of its kind to comprehensively examine the cost structures of offshore activities in the Gulf of Mexico. No other research has examined total costs, activity-specific costs, and the allocation of costs to onshore areas in the manner presented here. As noted earlier, there are a number of areas where this research can be improved. We are confident that this report has made a significant contribution to the literature. Nevertheless, we believe that, in conjunction with the work of our colleagues at the MMS, we have started the process of developing analytic tools that quantify the links between the offshore industry and onshore communities.

We believe that the results of our research have yielded benefits that go beyond intellectual curiosity. The process of creating real world models for offshore oil and gas activities in the Gulf of Mexico can yield meaningful differences when compared to standardized, secondary I-O models. We believe the MMS motivation for moving forward with creating these customized approaches appears to be justified.

In conclusion, we would like to present estimates that compare the standardized results from the IMPLAN modeling approach to the customized results for exploratory drilling in the 0-60 meter water depth for the LA-2 region. Table 5.1 presents two sets of analyses that result from shocking both the generalized IMPLAN model and the IMPLAN model using our specialized expenditure profiles and onshore allocations. The first analysis is the generalized, standard IMPLAN results, while the second analysis comes from our Gulf-specific analysis. The table shows considerable percent differences between the two types of analyses.

Table 5.1: Estimated Economic Impacts for Exploratory Drilling, LA-2 Region

Estimated Annual Impact -- Standard Analysis (1998 Dollars)				
	Direct	**Indirect**	**Induced**	**Total**
Output	179,502,016	16,454,092	15,543,905	211,500,011
Labor Income	14,524,824	3,839,397	5,936,279	24,300,500
Total Value Added	49,131,317	8,382,280	9,560,596	67,074,189
Employment (Number)	273	111	246	629
Estimated Annual Impact -- Modified, Gulf-Specific Analysis (1998 Dollars)				
	Direct	**Indirect**	**Induced**	**Total**
Output	178,219,407	29,111,563	21,800,854	229,131,826
Labor Income	17,490,114	8,875,273	8,325,832	34,691,221
Total Value Added	47,687,687	15,538,328	13,409,060	76,635,075
Employment (Number)	391	278	345	1,014

The differences in output, for instance, are 8 percent lower using our revised method of measuring economic impacts, than the canned approach included in IMPLAN. Labor income, however, is about 42 percent higher in our analysis relative to standard approaches. Value added is 14 percent higher in our model, while employment opportunities, represented by the number of jobs created by new exploratory wells, is 62 percent higher in our model than the standardized approach. These results, at minimum, support the notion that there are unique economic differences in the offshore industry and that further research should be conducted to better understand those differences and the impacts they have on human communities of the Gulf of Mexico.

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Appendix A:
Industry Cost Tables

Table A.1: Production Functions for Exploratory Drilling in the Gulf of Mexico by Major Water Depth

EXPLORATORY DRILLING						
IMPLAN Sectors	Sector Description	Average Production Function 0-60 Meters	Average Production Function 60-200 Meters	Average Production Function 200-900 Meters	Average Production Function 900 + Meters	Total Average Production Function (All Depths)
38	Oil & Gas Operations	0.6773	0.6741	0.7331	0.7322	0.7042
50	New Gas Utility Facilities					
53	Misc Natural Resource Facility Construction					
56	Maintenance and Repair, Other Facilities					
57	Other Oil & Gas Field Services	0.0343	0.0342	0.0292	0.0292	0.0317
160	Office Furniture and Equipment					
178	Maps and Charts (Msc Publishing)					
206	Explosives					
209	Chemicals, NEC					
210	Petroleum Fuels	0.0283	0.0283	0.0242	0.0241	0.0262
232	Hydraulic Cement	0.0669	0.0695	0.0580	0.0593	0.0634
258	Steel Pipe and Tubes	0.0619	0.0628	0.0441	0.0438	0.0531
284	Fabricated Plate Work					
290	Iron and Steel Forgings					
307	Turbines					
311	Construction Machinery & Equipment					
313	O&G Field Machinery					
331	Special Industrial Machinery					
332	Pumps & Compressors					
354	Industrial Machines, NEC					
356	Switchgear					
374	Communication Equipment, NEC					
392	Shipbuilding and Ship Repair					
399	Transportation Equipment, NEC					
401	Lab Equipment					
403	Instrumentation	0.0408	0.0407	0.0346	0.0346	0.0377
435	Demurrage/Warehousing/Motor Freight					
436	Water Transport	0.0828	0.0827	0.0701	0.0701	0.0764
437	Air Transport	0.0078	0.0078	0.0066	0.0066	0.0072
441	Communications					
443	Electric Services					
444	Gas Production/Distribution					
445	Water Supply					
446	Waste Disposal					
454	Eating/Drinking					
455	Msc Retail					
459	Insurance					
462	Real Estate					
469	Advertisement					
470	Other Business Services					
473	Msc. Equipment Rental and Leasing					
490	Doctors & Veterinarian Services					
494	Legal Services					
506	Environmental/Engineering Services					
507	Acct/Msc Business Services					
508	Management/Consulting Services					
509	Testing/Research Facilities					
Total		1.0000	1.0000	1.0000	1.0000	1.0000

Table A.2: Production Functions for Development Drilling in the Gulf of Mexico

DEVELOPMENT DRILLING						
IMPLAN Sectors	Sector Description	Average Production Function 0-60 Meters	Average Production Function 60-200 Meters	Average Production Function 200-900 Meters	Average Production Function 900 + Meters	Total Average Production Function (All Depths)
38	Oil & Gas Operations	0.65341	0.52344	0.64192	0.69198	0.62769
50	New Gas Utility Facilities					
53	Misc Natural Resource Facility Construction					
56	Maintenance and Repair, Other Facilities					
57	Other Oil & Gas Field Services	0.03447	0.02107	0.04069	0.03348	0.03243
160	Office Furniture and Equipment					
178	Maps and Charts (Msc Publishing)					
206	Explosives					
209	Chemicals, NEC					
210	Petroleum Fuels	0.02746	0.03349	0.03049	0.02664	0.02952
232	Hydraulic Cement	0.06566	0.11871	0.07490	0.06410	0.08084
258	Steel Pipe and Tubes	0.07104	0.15527	0.06077	0.05149	0.08464
284	Fabricated Plate Work					
290	Iron and Steel Forgings					
307	Turbines					
311	Construction Machinery & Equipment					
313	O&G Field Machinery	0.01545	0.01524	0.01039	0.00947	0.01264
331	Special Industrial Machinery					
332	Pumps & Compressors					
354	Industrial Machines, NEC					
356	Switchgear					
374	Communication Equipment, NEC					
392	Shipbuilding and Ship Repair					
399	Transportation Equipment, NEC					
401	Lab Equipment					
403	Instrumentation	0.04110	0.04222	0.04375	0.03817	0.04131
435	Demurrage/Warehousing/Motor Freight					
436	Water Transport	0.08355	0.08276	0.08873	0.07739	0.08311
437	Air Transport	0.00787	0.00780	0.00836	0.00729	0.00783
441	Communications					
443	Electric Services					
444	Gas Production/Distribution					
445	Water Supply					
446	Disposal					
454	Eating/Drinking					
455	Msc Retail					
459	Insurance					
462	Real Estate					
469	Advertisement					
470	Other Business Services					
473	Msc. Equipment Rental and Leasing					
490	Doctors & Veterinarian Services					
494	Legal Services					
506	Environmental/Engineering Services					
507	Acct/Msc Business Services					
508	Management/Consulting Services					
509	Testing/Research Facilities					
Total		1.00000	1.00000	1.00000	1.00000	1.00000

Table A.3: Production Functions for Offshore Production in the Gulf of Mexico

PRODUCTION , OPERATIONS						
IMPLAN Sectors	Sector Description	Average Production Function 0-60 Meters	Average Production Function 60-200 Meters	Average Production Function 200-900 Meters	Average Production Function 900 + Meters	Total Average Production Function (All Depths)
38	Oil & Gas Operations	0.29058	0.27271	0.26142	0.25126	0.26899
50	New Gas Utility Facilities					
53	Misc Natural Resource Facility Construction					
56	Maintenance and Repair, Other Facilities					
57	Other Oil & Gas Field Services	0.07158	0.07020	0.07018	0.07018	0.07054
160	Office Furniture and Equipment					
178	Maps and Charts (Msc Publishing)					
206	Explosives					
209	Chemicals, NEC					
210	Petroleum Fuels					
232	Hydraulic Cement					
258	Steel Pipe and Tubes	0.03560	0.03324	0.03171	0.03033	0.03272
284	Fabricated Plate Work					
290	Iron and Steel Forgings					
307	Turbines					
311	Construction Machinery & Equipment					
313	O&G Field Machinery	0.04846	0.04526	0.04317	0.04129	0.04455
331	Special Industrial Machinery					
332	Pumps & Compressors					
354	Industrial Machines, NEC					
356	Switchgear					
374	Communication Equipment, NEC					
392	Shipbuilding and Ship Repair					
399	Transportation Equipment, NEC					
401	Lab Equipment					
403	Instrumentation	0.02755	0.02573	0.02454	0.02347	0.02532
435	Demurrage/Warehousing/Motor Freight					
436	Water Transport	0.35196	0.32868	0.31353	0.29987	0.32351
437	Air Transport	0.05306	0.07260	0.07581	0.07832	0.06995
441	Communications	0.00843	0.01023	0.01043	0.01057	0.00991
443	Electric Services					
444	Gas Production/Distribution					
445	Water Supply					
446	Disposal					
454	Eating/Drinking	0.03637	0.03396	0.03240	0.03099	0.03343
455	Msc Retail					
459	Insurance	0.07641	0.10739	0.13681	0.16372	0.12108
462	Real Estate					
469	Advertisement					
470	Other Business Services					
473	Msc. Equipment Rental and Leasing					
490	Doctors & Veterinarian Services					
494	Legal Services					
506	Environmental/Engineering Services					
507	Acct/Msc Business Services					
508	Management/Consulting Services					
509	Testing/Research Facilities					
Total		1.00000	1.00000	1.00000	1.00000	1.00000

Table A.4: Production Functions for Platform Fabrication in the Gulf of Mexico

PLATFORM FABRICATION						
IMPLAN Sectors	Sector Description	Average Production Function 0-60 Meters	Average Production Function 60-200 Meters	Average Production Function 200-900 Meters	Average Production Function 900 + Meters	Total Average Production Function (All Depths)
38	Oil & Gas Operations					
50	New Gas Utility Facilities					
53	Misc Natural Resource Facility Construction					
56	Maintenance and Repair, Other Facilities					
57	Other Oil & Gas Field Services	0.02500	0.02500	0.02650	0.02750	0.02600
160	Office Furniture and Equipment					
178	Maps and Charts (Msc Publishing)					
206	Explosives					
209	Chemicals, NEC					
210	Petroleum Fuels					
232	Hydraulic Cement					
258	Steel Pipe and Tubes	0.36377	0.42526	0.48000	0.56312	0.45804
284	Fabricated Plate Work					
290	Iron and Steel Forgings					
307	Turbines	0.01312	0.01250	0.01250	0.01250	0.01266
311	Construction Machinery & Equipment					
313	O&G Field Machinery	0.00125	0.00125	0.00125	0.00125	0.00125
331	Special Industrial Machinery	0.05380	0.05750	0.05750	0.05750	0.05658
332	Pumps & Compressors	0.03205	0.03625	0.03625	0.03625	0.03520
354	Industrial Machines, NEC					
356	Switchgear					
374	Communication Equipment, NEC					
392	Shipbuilding and Ship Repair	0.43063	0.35395	0.27625	0.21337	0.31855
399	Transportation Equipment, NEC					
401	Lab Equipment					
403	Instrumentation					
435	Demurrage/Warehousing/Motor Freight					
436	Water Transport	0.01266	0.01714	0.02275	0.01972	0.01807
437	Air Transport	0.01250	0.01250	0.01250	0.01250	0.01250
441	Communications					
443	Electric Services					
444	Gas Production/Distribution					
445	Water Supply					
446	Waste Disposal					
454	Eating/Drinking	0.00377	0.00364	0.00425	0.00375	0.00385
455	Msc Retail					
459	Insurance					
462	Real Estate					
469	Advertisement					
470	Other Business Services					
473	Msc. Equipment Rental and Leasing					
490	Doctors & Veterinarian Services					
494	Legal Services					
506	Environmental/Engineering Services	0.05145	0.05501	0.07025	0.05254	0.05731
507	Acct/Msc Business Services					
508	Management/Consulting Services					
509	Testing/Research Facilities					
Total		1.00000	1.00000	1.00000	1.00000	1.00000

Table A.5: Production Functions for Pipeline Construction in the Gulf of Mexico

PIPELINES: CONSTRUCTION						
IMPLAN Sectors	Sector Description	Average Production Function 0-60 Meters	Average Production Function 60-200 Meters	Average Production Function 200-900 Meters	Average Production Function 900 + Meters	Total Average Production Function (All Depths)
38	Oil & Gas Operations	0.00209	0.01330	0.01560	0.00000	0.00775
50	New Gas Utility Facilities	0.78299	0.81386	0.78306	0.96255	0.83562
53	Misc Natural Resource Facility Construction					
56	Maintenance and Repair, Other Facilities					
57	Other Oil & Gas Field Services					
160	Office Furniture and Equipment	0.00508	0.00358	0.00587	0.00000	0.00363
178	Maps and Charts (Msc Publishing)					
206	Explosives					
209	Chemicals, NEC					
210	Petroleum Fuels					
232	Hydraulic Cement					
258	Steel Pipe and Tubes					
284	Fabricated Plate Work					
290	Iron and Steel Forgings					
307	Turbines					
311	Construction Machinery & Equipment					
313	O&G Field Machinery	0.19694	0.14566	0.18518	0.03629	0.14102
331	Special Industrial Machinery					
332	Pumps & Compressors					
354	Industrial Machines, NEC	0.00228	0.00226	0.00435	0.00000	0.00222
356	Switchgear					
374	Communication Equipment, NEC	0.00456	0.01054	0.00397	0.00116	0.00506
392	Shipbuilding and Ship Repair					
399	Transportation Equipment, NEC	0.00433	0.00614	0.00115	0.00000	0.00290
401	Lab Equipment	0.00088	0.00008	0.00001	0.00000	0.00024
403	Instrumentation					
435	Demurrage/Warehousing/Motor Freight					
436	Water Transport					
437	Air Transport					
441	Communications					
443	Electric Services					
444	Gas Production/Distribution					
445	Water Supply					
446	Waste Disposal					
454	Eating/Drinking					
455	Msc Retail					
459	Insurance					
462	Real Estate	0.00085	0.00457	0.00080	0.00000	0.00156
469	Advertisement					
470	Other Business Services					
473	Msc. Equipment Rental and Leasing					
490	Doctors & Veterinarian Services					
494	Legal Services					
506	Environmental/Engineering Services					
507	Acct/Msc Business Services					
508	Management/Consulting Services					
509	Testing/Research Facilities					
Total		1.00000	1.00000	1.00000	1.00000	1.00000

Table A.6: Production Functions for Pipeline O&M in the Gulf of Mexico

PIPELINES: OPERATIONS & MAINTENANCE						
IMPLAN Sectors	**Sector Description**	**Average Production Function 0-60 Meters**	**Average Production Function 60-200 Meters**	**Average Production Function 200-900 Meters**	**Average Production Function 900 + Meters**	**Total Average Production Function (All Depths)**
38	Oil & Gas Operations					
50	New Gas Utility Facilities					
53	Misc Natural Resource Facility Construction					
56	Maintenance and Repair, Other Facilities	0.162247	0.125630	0.129560	0.024087	0.110381
57	Other Oil & Gas Field Services					
160	Office Furniture and Equipment					
178	Maps and Charts (Msc Publishing)					
206	Explosives					
209	Chemicals, NEC					
210	Petroleum Fuels					
232	Hydraulic Cement					
258	Steel Pipe and Tubes					
284	Fabricated Plate Work					
290	Iron and Steel Forgings					
307	Turbines					
311	Construction Machinery & Equipment					
313	O&G Field Machinery					
331	Special Industrial Machinery					
332	Pumps & Compressors	0.004091	0.118562	0.127545	0.008342	0.064635
354	Industrial Machines, NEC					
356	Switchgear					
374	Communication Equipment, NEC					
392	Shipbuilding and Ship Repair					
399	Transportation Equipment, NEC					
401	Lab Equipment					
403	Instrumentation					
435	Demurrage/Warehousing/Motor Freight					
436	Water Transport					
437	Air Transport					
441	Communications	0.002782	0.005693	0.004815	0.038740	0.013007
443	Electric Services	0.028229	0.000000	0.000000	0.007096	0.008831
444	Gas Production/Distribution	0.420153	0.414360	0.410597	0.454391	0.424875
445	Water Supply					
446	Waste Disposal					
454	Eating/Drinking					
455	Msc Retail	0.040800	0.071190	0.012592	0.017434	0.035504
459	Insurance	0.034591	0.020910	0.045459	0.000605	0.025391
462	Real Estate					
469	Advertisement	0.000000	0.000089	0.000000	0.000000	0.000022
470	Other Business Services	0.002744	0.054240	0.028815	0.120269	0.051517
473	Msc. Equipment Rental and Leasing	0.013041	0.027807	0.031880	0.030699	0.025857
490	Doctors & Veterinarian Services					
494	Legal Services	0.141174	0.066919	0.089409	0.005405	0.075727
506	Environmental/Engineering Services	0.027406	0.027624	0.041986	0.292933	0.097487
507	Acct/Msc Business Services	0.042891	0.002233	0.000000	0.000000	0.011281
508	Management/Consulting Services	0.079852	0.064742	0.077341	0.000000	0.055484
509	Testing/Research Facilities					
Total		1.00000	1.00000	1.00000	1.00000	1.00000

Table A.7: Production Functions for Gas Processing & Storage Construction in the Gulf of Mexico

GAS PROCESSING & STORAGE: CONSTRUCTION						
IMPLAN Sectors	Sector Description	Average Production Function 0-60 Meters	Average Production Function 60-200 Meters	Average Production Function 200-900 Meters	Average Production Function 900 + Meters	Total Average Production Function (All Depths)
38	Oil & Gas Operations	0.58415	0.58415	0.58415	0.58415	0.58415
50	New Gas Utility Facilities					
53	Misc Natural Resource Facility Construction	0.04208	0.04208	0.04208	0.04208	0.04208
56	Maintenance and Repair, Other Facilities					
57	Other Oil & Gas Field Services					
160	Office Furniture and Equipment					
178	Maps and Charts (Msc Publishing)					
206	Explosives					
209	Chemicals, NEC					
210	Petroleum Fuels					
232	Hydraulic Cement					
258	Steel Pipe and Tubes					
284	Fabricated Plate Work					
290	Iron and Steel Forgings					
307	Turbines					
311	Construction Machinery & Equipment					
313	O&G Field Machinery	0.37186	0.37186	0.37186	0.37186	0.37186
331	Special Industrial Machinery					
332	Pumps & Compressors					
354	Industrial Machines, NEC					
356	Switchgear					
374	Communication Equipment, NEC	0.00000	0.00000	0.00000	0.00000	0.00000
392	Shipbuilding and Ship Repair					
399	Transportation Equipment, NEC					
401	Lab Equipment					
403	Instrumentation					
435	Demurrage/Warehousing/Motor Freight					
436	Water Transport					
437	Air Transport					
441	Communications					
443	Electric Services					
444	Gas Production/Distribution	0.00000	0.00000	0.00000	0.00000	0.00000
445	Water Supply					
446	Waste Disposal					
454	Eating/Drinking					
455	Msc Retail					
459	Insurance					
462	Real Estate	0.00192	0.00192	0.00192	0.00192	0.00192
469	Advertisement					
470	Other Business Services					
473	Msc. Equipment Rental and Leasing					
490	Doctors & Veterinarian Services					
494	Legal Services					
506	Environmental/Engineering Services					
507	Acct/Msc Business Services					
508	Management/Consulting Services					
509	Testing/Research Facilities					
Total		1.00000	1.00000	1.00000	1.00000	1.00000

Table A.8: Production Functions for Gas Processing & Storage O&M in the Gulf of Mexico

GAS PROCESSING & STORAGE: OPERATIONS & MAINTENANCE						
IMPLAN Sectors	Sector Description	Average Production Function 0-60 Meters	Average Production Function 60-200 Meters	Average Production Function 200-900 Meters	Average Production Function 900 + Meters	Total Average Production Function (All Depths)
38	Oil & Gas Operations	0.05635	0.05635	0.05635	0.05635	0.05635
50	New Gas Utility Facilities	0.00000	0.00000	0.00000	0.00000	0.00000
53	Misc Natural Resource Facility Construction					
56	Maintenance and Repair, Other Facilities	0.06933	0.06933	0.06933	0.06933	0.06933
57	Other Oil & Gas Field Services					
160	Office Furniture and Equipment					
178	Maps and Charts (Msc Publishing)	0.00007	0.00007	0.00007	0.00007	0.00007
206	Explosives					
209	Chemicals, NEC					
210	Petroleum Fuels					
232	Hydraulic Cement					
258	Steel Pipe and Tubes					
284	Fabricated Plate Work					
290	Iron and Steel Forgings					
307	Turbines					
311	Construction Machinery & Equipment					
313	O&G Field Machinery					
331	Special Industrial Machinery					
332	Pumps & Compressors	0.10274	0.10274	0.10274	0.10274	0.10274
354	Industrial Machines, NEC					
356	Switchgear					
374	Communication Equipment, NEC					
392	Shipbuilding and Ship Repair					
399	Transportation Equipment, NEC					
401	Lab Equipment					
403	Instrumentation	0.00216	0.00216	0.00216	0.00216	0.00216
435	Demurrage/Warehousing/Motor Freight	0.00000	0.00000	0.00000	0.00000	0.00000
436	Water Transport					
437	Air Transport					
441	Communications	0.00000	0.00000	0.00000	0.00000	0.00000
443	Electric Services	0.10139	0.10139	0.10139	0.10139	0.10139
444	Gas Production/Distribution	0.25144	0.25144	0.25144	0.25144	0.25144
445	Water Supply					
446	Waste Disposal					
454	Eating/Drinking					
455	Msc Retail	0.06783	0.06783	0.06783	0.06783	0.06783
459	Insurance	0.01348	0.01348	0.01348	0.01348	0.01348
462	Real Estate					
469	Advertisement	0.00052	0.00052	0.00052	0.00052	0.00052
470	Other Business Services	0.23464	0.23464	0.23464	0.23464	0.23464
473	Msc. Equipment Rental and Leasing	0.05566	0.05566	0.05566	0.05566	0.05566
490	Doctors & Veterinarian Services					
494	Legal Services	0.04236	0.04236	0.04236	0.04236	0.04236
506	Environmental/Engineering Services					
507	Acct/Msc Business Services	0.00199	0.00199	0.00199	0.00199	0.00199
508	Management/Consulting Services					
509	Testing/Research Facilities					
Total		0.99999	0.99999	0.99999	0.99999	0.99999

Table A.9: Production Functions for Workovers in the Gulf of Mexico

WORKOVERS						
IMPLAN Sectors	Sector Description	Average Production Function 0-60 Meters	Average Production Function 60-200 Meters	Average Production Function 200-900 Meters	Average Production Function 900 + Meters	Total Average Production Function (All Depths)
38	Oil & Gas Operations	0.06899	0.06543	0.06455	0.06375	0.06568
50	New Gas Utility Facilities					
53	Misc Natural Resource Facility Construction					
56	Maintenance and Repair, Other Facilities					
57	Other Oil & Gas Field Services	0.37196	0.35280	0.34804	0.34373	0.35413
160	Office Furniture and Equipment					
178	Maps and Charts (Msc Publishing)					
206	Explosives					
209	Chemicals, NEC					
210	Petroleum Fuels					
232	Hydraulic Cement					
258	Steel Pipe and Tubes					
284	Fabricated Plate Work					
290	Iron and Steel Forgings					
307	Turbines					
311	Construction Machinery & Equipment					
313	O&G Field Machinery	0.04905	0.04652	0.04589	0.04532	0.04669
331	Special Industrial Machinery					
332	Pumps & Compressors					
354	Industrial Machines, NEC					
356	Switchgear					
374	Communication Equipment, NEC					
392	Shipbuilding and Ship Repair					
399	Transportation Equipment, NEC					
401	Lab Equipment					
403	Instrumentation					
435	Demurrage/Warehousing/Motor Freight					
436	Water Transport	0.47569	0.49167	0.49529	0.49857	0.49030
437	Air Transport	0.02361	0.03282	0.03544	0.03781	0.03242
441	Communications	0.00214	0.00264	0.00278	0.00291	0.00261
443	Electric Services					
444	Gas Production/Distribution					
445	Water Supply					
446	Waste Disposal					
454	Eating/Drinking	0.00857	0.00812	0.00801	0.00792	0.00816
455	Msc Retail					
459	Insurance					
462	Real Estate					
469	Advertisement					
470	Other Business Services					
473	Msc. Equipment Rental and Leasing					
490	Doctors & Veterinarian Services					
494	Legal Services					
506	Environmental/Engineering Services					
507	Acct/Msc Business Services					
508	Management/Consulting Services					
509	Testing/Research Facilities					
Total		1.00000	1.00000	1.00000	1.00000	1.00000

Table A.10: Production Functions for Oil Spills in the Gulf of Mexico

OIL SPILLS						
IMPLAN Sectors	Sector Description	Average Production Function 0-60 Meters	Average Production Function 60-200 Meters	Average Production Function 200-900 Meters	Average Production Function 900 + Meters	Total Average Production Function (All Depths)
38	Oil & Gas Operations	0.00230	0.00119	0.00352	0.00352	0.00263
50	New Gas Utility Facilities					
53	Misc Natural Resource Facility Construction					
56	Maintenance and Repair, Other Facilities					
57	Other Oil & Gas Field Services	0.00210	0.00147	0.00178	0.00178	0.00178
160	Office Furniture and Equipment					
178	Maps and Charts (Msc Publishing)					
206	Explosives					
209	Chemicals, NEC	0.00399	0.00454	0.00444	0.00444	0.00435
210	Petroleum Fuels					
232	Hydraulic Cement					
258	Steel Pipe and Tubes					
284	Fabricated Plate Work					
290	Iron and Steel Forgings					
307	Turbines					
311	Construction Machinery & Equipment					
313	O&G Field Machinery					
331	Special Industrial Machinery					
332	Pumps & Compressors					
354	Industrial Machines, NEC					
356	Switchgear					
374	Communication Equipment, NEC					
392	Shipbuilding and Ship Repair	0.00536	0.00832	0.01409	0.01409	0.01047
399	Transportation Equipment, NEC					
401	Lab Equipment					
403	Instrumentation					
435	Demurrage/Warehousing/Motor Freight	0.00132	0.00088	0.00099	0.00099	0.00104
436	Water Transport					
437	Air Transport					
441	Communications	0.00012	0.00005	0.00000	0.00000	0.00004
443	Electric Services					
444	Gas Production/Distribution					
445	Water Supply					
446	Waste Disposal	0.00178	0.00018	0.00020	0.00020	0.00059
454	Eating/Drinking	0.00247	0.00148	0.00167	0.00167	0.00182
455	Msc Retail	0.00273	0.00104	0.00117	0.00117	0.00153
459	Insurance					
462	Real Estate					
469	Advertisement	0.00189	0.00109	0.00000	0.00000	0.00075
470	Other Business Services					
473	Msc. Equipment Rental and Leasing	0.01409	0.00903	0.01079	0.01079	0.01118
490	Doctors & Veterinarian Services	0.04327	0.04437	0.04387	0.04387	0.04384
494	Legal Services	0.67255	0.70237	0.77443	0.77443	0.73094
506	Environmental/Engineering Services	0.15935	0.14437	0.14287	0.14287	0.14736
507	Acct/Msc Business Services					
508	Management/Consulting Services					
509	Testing/Research Facilities	0.08669	0.07963	0.00019	0.00019	0.04167
Total		1.00000	1.00000	1.00000	1.00000	1.00000

Table A.11: Production Functions for Platform Abandonment in the Gulf of Mexico

PLATFORM ABANDONMENT							
IMPLAN Sectors	**Sector Description**	**FA Platform Abandonment**	**Average Production Function 0-60 Meters**	**Average Production Function 60-200 Meters**	**Average Production Function 200-900 Meters**	**Average Production Function 900 + Meters**	**Total Average Production Function (All Depths)**
38	Oil & Gas Operations	NA	0.14855	0.16929	0.17309	0.20139	0.17308
50	New Gas Utility Facilities	NA	0.03732	0.04683	0.05043	0.05972	0.04858
53	Misc Natural Resource Facility Construction	NA	0.05050	0.03210	0.01563	0.01667	0.02872
56	Maintenance and Repair, Other Facilities						
57	Other Oil & Gas Field Services	NA	0.17102	0.11066	0.10253	0.01389	0.09952
160	Office Furniture and Equipment						
178	Maps and Charts (Msc Publishing)						
206	Explosives						
209	Chemicals, NEC						
210	Petroleum Fuels						
232	Hydraulic Cement						
258	Steel Pipe and Tubes						
284	Fabricated Plate Work						
290	Iron and Steel Forgings						
307	Turbines						
311	Construction Machinery & Equipment						
313	O&G Field Machinery						
331	Special Industrial Machinery						
332	Pumps & Compressors						
354	Industrial Machines, NEC						
356	Switchgear						
374	Communication Equipment, NEC						
392	Shipbuilding and Ship Repair						
399	Transportation Equipment, NEC						
401	Lab Equipment						
403	Instrumentation						
435	Demurrage/Warehousing/Motor Freight						
436	Water Transport	NA	0.58534	0.62886	0.64319	0.69028	0.63692
437	Air Transport						
441	Communications						
443	Electric Services						
444	Gas Production/Distribution						
445	Water Supply						
446	Waste Disposal						
454	Eating/Drinking						
455	Msc Retail						
459	Insurance						
462	Real Estate						
469	Advertisement						
470	Other Business Services						
473	Msc. Equipment Rental and Leasing						
490	Doctors & Veterinarian Services						
494	Legal Services						
506	Environmental/Engineering Services	NA	0.00728	0.01226	0.01513	0.01806	0.01318
507	Acct/Msc Business Services						
508	Management/Consulting Services						
509	Testing/Research Facilities						
Total		NA	1.00000	1.00000	1.00000	1.00000	1.00000

Table A.12: Onshore Allocation of Offshore Expenses

IMPLAN Sectors	Definition	TX-1	TX-2	LA-1	LA-2	LA-3	MA-1	FL-1	FL-2	FL-3	FL-4	Gulf-Other	US-Other
38	Oil & Gas Operations	0.00	0.34	0.09	0.06	0.15	0.00	0.00	0.00	0.00	0.00	0.25	0.12
50	New Gas Utility Facilities	0.07	0.38	0.05	0.10	0.10	0.10	0.00	0.00	0.00	0.00	0.13	0.07
53	Misc Natural Resource Facility Construction	0.03	0.21	0.23	0.15	0.30	0.02	0.00	0.00	0.00	0.00	0.06	0.03
56	Maintenance and Repair, Other Facilities	0.06	0.31	0.04	0.08	0.09	0.08	0.00	0.00	0.00	0.00	0.22	0.11
57	Other Oil & Gas Field Services	0.00	0.30	0.26	0.12	0.16	0.00	0.00	0.00	0.00	0.00	0.11	0.05
160	Office Furniture and Equipment	0.15	0.54	0.00	0.00	0.08	0.23	0.00	0.00	0.00	0.00	0.00	0.00
178	Maps and Charts (Msc Publishing)	0.12	0.59	0.02	0.06	0.11	0.10	0.00	0.00	0.00	0.00	0.00	0.00
206	Explosives	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
209	Chemicals, NEC	0.03	0.64	0.04	0.10	0.04	0.04	0.00	0.00	0.00	0.00	0.08	0.04
210	Petroleum Fuels	0.11	0.50	0.09	0.16	0.09	0.05	0.00	0.00	0.00	0.00	0.00	0.00
232	Hydraulic Cement	0.00	0.10	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.50	0.30
258	Steel Pipe and Tubes	0.00	0.50	0.31	0.05	0.07	0.00	0.00	0.00	0.00	0.00	0.08	0.04
284	Fabricated Plate Work	0.04	0.63	0.06	0.09	0.05	0.14	0.00	0.00	0.00	0.00	0.00	0.00
290	Iron and Steel Forgings	0.00	0.81	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.14	0.00
307	Turbines	0.05	0.65	0.00	0.10	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00
311	Construction Machinery & Equipment	0.06	0.42	0.00	0.06	0.19	0.11	0.00	0.00	0.00	0.00	0.11	0.06
313	O&G Field Machinery & Equipment	0.03	0.18	0.27	0.18	0.22	0.00	0.00	0.00	0.00	0.00	0.08	0.04
331	Special Industrial Machinery	0.00	0.00	0.00	0.38	0.54	0.00	0.00	0.00	0.00	0.00	0.05	0.03
332	Pumps & Compressors	0.04	0.30	0.17	0.22	0.09	0.00	0.00	0.00	0.00	0.00	0.12	0.06
354	Industrial Machines, NEC	0.05	0.66	0.06	0.10	0.06	0.06	0.00	0.00	0.00	0.00	0.00	0.00
356	Switchgear	0.00	0.63	0.00	0.07	0.11	0.07	0.00	0.00	0.00	0.00	0.11	0.00
374	Communication Equipment, NEC	0.13	0.50	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.13	0.00
392	Shipbuilding and Ship Repair	0.09	0.24	0.05	0.24	0.18	0.19	0.00	0.00	0.00	0.00	0.00	0.00
399	Transportation Equipment, NEC	0.00	0.78	0.06	0.11	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00
401	Lab Equipment	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
403	Instrumentation	0.01	0.13	0.39	0.27	0.08	0.00	0.00	0.00	0.00	0.00	0.08	0.04
435	Demurrage/Warehousing/Motor Freight	0.11	0.37	0.21	0.09	0.09	0.01	0.00	0.00	0.00	0.00	0.12	0.00
436	Water Transport	0.02	0.27	0.10	0.25	0.22	0.04	0.01	0.00	0.01	0.00	0.08	0.00
437	Air Transport	0.03	0.42	0.11	0.11	0.08	0.02	0.00	0.00	0.00	0.01	0.22	0.00
441	Communications	0.09	0.51	0.07	0.11	0.11	0.11	0.00	0.00	0.00	0.00	0.00	0.00
443	Electric Services	0.13	0.36	0.06	0.15	0.12	0.18	0.00	0.00	0.00	0.00	0.00	0.00
444	Gas Production/Distribution	0.10	0.54	0.08	0.07	0.05	0.03	0.00	0.00	0.00	0.00	0.08	0.04
445	Water Supply	0.08	0.43	0.08	0.12	0.05	0.11	0.00	0.00	0.00	0.00	0.12	0.01
446	Waste Treatment/Disposal	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
454	Eating/Drinking	0.00	0.24	0.28	0.08	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00
455	Msc Retail	0.09	0.48	0.06	0.10	0.15	0.11	0.00	0.00	0.00	0.00	0.00	0.00
459	Insurance	0.04	0.47	0.07	0.12	0.09	0.00	0.00	0.00	0.00	0.00	0.18	0.03
462	Real Estate	0.09	0.47	0.04	0.08	0.11	0.08	0.00	0.00	0.00	0.00	0.12	0.01
469	Advertisement	0.06	0.45	0.06	0.08	0.15	0.08	0.00	0.00	0.00	0.00	0.12	0.01
470	Other Business Services	0.00	0.60	0.11	0.09	0.06	0.00	0.00	0.00	0.00	0.00	0.10	0.05
473	Msc. Equipment Rental and Leasing	0.09	0.26	0.22	0.10	0.10	0.01	0.00	0.00	0.00	0.00	0.20	0.03
490	Doctors & Veterinarian Services	0.09	0.53	0.06	0.09	0.14	0.08	0.00	0.00	0.00	0.00	0.00	0.00
494	Legal Services	0.07	0.48	0.07	0.11	0.19	0.08	0.00	0.00	0.00	0.00	0.00	0.00
506	Environmental/Engineering Services	0.06	0.38	0.11	0.08	0.08	0.03	0.01	0.00	0.02	0.00	0.21	0.01
507	Acct/Msc Business Services	0.06	0.46	0.05	0.09	0.13	0.07	0.00	0.00	0.00	0.00	0.12	0.01
508	Management/Consulting Services	0.04	0.54	0.04	0.09	0.11	0.05	0.00	0.00	0.00	0.00	0.12	0.01
509	Testing/Research Facilities	0.00	0.38	0.14	0.14	0.05	0.00	0.00	0.00	0.00	0.00	0.22	0.11

Table A.13: Total Cost Analysis: Summary of Total Costs by Offshore Activity and Water Depth

Category	0-60 Meters	60-200 Meters	200-900 Meters	900+ Meters
Exploratory Drilling				
Annual Total Cost Per Well (1998, $000)	4,245	3,240	6,897	10,577
Development Drilling				
Annual Total Cost Per Well (1998, $000)	4,231	2,774	5,045	9,779
Production Costs				
Annual Total Cost Per Well (1998)	240,908	253,764	263,152	271,070
Platform Installation Costs				
Total Cost Per Platform (1999, $ Million)	19.101	74.376	124.566	131.115
Installed Costs: Pipelines				
Total Costs Per Mile	541,315	891,654	1,509,284	3,850,385
O&M Costs: Pipelines				
Total Costs Per MMBTU (1998 Dollars)	0.0520	0.0642	0.0660	0.0767
Total Costs Per BCF (1998 Dollars)	53.3296	65.8886	67.6846	78.7038
Installed Cost: Gas Processing and Storage				
Total Costs per BCF/d Capacity (2000 $ Millions)	136	136	136	136
O&M Cost: Gas Processing and Storage				
Total Costs per BCF (1998)	36.9373	36.9373	36.9373	36.9373
Workover Costs				
Total Costs Per Workover Per Well (1998)	13,704	14,385	14,566	14,566
Oil Spill Costs				
Total Costs Per Gallon Spilled (1998)	107.19	67.88	45.45	45.45
Platform Abandonment and Removal Costs				
(Costs Per Platform)				
4-Pile Platform (By Method)				
Bulk Explosives (Topple) -- (1994)	572,500	1,236,435	6,128,504	10,032,703
Bulk Explosives (Std Practice) -- (1994)	707,500	1,676,685	10,108,047	17,421,039
Abrasive Cutting -- (1994)	880,000	1,991,857	8,403,445	13,536,319
Mechanical Cutting -- (1994)	976,750	2,172,751	9,120,996	14,678,739
Weighted Average (1994)	800,988	1,582,313	8,132,202	10,032,703
8-Pile Platform (By Method)				
Bulk Explosives (Topple) -- (1994)	835,000	2,030,700	10,869,108	17,931,115
Bulk Explosives (Std Practice) -- (1994)	987,500	2,473,299	15,377,140	26,629,383
Abrasive Cutting -- (1994)	1,221,250	2,842,409	11,950,378	19,253,528
Mechanical Cutting -- (1994)	1,435,750	3,263,999	13,572,417	21,837,837
Weighted Average	1,131,832	2,413,015	13,129,364	17,931,115

Appendix B:
Coastal Impact Tables

Appendix Table B.1:
Socioeconomic and Demographic Indicators

Project Area		Mean
LA1	Average earnings per job (dollars), 1997	25,810.60
LA2	Average earnings per job (dollars), 1997	27,712.00
LA3	Average earnings per job (dollars), 1997	27,999.80
LA1	Civilian labor force (BLS), number, 1996	47,883.80
LA2	Civilian labor force (BLS), number, 1996	44,441.00
LA3	Civilian labor force (BLS), number, 1996	112,520.80
LA1	Civilian labor force (BLS),unemployment rate, 1996	5.72
LA2	Civilian labor force (BLS),unemployment rate, 1996	7.27
LA3	Civilian labor force (BLS),unemployment rate, 1996	6.12
LA1	Educational attainment, percent of persons 25 years and over college graduates, 1990	12.58
LA2	Educational attainment, percent of persons 25 years and over college graduates, 1990	11.84
LA3	Educational attainment, percent of persons 25 years and over college graduates, 1990	15.82
LA1	Educational attainment, percent of persons 25 years and over high school graduates, 1990	64.46
LA2	Educational attainment, percent of persons 25 years and over high school graduates, 1990	65.72
LA3	Educational attainment, percent of persons 25 years and over high school graduates, 1990	69.24
LA1	Farm employment, 1997	4,567.00
LA2	Farm employment, 1997	5,163.00
LA3	Farm employment, 1997	911
LA1	Farm income (thousands of dollars), 1997	8,742.20
LA2	Farm income (thousands of dollars), 1997	5,751.09
LA3	Farm income (thousands of dollars), 1997	799
LA1	Mining Employment, 1997	21,977.00
LA2	Mining Employment, 1997	12,393.00
LA3	Mining Employment, 1997	15,938.00
LA1	Nonfarm employment, 1997	294,089.00
LA2	Nonfarm employment, 1997	552,095.00
LA3	Nonfarm employment, 1997	700,815.00
LA1	Nonfarm personal income (thousands of dollars), 1997	2,102,038.20
LA2	Nonfarm personal income (thousands of dollars), 1997	1,926,348.64
LA3	Nonfarm personal income (thousands of dollars), 1997	5,612,477.80
LA1	Nonfarm personal income (thousands of dollars), 1997	207,660.00
LA2	Nonfarm personal income (thousands of dollars), 1997	35,108.36
LA3	Nonfarm personal income (thousands of dollars), 1997	183,412.60
LA1	Per Capita Personal Income (dollars), 1997	19,565.80
LA2	Per Capita Personal Income (dollars), 1997	19,600.09
LA3	Per Capita Personal Income (dollars), 1997	22,064.00
LA1	Per capita transfer payments, 1997	3,643.20
LA2	Per capita transfer payments, 1997	3,785.73
LA3	Per capita transfer payments, 1997	4,545.40

(Continued)

Project Area		Mean
LA1	Population (number of persons), 1997	99,280.80
LA2	Population (number of persons), 1997	93,160.27
LA3	Population (number of persons), 1997	239,516.40
LA1	Population, 65 years and over, 1996	10,408.40
LA2	Population, 65 years and over, 1996	8,642.00
LA3	Population, 65 years and over, 1996	27,425.00
LA1	Population, percent American Indian, Eskimo, or Aleut, 1996	0.2
LA2	Population, percent American Indian, Eskimo, or Aleut, 1996	0.92
LA3	Population, percent American Indian, Eskimo, or Aleut, 1996	0.66
LA1	Population, percent Asian or Pacific Islander, 1996	1.1
LA2	Population, percent Asian or Pacific Islander, 1996	0.74
LA3	Population, percent Asian or Pacific Islander, 1996	1.98
LA1	Population, percent Hispanic (maybe of any race), 1996	1.74
LA2	Population, percent Hispanic (maybe of any race), 1996	1.75
LA3	Population, percent Hispanic (maybe of any race), 1996	4.72
LA1	Population, Percent Black, 1996	20.3
LA2	Population, Percent Black, 1996	29.03
LA3	Population, Percent Black, 1996	25
LA1	Poverty, percent below poverty, 1993	20
LA2	Poverty, percent below poverty, 1993	20.95
LA3	Poverty, percent below poverty, 1993	21.38
LA1	Private nonfarm establishments, percent retail trade, 1995	24.34
LA2	Private nonfarm establishments, percent retail trade, 1995	24.36
LA3	Private nonfarm establishments, percent retail trade, 1995	24.02
LA1	Private nonfarm establishments, percent service, 1995	33.48
LA2	Private nonfarm establishments, percent service, 1995	31.84
LA3	Private nonfarm establishments, percent service, 1995	35.6
LA1	Total full- and part-time employment, 1997	59,731.00
LA2	Total full- and part-time employment, 1997	50,660.00
LA3	Total full- and part-time employment, 1997	140,345.00

Source: REIS, U.S. BEA, and Government Information Sharing Project (Http://govinfo.kerr.orst.edu)

Appendix Table B.2:
Selected Socioeconomic and Demographic Indicators, All Louisiana

Indicator Description	Estimate
Average earnings per job (1996 dollars)	26,798.00
Civilian labor force (BLS), number, 1996	19,997,300.00
Civilian labor force (BLS),unemployment rate, 1996	6.7
Educational attainment, percent of persons 25 years and over college graduates, 1990	16.1
Educational attainment, percent of persons 25 years and over high school graduates, 1990	68.3
Farm employment, 1996	37,476.00
Farm income, 1996	497,478.00
Mining Employment, 1996	58,023.00
Nonfarm employment, 1996	2,258,496.00
Nonfarm personal income ($1000) , 1996	88,569,068.00
Oil and gas extraction earnings ($1000) , 1996	3,049,679.00
Per capita personal income (dollars) , 1996	20,458.00
Per capita transfer payments, 1996	4,326.00
Population (number of persons) , 1996	4,351,769.00
Population, 65 years and over, 1996	496,606.00
Population, percent white, 1996	66.3
Population, percent American Indian, Eskimo, or Aleut, 1996	0.4
Population, percent Asian or Pacific Islander, 1996	1.2
Population, percent Hispanic (maybe of any race), 1996	2.5
Population, percent Black, 1996	32
Poverty, percent below poverty, 1993	23.9
Private nonfarm establishments, percent retail trade, 1995	24.3
Private nonfarm establishments, percent service, 1995	36.5
Total full- and part-time employment, 1996	2,295,972.00

Source: REIS, U.S. BEA, and Government Information Sharing Project (http://govinfo.kerr.orst.edu)

Appendix Table B.3:
Commodities With Modified Regional Purchasing Coefficient

IMPLAN Code	Commodity	Net Commodity Supply	Total Gross Commodity Demand	Domestic SDP	Average RPC
1	Dairy Farm Products	130.32	177.59	0.7300	0.1900
13	Hay and Pasture	98.65	70.36	1.0000	0.0900
19	Sugar Crops	134.94	121.33	1.0000	0.9800
23	Greenhouse and Nursery Products	34.33	181.16	0.1900	0.0700
24	Forestry Products	416.00	401.36	1.0000	0.0100
38	Natural Gas & Crude Petroleum	6362.35	10775.30	0.5900	0.3600
45	Chemical- Fertilizer Mineral Mining- N.E.C.	0.00	50.28	0.0000	0.0000
60	Poultry Processing	495.19	446.04	1.0000	0.9800
69	Pickles- Sauces- and Salad Dressings	123.90	123.16	1.0000	0.0500
74	Rice Milling	163.57	71.75	1.0000	0.1000
95	Bottled and Canned Soft Drinks & Water	686.49	460.59	1.0000	0.1300
98	Prepared Fresh Or Frozen Fish Or Seafood	334.26	119.01	1.0000	0.1000
99	Roasted Coffee	539.98	101.61	1.0000	0.9000
162	Paper Mills- Except Building Paper	1109.05	422.75	1.0000	0.0000
163	Paperboard Mills	715.08	178.49	1.0000	0.0000
164	Paperboard Containers and Boxes	374.65	364.55	1.0000	0.9800
168	Bags- Paper	69.74	39.21	1.0000	0.0000
174	Newspapers	100.08	148.54	0.6700	0.1600
179	Commercial Printing	229.15	411.62	0.5600	0.1800
189	Inorganic Chemicals N.E.C.	980.76	665.76	1.0000	0.4400
191	Plastics Materials and Resins	1486.43	266.36	1.0000	0.8800
192	Synthetic Rubber	414.81	33.90	1.0000	0.8400
204	Agricultural Chemicals- N.E.C	259.26	159.84	1.0000	0.2800
210	Petroleum Refining	14599.54	3784.42	1.0000	0.8500
213	Lubricating Oils and Greases	498.39	110.92	1.0000	1.0000
214	Petroleum and Coal Products- N.E.C.	0.00	18.04	0.0000	0.0000
220	Miscellaneous Plastics Products	634.74	1366.61	0.4600	0.0000
243	Concrete Products- N.E.C	140.29	284.89	0.4900	0.0100
244	Ready-mixed Concrete	262.71	261.77	1.0000	0.0100
254	Blast Furnaces and Steel Mills	222.06	698.94	0.3200	0.0600
261	Primary Aluminum	201.17	62.35	1.0000	0.0200
265	Aluminum Rolling and Drawing	88.66	101.14	0.8800	0.0200
282	Fabricated Structural Metal	583.53	334.91	1.0000	0.0900
284	Fabricated Plate Work (Boiler Shops)	159.69	134.04	1.0000	0.0400
301	Industrial and Fluid Valves	355.59	288.24	1.0000	0.3300
303	Pipe- Valves- and Pipe Fittings	1.26	156.53	0.0100	0.0100
309	Farm Machinery and Equipment	100.55	153.42	0.6600	0.6600
313	Oil Field Machinery	94.92	148.68	0.6400	0.5300
314	Elevators and Moving Stairways	9.01	38.15	0.2400	0.2400
354	Industrial Machines N.E.C.	378.03	305.17	1.0000	0.0000

(Continued)

IMPLAN Code	Commodity	Net Commodity Supply	Total Gross Commodity Demand	Domestic SDP	Average RPC
369	Lighting Fixtures and Equipment	209.83	264.61	0.7900	0.0000
392	Ship Building and Repairing	1114.65	482.23	1.0000	0.0800
393	Boat Building and Repairing	154.05	110.61	1.0000	0.0200
441	Communications- Except Radio and TV	2638.85	3697.48	0.7100	0.5500
442	Radio and TV Broadcasting	49.96	50.90	0.9800	0.4200
456	Banking	3503.09	4880.19	0.7200	0.5600
457	Credit Agencies	453.91	571.53	0.7900	0.5600
460	Insurance Agents and Brokers	1094.68	615.82	1.0000	0.5200
461	Owner-occupied Dwellings	5193.65	7647.46	0.6800	0.6800
462	Real Estate	4020.84	8567.45	0.4700	0.4700
467	Funeral Service and Crematories	189.45	169.26	1.0000	0.9000
482	Miscellaneous Repair Shops	541.96	461.39	1.0000	0.6900
488	Amusement and Recreation Services- N.E.C.	1940.41	768.92	1.0000	0.8500
495	Elementary and Secondary Schools	383.69	408.37	0.9400	0.8000
497	Other Educational Services	320.74	299.64	1.0000	0.8000
503	Business Associations	234.10	196.80	1.0000	0.6000
504	Labor and Civic Organizations	239.34	271.48	0.8800	0.6000
513	U.S. Postal Service	734.14	742.65	0.9900	0.5100
515	Other Federal Government Enterprises	90.28	53.42	1.0000	0.5100

Source: IMPLAN, Minnesota Implan Group, Inc.

Appendix Table B.4:
Adjusted RPC and State Domestic Product Ratio for Selected Commodities

IMPLAN Code	Commodity	SDP Ratio	Modified RPC
1	Dairy Farm Products	0.7339	0.7000
13	Hay and Pasture	1.0000	1.0000
19	Sugar Crops	1.0000	1.0000
23	Greenhouse and Nursery Products	0.1895	0.0837
24	Forestry Products	1.0000	0.6000
38	Natural Gas & Crude Petroleum	0.5905	0.3200
39	Natural Gas Liquids	0.5919	0.3500
45	Chemical- Fertilizer Mineral Mining- N.E.C.	1.0000	0.5000
60	Poultry Processing	1.0000	0.3000
69	Pickles- Sauces- and Salad Dressings	1.0000	0.5000
74	Rice Milling	1.0000	0.3000
95	Bottled and Canned Soft Drinks & Water	1.0000	0.9000
98	Prepared Fresh Or Frozen Fish Or Seafood	1.0000	0.2000
99	Roasted Coffee	1.0000	0.6000
162	Paper Mills- Except Building Paper	1.0000	0.5000
163	Paperboard Mills	1.0000	0.7500
168	Bags- Paper	1.0000	0.5000
174	Newspapers	0.6738	0.6000
179	Commercial Printing	0.5567	0.5500
189	Inorganic Chemicals Nec.	1.0000	0.7000
191	Plastics Materials and Resins	1.0000	0.8000
192	Synthetic Rubber	1.0000	0.7000
204	Agricultural Chemicals- N.E.C	1.0000	0.5500
210	Petroleum Refining	1.0000	0.7500
213	Lubricating Oils and Greases	1.0000	0.7500
214	Petroleum and Coal Products- N.E.C.	1.0000	0.7500
220	Miscellaneous Plastics Products	0.4645	0.2000
243	Concrete Products- N.E.C	0.4925	0.4500
244	Ready-mixed Concrete	1.0000	1.0000
254	Blast Furnaces and Steel Mills	0.3177	0.1000
261	Primary Aluminum	1.0000	0.5000
265	Aluminum Rolling and Drawing	0.8766	0.2500
282	Fabricated Structural Metal	1.0000	0.5000
284	Fabricated Plate Work (Boiler Shops)	1.0000	0.2500
301	Industrial and Fluid Valves	1.0000	0.5000
303	Pipe- Valves- and Pipe Fittings	0.9400	0.5000
309	Farm Machinery and Equipment	0.6554	0.6000
313	Oil Field Machinery	0.6384	0.5500
354	Industrial Machines N.E.C.	1.0000	0.5000
369	Lighting Fixtures and Equipment	0.7930	0.5000
392	Ship Building and Repairing	1.0000	0.3000

(Continued)

IMPLAN Code	Commodity	SDP Ratio	Modified RPC
393	Boat Building and Repairing	1.0000	0.5000
441	Communications- Except Radio and TV	0.7137	0.6500
442	Radio and TV Broadcasting	0.9816	0.7500
456	Banking	0.7178	0.6000
457	Credit Agencies	0.7942	0.7500
460	Insurance Agents and Brokers	1.0000	0.9000
461	Owner-occupied Dwellings	0.6791	1.0000
467	Funeral Service and Crematories	1.0000	1.0000
482	Miscellaneous Repair Shops	1.0000	0.9000
488	Amusement and Recreation Services- N.E.C.	1.0000	0.9500
495	Elementary and Secondary Schools	0.9396	0.9000
496	Colleges- Universities- Schools	0.9550	0.9000
497	Other Educational Services	1.0000	0.9500
503	Business Associations	1.0000	0.7500
504	Labor and Civic Organizations	0.8816	0.7500
513	U.S. Postal Service	0.9885	0.9000
515	Other Federal Government Enterprises	1.0000	1.0000

Source: IMPLAN, Minnesota Implan Group, Inc.

Appendix Table B.5:
Onshore Allocation Ratios/Profile for LA1, LA2, LA3 in Gulf of Mexico

IMPLAN Sector	Description	LA1	LA2	LA3
38	Oil & Gas Operations	0.0900	0.0600	0.1500
50	New Gas Utility Facilities	0.0500	0.1000	0.1000
53	Misc. Natural Resource Facility Construction	0.2300	0.1500	0.3000
56	Maintenance and Repair, Other Facilities	0.0400	0.0800	0.0900
57	Other Oil & Gas Field Services	0.2600	0.1200	0.1600
160	Office Furniture and Equipment	0.0000	0.0000	0.0800
178	Maps and Charts (Misc. Publishing)	0.0200	0.0600	0.1100
206	Explosives	0.0000	0.0000	0.0000
209	Chemicals, NEC	0.0400	0.1000	0.0400
210	Petroleum Fuels	0.0900	0.1600	0.0900
232	Hydraulic Cement	0.0000	0.0000	0.0000
258	Steel Pipe and Tubes	0.3100	0.0500	0.0700
284	Fabricated Plate Work	0.0600	0.0900	0.0500
290	Iron and Steel Forgings	0.0000	0.0000	0.0500
307	Turbines	0.0000	0.1000	0.2000
311	Construction Machinery & Equipment	0.0000	0.0600	0.1900
313	O&G Field Machinery & Equipment	0.2700	0.1800	0.2200
331	Special Industrial Machinery	0.0000	0.3800	0.5400
332	Pumps & Compressors	0.1700	0.2200	0.0900
354	Industrial Machines, NEC	0.0600	0.1000	0.0600
356	Switchgear	0.0000	0.0700	0.1100
374	Communication Equipment, NEC	0.0000	0.0000	0.2500
392	Shipbuilding and Ship Repair	0.0500	0.2400	0.1800
399	Transportation Equipment, NEC	0.0600	0.1100	0.0000
401	Lab Equipment	0.0000	0.0000	0.0000
403	Instrumentation	0.3900	0.2700	0.0800
435	Demurrage/Warehousing/Motor Freight	0.2100	0.0900	0.0900
436	Water Transport	0.1000	0.2500	0.2200
437	Air Transport	0.1100	0.1100	0.0800
441	Communications	0.0700	0.1100	0.1100
443	Electric Services	0.0600	0.1500	0.1200
444	Gas Production/Distribution	0.0800	0.0700	0.0500
445	Water Supply	0.0800	0.1200	0.0500
446	Waste Treatment/Disposal	0.0000	0.0000	0.0000
454	Eating/Drinking	0.2800	0.0800	0.4000
455	Misc. Retail	0.0600	0.1000	0.1500
459	Insurance	0.0700	0.1200	0.0900
462	Real Estate	0.0400	0.0800	0.1100
469	Advertisement	0.0600	0.0800	0.1500
470	Other Business Services	0.1100	0.0900	0.0600
473	Misc. Equipment Rental and Leasing	0.2200	0.1000	0.1000
490	Doctors & Veterinarian Services	0.0600	0.0900	0.1400
494	Legal Services	0.0700	0.1100	0.1900
506	Environmental/Engineering Services	0.1100	0.0800	0.0800
507	Acct/Misc. Business Services	0.0500	0.0900	0.1300
508	Management/Consulting Services	0.0400	0.0900	0.1100
509	Testing/Research Facilities	0.1400	0.1400	0.0500

Source : IMPLAN, Minnesota Implan Group, Inc.

Appendix Table B.6:
Expenditure Allocation

Appendix Table B.6.1:
LA Model Exploratory Drilling Expenditure Distribution by Water Depth

IMPLAN Sector	Description	Water Depth				
		0-60 m	60-200 m	200-900 m	900 m+	All Depths
38	Oil & Gas Operations	0.6773	0.6741	0.7331	0.7322	0.7042
57	Other Oil & Gas Field Services	0.0343	0.0342	0.0292	0.0292	0.0317
210	Petroleum Fuels	0.0283	0.0283	0.0242	0.0241	0.0262
232	Hydraulic Cement	0.0669	0.0695	0.0580	0.0593	0.0634
258	Steel Pipe and Tubes	0.0619	0.0628	0.0441	0.0438	0.0531
403	Instrumentation	0.0408	0.0407	0.0346	0.0346	0.0377
436	Water Transport	0.0828	0.0827	0.0701	0.0701	0.0764
437	Air Transport	0.0078	0.0078	0.0066	0.0066	0.0072
	Total:	1.0000	1.0000	1.0000	1.0000	1.0000

Appendix Table B.6.2:
LA Model Development Drilling Expenditure Distribution by Water Depth

IMPLAN Sector	Description	Water Depth				
		0-60 m	60-200 m	200-900 m	900 m+	All Depths
38	Oil & Gas Operations	0.6534	0.5234	0.6419	0.6920	0.6277
57	Other Oil & Gas Field Services	0.0345	0.0211	0.0407	0.0335	0.0324
210	Petroleum Fuels	0.0275	0.0335	0.0305	0.0266	0.0295
232	Hydraulic Cement	0.0657	0.1187	0.0749	0.0641	0.0808
258	Steel Pipe and Tubes	0.0710	0.1553	0.0608	0.0515	0.0846
313	O&G Field Machinery & Equipment	0.0155	0.0152	0.0104	0.0095	0.0126
403	Instrumentation	0.0411	0.0422	0.0438	0.0382	0.0413
436	Water Transport	0.0836	0.0828	0.0887	0.0774	0.0831
437	Air Transport	0.0079	0.0078	0.0084	0.0073	0.0078
	Total:	1.0000	1.0000	1.0000	1.0000	1.0000

Appendix Table B.6.3:
LA Model Production Drilling Expenditure Distribution by Water Depth

IMPLAN Sector	Description	Water Depth				
		0-60 m	60-200 m	200-900 m	900 m+	All Depths
38	Oil & Gas Operations	0.2906	0.2727	0.2614	0.2513	0.2690
57	Other Oil & Gas Field Services	0.0716	0.0702	0.0702	0.0702	0.0705
258	Steel Pipe and Tubes	0.0356	0.0332	0.0317	0.0303	0.0327
313	O&G Field Machinery & Equipment	0.0485	0.0453	0.0432	0.0413	0.0446
403	Instrumentation	0.0276	0.0257	0.0245	0.0235	0.0253
436	Water Transport	0.3520	0.3287	0.3135	0.2999	0.3235
437	Air Transport	0.0531	0.0726	0.0758	0.0783	0.0700
454	Eating/Drinking	0.0364	0.0340	0.0324	0.0310	0.0334
459	Insurance	0.0764	0.1074	0.1368	0.1637	0.1211
	Total:	1.0000	1.0000	1.0000	1.0000	1.0000

Appendix Table B.7:
Implan Exogenous Shock Vector by Water Depth and Activity, and LA Area Activity

Appendix Table B.7.1:
LA1: Exploratory Wells
($000)

IMPLAN Sector	Description	Water Depth			
		0-60 m	60-200 m	200-900 m	900 m+
38	Oil & Gas Operations	691,730	525,388	1,216,429	1,863,125
57	Other Oil & Gas Field Services	34,994	26,637	48,417	74,255
210	Petroleum Fuels	28,933	22,052	40,080	61,448
232	Hydraulic Cement	68,314	54,147	96,313	150,993
258	Steel Pipe and Tubes	63,181	48,907	73,233	111,408
403	Instrumentation	41,635	31,736	57,441	87,993
436	Water Transport	84,526	64,443	116,317	178,409
437	Air Transport	7,961	6,072	10,968	16,833
	Total:	1,021,275	779,384	1,659,198	2,544,464

Appendix Table B.7.2:
LA1: Development Wells
($000)

IMPLAN Sector	Description	Water Depth			
		0-60 m	60-200 m	200-900 m	900 m+
38	Oil & Gas Operations	996,742	523,483	1,167,414	2,439,502
57	Other Oil & Gas Field Services	52,575	21,071	74,004	118,035
210	Petroleum Fuels	41,894	33,492	55,457	93,924
232	Hydraulic Cement	100,157	118,719	136,210	225,973
258	Steel Pipe and Tubes	108,366	155,282	110,522	181,517
313	O&G Field Machinery & Equipment	23,566	15,238	18,897	33,375
403	Instrumentation	62,694	42,227	79,559	134,572
436	Water Transport	127,446	82,763	161,365	272,829
437	Air Transport	12,012	7,798	15,204	25,707
	Total:	1,525,452	1,000,073	1,818,631	3,525,434

Appendix Table B.7.3:
LA1: Production Wells
($000)

IMPLAN Sector	Description	Water Depth			
		0-60 m	**60-200 m**	**200-900 m**	**900 m+**
38	Oil & Gas Operations	20,441,559	20,207,687	20,088,158	19,887,889
57	Other Oil & Gas Field Services	5,035,185	5,202,146	5,392,425	5,555,373
258	Steel Pipe and Tubes	2,504,271	2,463,413	2,436,825	2,400,751
313	O&G Field Machinery & Equipment	3,409,248	3,353,624	3,317,429	3,268,318
403	Instrumentation	1,938,100	1,906,479	1,885,903	1,857,984
436	Water Transport	24,759,234	24,355,271	24,092,407	23,735,751
437	Air Transport	3,732,265	5,379,830	5,825,176	6,199,475
441	Communications	593,278	758,029	801,245	836,403
454	Eating/Drinking	2,558,454	2,516,711	2,489,549	2,452,694
459	Insurance	5,374,999	7,957,432	10,512,860	12,959,441
	Total:	70,346,593	74,100,623	76,841,976	79,154,080

Appendix Table B.7.4:
LA2: Exploratory Wells
($000)

IMPLAN Sector	Description	Water Depth			
		0-60 m	**60-200 m**	**200-900 m**	**900 m+**
38	Oil & Gas Operations	461,153	350,258	810,953	1,242,083
57	Other Oil & Gas Field Services	23,330	17,758	32,278	49,503
210	Petroleum Fuels	19,288	14,701	26,720	40,965
232	Hydraulic Cement	45,543	36,098	64,209	100,662
258	Steel Pipe and Tubes	42,120	32,605	48,822	74,272
403	Instrumentation	27,757	21,158	38,294	58,662
436	Water Transport	56,351	42,962	77,545	118,939
437	Air Transport	5,308	4,048	7,312	11,222
	Total:	680,850	519,589	1,106,132	1,696,310

Appendix Table B.7.5:
LA2: Development Wells
($000)

IMPLAN Sector	Description	Water Depth			
		0-60 m	60-200 m	200-900 m	900 m+
38	Oil & Gas Operations	664,495	348,988	778,276	1,626,335
57	Other Oil & Gas Field Services	35,050	14,047	49,336	78,690
210	Petroleum Fuels	27,929	22,328	36,971	62,616
232	Hydraulic Cement	66,772	79,146	90,807	150,649
258	Steel Pipe and Tubes	72,244	103,522	73,681	121,011
313	O&G Field Machinery & Equipment	15,710	10,159	12,598	22,250
403	Instrumentation	41,796	28,151	53,039	89,715
436	Water Transport	84,964	55,175	107,577	181,886
437	Air Transport	8,008	5,199	10,136	17,138
	Total:	1,016,968	666,715	1,212,421	2,350,289

Appendix Table B.7.6:
LA2: Production Wells
($000)

IMPLAN Sector	Description	Water Depth			
		0-60 m	60-200 m	200-900 m	900 m+
38	Oil & Gas Operations	13,627,706	13,471,792	13,392,105	13,258,593
57	Other Oil & Gas Field Services	3,356,790	3,468,097	3,594,950	3,703,582
258	Steel Pipe and Tubes	1,669,514	1,642,275	1,624,550	1,600,501
313	O&G Field Machinery & Equipment	2,272,832	2,235,749	2,211,619	2,178,879
403	Instrumentation	1,292,067	1,270,986	1,257,268	1,238,656
436	Water Transport	16,506,156	16,236,848	16,061,605	15,823,834
437	Air Transport	2,488,176	3,586,553	3,883,451	4,132,983
441	Communications	395,519	505,353	534,163	557,602
454	Eating/Drinking	1,705,636	1,677,808	1,659,699	1,635,129
459	Insurance	3,583,332	5,304,955	7,008,573	8,639,627
	Total:	46,897,729	49,400,415	51,227,984	52,769,386

Appendix Table B.7.7:
LA3: Exploratory Wells
($000)

IMPLAN Sector	Description	Water Depth			
		0-60 m	60-200 m	200-900 m	900 m+
38	Oil & Gas Operations	1,152,883	875,646	2,027,382	3,105,208
57	Other Oil & Gas Field Services	58,324	44,395	80,695	123,758
210	Petroleum Fuels	48,221	36,753	66,799	102,413
232	Hydraulic Cement	113,857	90,245	160,522	251,656
258	Steel Pipe and Tubes	105,301	81,512	122,055	185,680
403	Instrumentation	69,392	52,896	95,735	146,655
436	Water Transport	140,877	107,406	193,862	297,348
437	Air Transport	13,269	10,120	18,280	28,055
	Total:	1,702,124	1,298,973	2,765,330	4,240,774

Appendix Table B.7.8:
LA3: Development Wells
($000)

IMPLAN Sector	Description	Water Depth			
		0-60 m	60-200 m	200-900 m	900 m+
38	Oil & Gas Operations	1,661,237	872,471	1,945,690	4,065,837
57	Other Oil & Gas Field Services	87,624	35,119	123,340	196,724
210	Petroleum Fuels	69,823	55,819	92,428	156,540
232	Hydraulic Cement	166,929	197,865	227,017	376,622
258	Steel Pipe and Tubes	180,610	258,804	184,203	302,529
313	O&G Field Machin. & Equipment	39,276	25,397	31,495	55,625
403	Instrumentation	104,489	70,379	132,598	224,286
436	Water Transport	212,411	137,939	268,942	454,716
437	Air Transport	20,021	12,997	25,340	42,844
	Total:	2,542,420	1,666,788	3,031,052	5,875,723

Appendix Table B.7.9 :
LA3: Production Wells
($000)

IMPLAN Sector	Description	Water Depth			
		0-60 m	60-200 m	200-900 m	900 m+
38	Oil & Gas Operations	34,069,265	33,679,479	33,480,263	33,146,482
57	Other Oil & Gas Field Services	8,391,975	8,670,244	8,987,374	9,258,956
258	Steel Pipe and Tubes	4,173,786	4,105,688	4,061,375	4,001,252
313	O&G Field Machinery & Equipment	5,682,080	5,589,373	5,529,048	5,447,197
403	Instrumentation	3,230,167	3,177,465	3,143,171	3,096,641
436	Water Transport	41,265,389	40,592,119	40,154,012	39,559,584
437	Air Transport	6,220,441	8,966,383	9,708,627	10,332,458
441	Communications	988,797	1,263,381	1,335,408	1,394,004
454	Eating/Drinking	4,264,090	4,194,519	4,149,248	4,087,824
459	Insurance	8,958,331	13,262,387	17,521,433	21,599,068
	Total:	117,244,322	123,501,038	128,069,960	131,923,466

Appendix C:
Discussion of Input-Output Structure

Appendix C.1: The Basic Structure of Theoretical Input-Output Models

Let z_{ij} be noted as the sales of industry i to j. Assume an economy with n sectors, and let X_i be the total output (production) of sector i and Y_i the total final demand for sector i's product, then

(1) $$X_i = z_{i1} + z_{i2} + z_{i3} + ... + z_{ii} .....+ z_{in} + Y_i$$

such that the z terms represent inter-industry sales by sector i , thus the right hand side of (1) is the sum of all sector i's inter-industry sales and its sales to final demand. Also, the above equation represents the distribution of sector i's output. For the entire economy, a system of equations with the structure given above can be constructed.

Value-added consists of returns to factors of production (labor and capital), and land as a form of capital in some cases and indirect business taxes. Since not all local demand may be met by local production for all local activities, the I-O table also includes a trade row that accounts for all imports into the region's economy.

Given a Leontief production model, output to input relationship can be expressed such that

(2) $$X_j = \min[\, z_{1j}/a_{1j} , z_{2j}/a_{2j}, ..., z_{nj}/a_{nj}]$$

Hence , the system of equation modeling the economy becomes

(3) $$X_1 = a_{11}X_1 + a_{12}X_2 +......+ a_{1i}X_i + ...+ a_{1n}X_n + Y_1$$

$$X_i = a_{i1}X_1 + a_{i2}X_2 +....+ a_{ii}X_i + ... + a_{in}X_n + Y_i$$

$$X_n = a_{n1}X_1 + a_{n2}X_2 +....+ a_{ni}X_i + ... + a_{nn}X_n + Y_i$$

where a_{ij} is the intermediate requirements from sector i per unit of sector j, or I-O technical coefficients.

These equations serve to make explicit the interdependence of inter-industry flows on the total outputs of each sector. Separate prices and quantity relationships are incorporated into the accounts by letting P_i equal the price of output in sector i. Assume for now that there are no exports and imports, the rows of the nominal input-output accounts can be written as

(4) $$P_iX_i = P_iX_i + P_iY_i$$

(5) $$a_{ij} = X_{ij}/X_j$$

The relationship between nominal intermediate flows to nominal output (expressed as ratios) is given by

(6) $$P_i a_{ij} /P_j = P_i X_i /P_j X_j$$

Given a base-year, normalized units can be used where flows are in real units and all prices equal one. In this case, equation (5) and equation (6) above are equivalent. Dividing by the price and using the I-O coefficients, (4) above can be written as

(7) $$X_i = a_{ij} X_j + Y_i$$

This is the material balance equation of the I-O model. In matrix notation, it is

(8) $$X = AX + Y$$

or, solving for X,

(9) $$X = (I-A)^{-1}Y$$

where, $(I-A)^{-1}$ is the well known Leontief inverse. The most basic element in input-output analysis is estimating changes in output levels for particular sector(s) of an economy that is required to achieve a final output (Hewings, 1985). Given exogenously specified final demand, (y_i) production requirements necessary to satisfy the demand can be estimated using the Leontief inverse. That is,

(10) $$X = (I-A)^{-1} Y$$

Given final demand targets, the Leontief inverse $(I-A)^{-1}$ allows for the estimation of the implied targets for sectoral production.

Appendix C.2: The Basic Structure of Theoretical SAM Models

Mathematically, an algebraic representation of SAM is essentially the same as an I-O. In this case, the matrices and vectors are of higher dimensions since more variables are considered and more issues may be analyzed. For example, the A-matrix may be expanded to include households as producers and other institutions may be included as rows and columns in highly disaggregated and explicit formulation (Holland and Wyeth, 1993; Waters and Holland, 1996).

Assume households, government revenue, and employments are treated as endogenous. Given this framework, various multipliers can be estimated. Hence, the total impact of a policy change on the entire economy can be estimated. As an illustration, the result of treating households endogenously is a partitioned SAM specified as follows:

(11)

$$S = \begin{bmatrix} A & O & C \\ V & O & O \\ O & Y & H \end{bmatrix} \quad \begin{matrix} \text{Activities} \\ \text{Value - Added} \\ \text{Endogenous Institution} \end{matrix}$$

where: S is the matrix of SAM direct coefficients
A is the matrix of technical coefficients (analogous to the input-output coefficients),
V is the matrix of value-added (VA) coefficients,
Y is the matrix of VA distribution coefficients,
C is the matrix of expenditure coefficients, and
H is the matrix of institutional and household distribution coefficients.
It is possible to represent demand and supply balance equations as

(12)

$$\begin{bmatrix} x \\ v \\ y \end{bmatrix} = S\begin{bmatrix} x \\ v \\ y \end{bmatrix} + \begin{bmatrix} ex \\ ev \\ ey \end{bmatrix}$$

where: X is the vector of sector supply
V is the vector of value-added by categories
Y is the vector of household incomes
ex is the vector of exogenous commodity demand
ev is the vector of exogenous value-added, and
ey is the vector of exogenous household incomes (Holland and Wyeth, 1993).

From (12), an (I-S) matrix can be constructed that when inverted is a matrix equation showing the level of sectoral supply, value-added, and household income as a function of exogenous variables or

(13) $$\begin{bmatrix} x \\ v \\ y \end{bmatrix} = (I - S)^{-1} \begin{bmatrix} ex \\ ev \\ ey \end{bmatrix}$$

where $(I - S)^{-1}$ represents the matrix of SAM inverse coefficients. Notice that $(I - S)^{-1}$ is similar to the $(I - A)^{-1}$ in I-O models but now includes more endogenous accounts. Hence, embodied in the matrix is the notion that the SAM provides a more complete flow in the economy. The effect of a change in say agricultural output (i.e. changes in ex in equation 5) on the levels of sectoral supply, value-added, and household incomes can thus be examined.

Appendix C.3: Common Accounts of an I-O or SAM Model

C.3.1 Expenditure (Column) Accounts: Expenditure accounts (read along a column in the tables) are payments made by the sector or institution represented in that column to the receiving sectors or institution in the respective row. In the fixed-price models these include payments made for intermediate goods and services by industries, payment made by industries to factors of production, payments to institutions such as households, governments, or for investments.

C.3.2 Production (Intermediate Demand) Accounts: Production accounts hold the records of payments made by the industry in that column to other industries in the corresponding row as inputs to its production to meet final demand in the economy (Miller and Blair, 1985). The Louisiana models were based on the industry-by-industry format. The industry-by-industry format uses an industry-based technology approach, which assumes that an industry has the same input structure, regardless of its output product mix.

C.3.3 Factors Expenditure Accounts: The traditional economic definition of factors of production includes land, labor and capital. In inter-industry models, capital and labor are designated as factors of production, with land included in the capital account. IMPLAN follows the conventional national accounts for the U.S. I-O table. Factor payments are comprised of employee compensation (returns to labor), proprietary income (returns to labor and capital), other property income (returns to capital), and indirect business taxes.

Factor cost of each industry in the region, that is, wages and salaries, as well as benefits such as health and life insurance, retirement payments, and non-cash items. Proprietary income is made up of payments received by self-employed individuals as income. Hence, proprietary income is a return to both capital investment and labor by owner-operators. Other property income consists of payments individuals receive from rents, royalties, and dividends and corporate profits, retained earnings, and depreciation by corporations. Indirect business taxes (IBT) consist of excise and sales taxes paid by individuals to businesses. That is, IBT are taxes that are imbedded (included) in prices.

Factor account columns in the fixed price models represent factor expenditures in the study period. Factor or value-added as expenditure accounts are absent in the Louisiana I-O model, as is the case in most basic regional I-O models. In the SAM, these accounts include expenditures made for factor income disbursements to institutions, taxes paid, depreciation expenditures, and import expenditures for factor services or factor leakages out of the region.

C.3.4 Institutional Expenditure Accounts: Institutional expenditure accounts are found only in the SAM, which represents one point of departure between I-O and SAM based models. Institutions are defined to include households, government, investment and savings accounts. In the Social Accounting Matrix, an institution category is often included that serves as a bridge between factor accounts and households. The inclusion of specific institution accounts is justified on the grounds that households do not ordinarily receive payment directly from factors. This particular formulation overcomes the familiar “brain-dead SAM” ordinarily constructed from social accounts of ready-made models such as the IMPLAN. These SAMs are said to be brain-dead because there is no explicit correspondence between detailed sectoral value-added receipts by factors from industry and the factor disbursement sub-matrix containing only aggregated allocations of factor receipts by institutions (Sullivan, McCollum, and Alward, 1997). The Louisiana models defined institutions to include labor, property, and enterprise institutions while also explicitly designating the usual institutional categories of households, government, and capital/savings accounts. Labor as an institution receives and disburses labor payments to households (“owners” of labor); property as an institution receives and disburses land income to landowners. The enterprise institution disburses capital income to owners of capital in addition to accounting enterprise savings.

C.3.5 Household Expenditure Accounts: Depending on the goals of a particular study, it is often convenient to group households in the region into two or more classes either along income lines such as low, medium, and high income level groups, or along functional lines such as urban and rural households. This study adopts the latest BEA nine income classes, which is now standard in the latest IMPLAN SAMs. Household expenditure accounts represent one of the final demand categories in both I-O and SAM models. In the Louisiana I-O, these expenditures include personal consumption expenditures on goods and services produced by the 27 industrial sectors, taxes paid by households, household savings, and imports of goods and services by Louisiana households.

C.3.6 Federal Government Expenditure Accounts: The column values in these accounts represent another category of final demand in the fixed price models. In the IMPLAN framework, expenditures by the federal government in a region are divided into military and non-military purchases. In the Louisiana fixed-price models, these two accounts are combined to form a single federal government expenditure account. In the SAM, federal government expenditures include federal agencies’ purchase of goods and services from the industrial sectors; transfers to institutions, households, and state/local government; and imports purchases or income transfers out of the region. In the Louisiana I-O, all the transfer accounts are absent. Thus, income transfers are not explicitly mapped, which is a limitation in representing economic flows in a standard I-O model.

C.3.7 State/Local Government Expenditure Accounts: State and local government expenditures in IMPLAN include purchases for educational and non-educational uses. These categories are combined into a single state/local government purchases category in the Louisiana I-O and SAM models. The structure of these government accounts are similar to the structure of the government account except that in the Louisiana I-O, unlike the Louisiana SAM, the state/local government accounts include savings and no inter-governmental transfers.

C.3.8 Investment (Capital) Accounts: Capital (investment demand) accounts are also part of the final demand categories in regional models. In IMPLAN, investment demand accounts are defined to include inventory purchases and capital formation. For each industry, inventory purchases are purchased commodities that are not used in the current year production while capital formation are expenditures made on durable goods or capital equipment. These two capital accounts categories are combined into a single capital account in the Louisiana I-O and SAM models for the nine industrial sectors.

C.3.9 Rest of the World (Trade) Expenditure Account: The rest of the world (ROW) account consists of exports out of the region and earned income received by regional economic agents from out-of-the sources, such as dividend payments to residents from outside of the state capital investments. In general, IMPLAN ROW expenditures consist of foreign exports, which are the demand by regional consumers for goods and services produced outside of the U.S., and domestic exports, which are the demands by regional consumers for goods and services produced elsewhere in the U.S. These two accounts are consolidated into a single export account in the Louisiana I-O and SAM models.

C.3.10 Receipts (Rows) Accounts: Revenue accounts (read across a row in the tables) are income received (earned or transfers) by the sector or institution represented in that row from the paying sector or institution in the respective column. In the fixed-price models these include income received for sales of intermediate goods and services to industries, income received by factors as value-added from industries, income received by institutions such as households, governments, or savings.

C.3.11 Production (Intermediate Sales) Accounts: Intermediate sales accounts are the mirror image of the intermediate purchase accounts. In both the I-O and SAM models all purchases made by each of the nine industrial sectors from other regional sectors are sales revenues earned by the same nine sectors. Thus, the inter-industry matrix is always square.

C.3.12 Value-Added Revenue Accounts: Value-added accounts show payments (wages, interests, profits, and IBT) by industrial sector to the designated factors of production. The value-added detail income received by designated categories of factors from the nine industrial sectors as wages, taxes, interests, and profits. Value-added accounts are similar to the factor expenditure accounts. As indicated earlier, IMPLAN's four categories are realigned to follow economic theory and for consistency with the goals of this study.

C.3.13 Institutional Income Accounts: Institutional accounts are absent in the Louisiana I-O but included in the SAM. Institutions in the Louisiana SAM received payments from the corresponding factor categories. These accounts also receive transfer payments from both federal and state/local governments.

C.3.14 Household Income Accounts: Except when models are closed with respect to household income, explicit household income accounts are absent in I-O models. Hence, unlike the SAM, which maps income flows to expenditures in their entirety, the I-O shows only a partial mapping via the factor payments to labor. Because in an I-O table, the flow of income to households and other institutions that is detailed in the institutional account in the SAM is missing, the multiplier estimate of an exogenous change in a sector in the economy is different. In the I-O, the multiplier is usually restricted to the inter-industry matrix (i.e. A-matrix). Thus, it is suggested that when, as is done in some regional applications of I-O, households are endogenized, the result is a gross overestimation of multiplier effects. This is because value-added is often used as a proxy for household income in these studies and is a much larger figure than personal income in a SAM (Holland and Wyeth, 1993). On the other hand, the structure of the SAM as constructed in this study allows for explicit mapping of household income from three economic perspectives: value-added, non-household institutions, and households. Therefore, the multiplier effects of an exogenous change in the SAM when closed with respect to any or all of these perspectives, allows for both the open loop and close loop effects[5] often observed in the SAM. In the Louisiana SAM, payments received by each household category include institutional income distribution, payments between the three household income groups, government income transfers to households and enterprises, and remittances from out of the region to households and governments.

C.3.15 Federal Government Revenue Accounts: In most applications, a regional I-O does not include an explicit government income-receiving sector. A SAM includes a government sector and also disaggregates it into each level of government. For I-O models with a government sector (Wolff and Howell, 1989), it is usually a single consolidated account of all levels of government. In the Louisiana I-O, a single consolidated government sector is used. The federal government sector in the SAM receives income from businesses in the form of IBT, tax revenue from factor accounts, corporate tax revenue, personal income tax revenue from household accounts, and out of region remittances. For state/local government sector, a single consolidated government account receives all income due to all levels of government in the SAM; revenue sources are similar to those of the federal government except that state/local government also receives direct transfers from the federal government.

C.3.16 Capital (Savings) Account: Savings are usually treated as pure leakage in regional I-O models and thus accounted for in the ROW account. Because of this treatment of regional savings, a consolidated capital account is often constructed to accommodate savings and ROW receipts. When capital income is also considered a pure leakage, the leakage account combines capital income, savings and ROW accounts (Kraybill, 1994). The savings account is present in both the Louisiana I-O and the SAM models. In the Louisiana I-O, the savings account includes household savings, government savings, and net capital remittances from out of the region. In the Louisiana SAM, these sources of savings are also present, but depreciation and retained earnings by enterprises are now included.

[5]Open loop multipliers describe the effects of an external shock that is transmitted to other blocks of the SAM matrix and end there, not been fed back to the sector where they originated. Close loop multipliers describe the effects that proceed outwards from the block in the SAM where they originated and then fed back to it (Holland and Wyeth, 1993).

C.3.17 Rest of the World (ROW) Account: The ROW account holds import of industrial sector for production of local goods, household and government imports of goods and services. It also includes income transfers out of the region by regional economic agents such as remittances by Louisiana households living abroad or public servants working abroad.

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Recent changes in oil and gas activities on the Gulf of Mexico (GOM or Gulf) Outer Continental Shelf (OCS) have sparked interest in the economic impact that these activities have on coastal regions. Input-Output (I-O) models examine relationships between industries and other economic agents within an economy. The mathematical formulae used to construct an I-O allow a researcher to simulate the effects that a change in one or several economic activities has on the entire economy.

This report addresses a number of methodological shortcomings in the application of I-O analysis to the oil and gas industry. Our report presents examples of how the two approaches present differing empirical conclusions and why some modifications are in order. We offer a number of practical and applied alternatives to existing methods, as well as suggestions on improving production function and other standardized input data, to improve the understanding of how the oil and gas industry impacts coastal communities. We use coastal Louisiana as a case study for examining the implications of our work.

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The Department of the Interior Mission

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

The Minerals Management Service Mission

As a bureau of the Department of the Interior, the Minerals Management Service's (MMS) primary responsibilities are to manage the mineral resources located on the Nation's Outer Continental Shelf (OCS), collect revenue from the Federal OCS and onshore Federal and Indian lands, and distribute those revenues.

Moreover, in working to meet its responsibilities, the **Offshore Minerals Management Program** administers the OCS competitive leasing program and oversees the safe and environmentally sound exploration and production of our Nation's offshore natural gas, oil and other mineral resources. The MMS **Minerals Revenue Management** meets its responsibilities by ensuring the efficient, timely and accurate collection and disbursement of revenue from mineral leasing and production due to Indian tribes and allottees, States and the U.S. Treasury.

The MMS strives to fulfill its responsibilities through the general guiding principles of: (1) being responsive to the public's concerns and interests by maintaining a dialogue with all potentially affected parties and (2) carrying out its programs with an emphasis on working to enhance the quality of life for all Americans by lending MMS assistance and expertise to economic development and environmental protection.