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**THE ECONOMY OF BIG HORN, HOT SPRINGS, PARK,
AND WASHAKIE COUNTIES, WYOMING
WORLAND BLM DISTRICT**

by

**John R. McKean
Joseph C. Weber**

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THE ECONOMY OF BIG HORN, HOT SPRINGS, PARK,
AND WASHAKIE COUNTIES, WYOMING

WORLAND BLM DISTRICT

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May 1983

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CHAPTER 1
INTRODUCTION

The purpose of this report is to provide a description and analysis of a regional economy with the State of Wyoming. The intent of the researchers is to provide policy makers with specific information contributing to the decision-making and planning processes and to provide a planning tool having the capability of analyzing a number of alternative development scenarios in the study region.

THE REGION UNDER STUDY

The study area consists of four counties in northwest Wyoming: Big Horn, Hot Springs, Park and Washakie. These counties encompass an area of approximately 12,694 square miles and account for nearly 13 percent of the total land area of Wyoming. About 68 percent of the region's total land area is owned by the federal government.¹ The region's 1980 population is estimated at 48,741 inhabitants with a personal income of over 394 million. The population of the region makes up about 10.4 percent of state totals while personal income in

¹Private land ownership varies considerably among the four counties. Almost 31 percent of the 1,294,080 acres comprising Hot Springs county is privately held, about 23.5 percent of Washakie county is private, 22 percent of Park county is private and about 16.8 percent of Big Horn county is private.

the region accounts for about 9 percent of the state total.² Almost 77 percent of the region's exports are in the oil and gas production and services sector. The regional economy is also characterized by a small base in light manufacturing which makes up about 11 percent of exports. However, the region imports nearly all finished consumer products, heavy industry products, and most ingredient materials.

STATEMENT OF THE PROBLEM

The natural resource base in the region, while relatively abundant in terms of the capability to satisfy local demands, is nonetheless the focal point for regional and extra-regional economic conflict. Ownership of the large deposits of exploitable resources is vested largely with the federal government and corporations headquartered out of state. Thus, from a regional perspective, policies affecting the disposition of the regional resource base are largely determined outside of the region. From this same perspective, there is a need to develop a detailed description of the economy as it presently exists and an analytical framework which is capable of assessing the direct and indirect consequences of alternative scenarios for resource exploitation proposed by the public and private sectors of the economy. This description and analysis constitutes the major thrust of the research reported here.

²Wyoming Department of Administration and Fiscal Control, Wyoming Data Handbook, 5th Edition, 1981.

THE MODEL USED

A tool particularly adapted to these questions is the comprehensive interindustry production model developed by W. W. Leontief*. The strength of this model (often termed the input-output model) lies in its capability not only to describe the interdependence existing among sectors of an economy but also in the capacity to demonstrate, sector by sector, the total consequences of any number of development scenarios. The model is thus both descriptive and analytical. The descriptive components are accommodated through the collection of extensive primary data, from firms within the region, and subsequent tabulation of the data in a form required by the interindustry framework. The analytical phase consists of the impact analysis, development of the various multipliers, and consistent forecasting under alternative resource development scenarios.

OUTLINE OF THE REPORT

The remainder of the report consists of a description of the method of the study which is presented in Chapter 2; the analysis of the regional economy, which is the concern of Chapter 3; and an extension of the basic model to include an analysis of water use which is contained in Chapter 4.

In addition to the main text of the report, there are several appendices. These contain the sector definitions, the input-output tables, the survey form and a bibliography.

*Recent Nobel Prize recipient in Economics.

CHAPTER 2

THE METHODOLOGY OF THE STUDY

INTRODUCTION

The national energy and minerals situation has focused an increasing attention on the natural resources in the Worland region of northwest Wyoming. The exploration, development, and extraction activities associated with these natural resources have generally been viewed as isolated from, or independent of, the remainder of the economic environment. While it is not proposed to perform an ex-post evaluation of the impacts of existing developments, a major product of this research is the provision of the analytical capability for assessing the regional impacts of continued resource developments.

The interindustry production model (I-O model) popularized by W. W. Leontief is particularly adapted to the study of resource use in a regional economy.¹ This model's strength is its capability to empirically illustrate the interdependence existing among sectors of an economy and to demonstrate, sector by sector, the total consequences of any number of development scenarios.

¹See Chapter 3 for a detailed description of the interindustry model.

The I-0 model provides an account of transactions for each sector of the economy, a calculation of the input requirements of these sectors and a measurement of the effects of growth in demand for the outputs of each sector. Essentially, the model is a system of double entry bookkeeping in which annual sales and purchases by each sector to and from all other sectors are accounted for and measured.

The model consists of two major components: intermediate transactions are the purchase and sale of intermediate goods, which are subject to further local processing. Final transactions include all purchases and sales from or to sectors that are external to the model and not identified as intermediate or producing sectors.

The I-0 model is driven by final demand sectors: any particular sector's sales to state or federal government, investment, or export. If these change, the model estimates the impacts of this change on the entire economy. These impacts, whether measured in terms of employment, income or value of production, provide consistent estimates that mutually and simultaneously satisfy all requirements for intermediate and final production.²

Once the model's essentials have been identified and the basic empirical description of economic transactions developed, forecasting with the analytical technique requires only the specification of appropriate changes in final demand.

The I-0 technique provides two forecasting tools: multipliers and development scenarios. A multiplier indicates how much total business activity in sales dollars, units of energy input, employment,

²The projections are consistent but the underlying assumption in the model of fixed production coefficients qualify the results unless some dynamic adjustment of technology is explicitly involved.

water use, etc., is generated by a given industry within the region for each dollar of sales to final demand. A multiplier will be large for an industry that purchases a large part of its inputs from within the local economy since the money which the industry earns from its sales will be spent again in the region. The important "basic" or driving exporting industries usually will be characterized by large multipliers.

Several types of multipliers may be calculated. The business multiplier shows the total business spending within the region per dollar of additional sales to final demand by a given industry. An employment multiplier shows the total added person year of labor required in the region per dollar of additional sales to final demand by a given industry. An income multiplier shows the increase of total personal income in the region per dollar of additional wages paid by a given industry.

The multipliers may all include direct, indirect and induced effects. This means that if a "basic" industry expands its sales to exports by \$1,000, it may spend \$600 directly on locally produced goods. The producers of these local goods then are indirectly required to purchase local goods and services to meet this additional demand. Induced impact assumes that labor hired directly will respnd a fixed proportion of its added income, stimulating further expansion of the regional economy. Thus, both local producers and local labor are assumed to respnd locally part of their increased incomes, which

resulted from the increased exports by the "basic" industry. The total effect is reflected in the multiplier.³

The second forecasting tool provides a projection of future business activity by sector (development scenario). In addition to the projection of dollar sales for each sector, variables that rise proportionately with production also may be estimated. Employment, water use, population and energy use are examples of such variables.

Projections of future economic activity are derived by focusing on the "basic" or driving industries. Examination of the size of the multipliers and the size and expected growth of the basic industries reveal key sectors. Estimates of expected export growth and related investment spending in these sectors must be obtained independently to drive the I-0 model. Scenarios for growth in these sectors might be constructed from information obtained from personal interviews with representatives of major firms in each sector. Government growth estimates are often available directly from appropriate government agencies. The expected growth estimates for the basic industry and government sectors are introduced into the I-0 model to generate new, consistent estimates of the value of sales for each industry.

PROCEDURES FOLLOWED

The discussion of procedures followed in conducting the research may be conveniently condensed into several categories including: the definition of the region, delineation of economic sectors, the data collection effort, selection of the base year, and data processing.

³The "induced" household spending effect can be removed, if desired, by shifting the household sector out of processing into final demand so that household purchases are assumed to be exogenous.

Each is discussed as briefly as possible in the following pages.

DEFINITION OF THE REGION

The Worland region, for purposes of this study, was defined as Big Horn, Hot Springs, Park, and Washakie counties. This regional definition allows for an analysis of an area containing public lands under the jurisdiction of the Worland BLM district office.

SECTOR DELINEATIONS

The interindustry model requires the separation of the economy into various economic entities or "sectors". Total output, by inter-industry accounting procedures, is the aggregate value of all sales or purchases that take place, i.e., the total sales or purchases during a year. This total output must be divided up into sectors in order to assess the interindustry structural dependence that prevails. The model structures economic activity into two major components, suppliers (or sellers) and purchasers (or users). Each of these is further subdivided according to the following scheme: Suppliers include: 1) intermediate or processing suppliers who are producers who must purchase inputs to be processed into output which they sell to final users or as inputs to other processors; and 2) primary suppliers whose output is not directly dependent on purchased inputs. This latter category includes non-local suppliers (or imports). Purchasers include: 1) intermediate or processing purchasers who buy the outputs of suppliers for use as inputs for further processing; and 2) final purchasers who buy the outputs of suppliers in their final form and for

final use. This latter category includes purchases by non-local users (or sales to exports). The level of demand by final purchasers, and its composition, are determined outside the processing sector. Production to meet the exogenously determined final demands generates intermediate purchases and sales. Primary suppliers and final purchasers may or may not be one and the same. However, in the inter-industry model, their activities are treated as if they were completely independent of one another.

In summary, the two major divisions of suppliers are the intermediate suppliers, which are called the processing sector, and the primary suppliers, which are referred to as the final payments sector. (The suppliers are conventionally shown along the left border of an interindustry table.) The two major divisions of the purchasers are the intermediate purchasers, which are labeled as the processing sector (just as with the intermediate suppliers) and the final purchasers which are labeled final demand. (The purchasers are conventionally shown along the top of an interindustry or input-output table.) It is within this general framework that a further sector disaggregation must be accomplished.

The ideal sector delineation would allow unique recognition of industries or producer groups which provide a homogenous good or service. This ideal is very difficult to achieve because of the large amounts of time and finances required for detailed disaggregation, disclosure problems, and lack of data. Any of these factors or a combination of them lead to a violation of the homogenous product ideal.⁴

⁴Information obtained from the Wyoming Employment Security Commission cannot be published unless there are at least three firms in a given sector and no two firms account for more than 30 percent of the total employment. Ethical considerations also dictate that the operations of any single enterprise can never be divulged.

Sector selection, in addition to dependence upon financing, time, and data availability, is determined to a large extent by the objectives of the study. Research objectives can often be achieved without detailed disaggregation in all sectors. Since the purpose here is largely to determine the impacts of coal development and other sectors such as uranium, trona, agriculture, and local government, economic sectors such as trade and services do not require detailed disaggregation. The final delineation of the sectoring plan adopted for this study is shown in Table 2-1.

Where enterprise accounting was employed, the profit sector includes after-tax profits, charges to reserves for bad debts, capital loss amortization, and outlays for rents and royalties.⁵ Where government fund accounting was employed, the profit sector includes surplus of current revenues over current⁶ expenditures⁷, the value of capital expenditures appropriated out of current revenues, contributions to bond indenture sinking funds out of current revenues, net charges out of current revenues to any other reserve fund (e.g., contingency funds), and rent payments. The profit sector also includes both depreciation and net inventory depletions. Inventory depletions are,

⁵Except in the case where rents (e.g., agricultural land leases) and royalties (e.g., oil and gas) were paid to the Wyoming and federal governments. In these instances the amounts are shown as being paid directly to the respective governments.

⁶Current in the sense that it occurred in 1980.

⁷An exception to this is in the Wyoming and federal government sectors; see the explanation of the transfer section.

TABLE 2-1
 SECTOR IDENTIFICATION, WORLAND REGION
 OF NORTHWEST WYOMING, 1980

Sector Number	Sector Description	1972 SIC Codes
1	CROP-LVSTK Crops, Livestock, Reclamation and Seeding	01, 02, 07, 08
2	MINING Mining and Mining Services	10, 14 (less 144)
3	O/G-SERV Oil and Gas Production and Services	13
4	CONSTRUCT Construction (Maintenance and Repair)	15-17
5	MFG Manufacturing	20-39, 144
6	TRANS/COMM Transportation and Communication	40-42, 44-48
7	UTILITIES Electric and Gas Utilities	491, 492
8	WAT/SEW/TR Water, Sewer, and Trash Removal	494, 495, 497
9	WHOLESALE Wholesale	50-51
10	EAT/DRINK Restaurants and Drinking Places	58
11	OTHER-RET Other Retail	52-57, 59
12	F/I/R/E Finance, Insurance and Real Estate	60-67
13	LODGING Lodging	70
14	HEALTH-SER Health Services	80
15	EDUCAT-SER Educational Services	82
16	OTHER-SERV Other Services	72-79, 81, 83-89
17	LOC-GOVT Local Government	91-96
18	HOUSEHOLDS Households	--
19	STATE-GOVT State Government	91-96
20	FED-GOVT Federal Government	91-97

relatively speaking, insignificant and are placed with depreciation charges. Similarly, the net inventory accumulation values were incorporated in the investment sector.

With the exception of the intersection of the household row and the transfer column and the household on household cell, the household row represents wages and salaries paid subject to withholding.

QUESTIONNAIRE DESIGN AND USE

Previous experience has shown that a questionnaire, alone, should not be used to obtain primary data. No firm accounts for expenditure and revenue patterns on a Standard Industrial Classification (SIC) basis, the language ultimately employed in an interindustry model. Rather, a firm's books are designed around process or product activities. The use of a questionnaire, either by mail or by interview, presupposes adequate translation from a firm's accounting language into SIC codes.

Accordingly, all interviews were conducted in a basic accounting language tailored to the individual firms involved and were translated to SIC classification. The sample questionnaire shown in the appendix represents the format for the final translation by the researcher.

Not all interviews could be conducted as planned. For example, some firms wanted legal advice before participating while others did not want to reveal information in the form desired. A questionnaire, therefore, was designed for use as an interview focal point and as an item that could be left with the firm.

The questionnaire's cover sheet briefly explained the research and solicited information about the firm's product lines, number of employees and level of capacity utilization. Outlay patterns, both cash flow and non-cash flow, were requested on the second sheet. Information on sales distribution was solicited on the third sheet. Sales and outlay patterns were grouped by economic sector and were regionalized according to location within or outside the study region.

SELECTION OF THE BASE YEAR

There is no price index constructed specifically for Wyoming. This effectively removes one criterion (relatively stable prices) from consideration when selecting a base year for Wyoming economic studies. The 1980 base was selected for the initial survey for the following two reasons.

Interviewing for the Worland region interindustry study began in November, 1981. Calendar 1980 was the most recently completed accounting cycle for most firms; it was anticipated that the information from this cycle would be, qualitatively speaking, foremost in the command of the interviewees. Also, activities of relatively new firms were automatically incorporated in the primary data base by soliciting what was then the most current information.

CONDUCT OF THE SURVEY

Interview schedules were arranged by telephone between three days and a week in advance. Every effort was made to gain an interview with the person who would have immediate authority to release information. The length of time spent on an individual interview varied from

firm to firm. Several were conducted in less than an hour; some took place over several days. The survey process continued over a two-month period.

PROCESSING THE DATA

Information gathered on the outlay and sales patterns for any given enterprise was tabulated to conform to the sector delineations and regional descriptions as defined in Table 2-1. Care was exercised at this step to assure a balance between outlays and sales. Any anomalies were checked and corrected before proceeding further.

The next step was to aggregate questionnaire forms within a sector and to expand the information to represent gross flows. An iterative process was used to accomplish this so that the relative composition of a given sector delineated for the Worland region inter-industry model would be more truly reflected.⁸ The final iteration produced gross flow patterns for the respective sectors delineated in the model.⁹ The gross flows identified in this manner provide the border totals for the initial transactions statement.

⁸For example: There were three two-digit SIC classifications incorporated in the sector delineation for construction. Accordingly the questionnaire forms were first aggregated on the basis of the two-digit categories. Regional payroll data from the Wyoming Employment Security Commission were then aggregated on the same basis. The payroll values on the aggregated questionnaire forms represented a given proportion of the regional payroll in each respective SIC classification; based on this ratio the information on the aggregated two-digit level questionnaire sheets was blown up to represent the total pattern for the two-digit delineation. Subsequently, the computed totals at the two-digit level were aggregated to represent the construction sector in the Worland region interindustry model.

⁹The gross flow patterns were arrived at in either one of two ways. First there was a method that used payroll data (described in the preceding footnote) when an adequate total gross output value had not been identified. The second method distributed gross flows within the bounds of a total gross output value based on the relative allocation of the flows identified on initially aggregated questionnaire forms.

Reconciling discrepancies in any given transaction cell is to be expected; only if the research yielded perfect knowledge about outlays and sales would this be avoided. A discrepancy can emanate from one of several sources or a combination thereof. The sales or purchases of one industry to or from another can be misrepresented, or the total gross output value for individual sectors can be in error. In the former case other rows and columns are affected by the error. In the latter, there is an aggregate distribution error in both outlays and sales for the sector. Each discrepancy is examined individually and reconciled on a case-by-case basis. Fortunately, the sources of relatively large discrepancies could be isolated and remedied through additional examination. Small discrepancies were reconciled by using imports from and exports to the world other than Wyoming as residual accounts.

CHAPTER 3
ANALYSIS OF THE WORLAND REGION OF NORTHWEST WYOMING

INTRODUCTION

The results of the descriptive analysis of the Worland region economy are presented in this chapter. The discussion contained in the chapter includes: the description of the economy; an analysis of the nature and magnitude of economic interdependence among processing sectors; the various business activity and income multipliers; and an analysis of employment in the region.

The description and analysis of the economy hinges on three major components of the interindustry model. These are: the gross flows or transactions table; the table of direct production requirements; and the table of direct plus indirect production requirements. These tables are discussed and interpreted in turn. Because of the size of the tables, they are presented in the appendix.

THE TRANSACTIONS AMONG SECTORS TABLE

The first essential component of any interindustry study is the collection and tabulation of data which serve to describe the flows of commodities from each supplying sector to each purchasing sector. These flows are typically expressed in terms of the dollar value of transactions occurring in a specific period of time, normally one

year. The information is arrayed in tabular form with the suppliers (selling sectors) listed at the left of the table and the purchasing sectors listed at the top. The information in this table, termed the transactions table, does two things simultaneously: it identifies the estimated dollar value of sales by each sector to each of the other sectors, (thus, the distribution of each sector's output) and it identifies the purchases of ingredients of production by each sector from each of the other sectors (the distribution of purchases). In essence, the material contained in the transactions table represents a double-entry system of bookkeeping in which every sale is simultaneously described as a purchase. Thus, the system deliberately double counts. The transactions table for the Worland region economy is found in the appendix. A description of the sector identification labels used throughout the appendix and in the tables of this chapter is also shown in the appendix.

The rows and columns of Table B-1 which are numbered 1-17 identify the processing, or intermediate demand, sectors. (The household sector in row and column 19 is included in the processing sector also when the projection scenarios are developed.) Row and column 18 represent subtotals of activities within the processing sector. This portion of the table describes, in dollar terms, the flow of goods and services necessary to satisfy intermediate demands. Final demands, i.e., demands for goods and services that will not be further processed within the region, are identified in columns 19-26 and 28. Rows 19-21 and 23-25 identify the final payments sector. These payments include, then, federal and state taxes, wages, profits, rents,

losses, net inventory depletions, and payments for goods and services imported from outside the region. The rows and columns numbered 22 and 27, respectively (the transfer account) is an accounting device. The last row and column of Table B-1 contain, respectively, total outlay (purchases) and total output (sales) for each sector of the regional economy.

The distribution of total output of each sector, according to the sectors in which the output is sold, may be readily discerned by reading across the rows of Table B-1. The bill of purchases by each sector is found by reading down any column of the table. These column entries show the allocation of purchases by cost component.

For example, consider sector 2, MINING. Reading across row 2 of Table B-1 shows that the total output of coal mines was distributed in the following way: \$368,068 to MINING (mining services); \$27,701 to CONSTRUCT; \$1,425,363 to MFG; and so forth. Total sales by coal mines to the processing sector of the economy amounted to \$1,821,132. The remaining sales were to the final demand sectors consisting of STATE-GOVT, \$702,423; ROAD-CONST, \$253,951; and exports, \$53,859,294. Total sales to final demand thus amounted to \$54,815,668. The total gross output of the MINING sector is the sum of these individual sales or \$56,636,800.

The distribution of purchases by MINING, by cost category, is shown in column 2 of Table B-1. Purchases by MINING from CROP-LVSTK were \$488,028; from MINING, \$368,068; from CONSTRUCT, \$3,224,721; from MFG, \$27,967; and so forth. MINING paid local property and sales taxes amounting to \$407,465. The total purchases by MINING from the

processing sector are estimated at \$25,906,437 for 1980. Final payments made by coal mines were estimated at \$30,730,363. These payments were distributed as follows: wages subject to withholding, \$6,915,506; taxes and charges of the State of Wyoming, \$674,000; taxes and charges of the Federal Government, \$2,959,363; profits, depreciation, royalties, and rents, \$5,893,025; imports from Wyoming, \$5,244,795; imports from the rest of the world, \$9,043,674. Total purchases thus amount to \$56,636,800 and, as required by the accounting format, equal the value of output.

Other information can be obtained directly from the transactions table. The household row, with the exception of the sale by households to the transfer account represents wages paid subject to withholding. This row shows household income. The leading contributors to household income are: TRANSFERS, O/G-SERV, FED-GOVT, TRANS/COMM, MFG, and EDUCAT-SERV. Similarly, sector by sector contributions to taxes may be directly obtained from Table B-1. The processing sectors showing the greatest dollar outlay for local and county taxes are: O/G-SERV, HOUSEHOLDS, TRANS/COMM, and CROP-LVSTK. These four sectors account for 90 percent of local taxes.

Estimates of gross regional income and gross regional product may be obtained from the final payments and final demands portion of the table. Gross regional product is defined as the sum of deliveries to final demand, net of imports. Traditionally, local and county government activities are included as part of final demand. Because this model treats these accounts as part of the processing sector, an adjustment is required. Also, the transfer account cannot be counted

in final demand, for to do so would be double counting. Thus the sum of education; water, sewerage, and sanitation; local government; households; state government; federal government; investment and new construction; and exports from the Worland region, less regional imports, yields an estimated gross regional product. Gross regional income (which must equal gross regional product) is computed as the sum of final payments excluding imports. Again, the transfer account must also be excluded to avoid double counting.

While these items, obtained directly from the transactions table, are useful as initial indicators of the relative importance of each sector in the regional economy, the important question of interdependence is not addressed. In order to do so, it is first necessary to isolate the direct production relationships existing in the economy.

DIRECT PRODUCTION REQUIREMENTS

The direct production requirements, or coefficients, represent the second major component of the interindustry analysis. These direct requirements are presented in the appendix. Computation of the direct production requirements is quite simple, and requires only that each column entry of the transactions table be divided by the respective column total. The resulting coefficients describe the direct purchases necessary from each supplier (at the left of the table) in order for the purchasing sector (at the head of the column) to produce one dollar's worth of output. The coefficients, then, are interpreted as the direct requirements per dollar of output produced by each sector.

As an example consider the MINING sector, sector 2 (column 2, of Table B-2 the direct requirements table). For every dollar's worth of output produced by MINING in the region, \$.008617 worth of CROP-LVSTK products are required, \$.006499 from MINING (services), \$.056937 from CONSTRUCT, and so on down the column. It is obvious from the table that far and away the largest direct purchases made by the MINING sector are those for transportation, with a direct outlay of over 27 cents per each dollar of output produced, and imports from outside the region, with a coefficient of .2523 for all imports. This says that a dollar's worth of production of coal requires imports valued at 25.23 cents. Each column of the direct requirements table is interpreted in this manner.

These direct requirements identify only a portion of the total economic impacts that would accompany a change in final demands for the output of a given sector. There are additional, or indirect, impacts which can be quite important. Assessment of all direct and indirect impacts of these exogenous (final demand) changes is made possible through the third analytical component of interindustry analysis. This component is the table of direct plus indirect production requirements.

DIRECT PLUS INDIRECT IMPACTS

The concept of interdependence can be established with a brief example. Suppose that the export demand for coal production increases. There will be immediate, or direct, responses of the following type. Coal production will have to increase. In order for coal production

to increase, inputs must be obtained from sectors such as transportation, utilities for power, and labor. These are direct impacts. As transportation and utilities increase their output to meet the increasing requirements in the coal sector, their own requirements for productive ingredients increase, e.g., services, labor, petroleum and natural gas, and coal. The chain of events goes on. The total impacts are readily estimated through the input-output framework and are presented in the appendix in Table B-3.

Before proceeding to a discussion of the table, a few comments regarding the treatment of households are in order. Households may be treated as either a part of the processing sector of the economy or as a part of the final demand component. In the first instance, households are treated in precisely the same manner as any other production sector. The estimate of the direct and indirect production impacts of a change in final demand include the induced production impacts which derive from increased household incomes and increased consumption. In the latter, with households a component in final demand, the induced impacts of successive rounds of consumer spending are omitted. For purposes of this report, the discussion of economic interdependencies and the subsequent business and income multiplier analysis includes both the model with households as a member of the processing sector of the economy and as a final demand sector.

The direct plus indirect coefficients are interpreted as the production required or generated in all sectors of the economy in order to sustain the delivery of one dollar's worth of output to final demand by any single sector. It should be carefully noted that these

coefficients reflect production generated per dollar of final demand as opposed to requirements per dollar of output. This, of course, reflects the fact that the model is driven by change in final demand.

For purposes of interpretation, consider the MINING sector. Suppose that the export demand for MINING increases by \$1 million. What is the estimated impact that this increase will have on the entire Worland region of the Wyoming economy? The answer to this question may be obtained directly by reading down column 2 of the table and summing the individual sector impacts. Thus, the increase of \$1 million in the final demand for coal generates a total direct plus indirect production valued at \$58,900 in CROP-LVSTK, \$1,006,800 in MINING, \$60,100 in O/G-SERV, and so on down the column. Any column of this table is interpreted in this same manner. The sum of the entries in column 2 shows the total production generated locally as a result of the increase in final demands for MINING. Thus, the total business activity generated per dollar increase in final demand for MINING is 2.2444 or, in our example assuming a \$1 million increase, \$2,244,400 million worth of business activity results. These column sums are one of the various multipliers concepts which are derived from input-output analysis.

BUSINESS MULTIPLIERS

The column sums of the direct plus indirect requirements table are termed business activity (or production) multipliers. They identify the total value of production in the region which results from a dollar's worth of output delivered to final demand. Table 3-1 presents

TABLE 3-1
 BUSINESS ACTIVITY MULTIPLIERS
 WORLAND REGION OF NORTHWEST WYOMING
 BY SECTOR, 1980

(In dollars of business activity generated in the Worland region
 of Northwest Wyoming per dollar delivered to final demand)

Sector	Business Multiplier II	Business Multiplier I
1 CROP-LVSTK	1.9797	1.6480
2 MINING	2.2444	1.7137
3 O/G-SERV	1.3475	1.2323
4 CONSTRUCT	2.0042	1.4733
5 MFG	2.0175	1.6802
6 TRANS/COMM	2.1917	1.4423
7 UTILITIES	1.9122	1.6624
8 WAT/SEW/TR	2.3186	1.1210
9 WHOLESALE	2.7421	2.1921
10 EAT/DRINK	2.1455	1.3907
11 OTHER-RET	2.3168	1.4054
12 F/I/R/E	1.2947	1.0650
13 LODGING	2.2087	1.5262
14 HEALTH-SER	2.2741	1.1367
15 EDUCAT-SER	2.1487	1.2226
16 OTHER-SERV	1.9139	1.2166
17 LOC-GOVT	2.4567	1.7437
18 HOUSEHOLDS	1.9907	---

the business multipliers. These estimates indicate that the greatest business activity generated per dollar of delivery to final demand is in the WHOLESale account. The business multiplier for this sector is 2.74 which indicates that, as the "final demand" for WHOLESale increases by \$1, a total production of \$2.74 is generated in the Worland economy. Other sectors of the economy which have relatively large business multipliers are: LOC-GOVT, WAT/SEW/TR, OTHER-RET, HEALTH-SER, MINING and TRANS-COMM. LOC-GOVT, WAT/SEW/TR and HEALTH-SER are unlikely to have large exports, and their large multipliers are of little significance. At the margin, these sectors generate the greatest business activity per dollar of output delivered to final demand. The phrase, "at the margin," is important as a qualification in the use of the multipliers. It implies a word of caution concerning the implications of the multipliers. The HEALTH-SER sector in 1980 had total final demand deliveries of \$3,428. Thus a 10 percent increase in final demand, i.e., an increase of \$343, would result in a total business activity of \$780 in the regional economy. This same 10 percent increase in the final demand for the output of oil and natural gas production, an increase of \$111,247,715, yields a total business activity of \$149,906,296 in the regional economy. This is, of course, because of the larger absolute magnitude of final demands for the oil and natural gas sector's output. In using the business multipliers, the argument thus should be stated in terms of the impacts of an equal dollar increase in final demands. Thus, for an equal increase (in dollar terms) in final demands, wholesale and retail trade industries will generate more business activity in the local economy

than will any other private sector. The first column of Table 3-1 shows the business multipliers with households endogenous, the second column shows the business multipliers with households in final demand.

INCOME MULTIPLIERS

Other multiplier effects can also be estimated from the inter-industry model. For example, there are income multipliers which relate to changes in income paid to the household sector. The following discussion presents what are termed the Type I and Type II income multipliers.

The Type I and Type II income multipliers are estimated ratios: Type I is the ratio of direct plus indirect income to the direct income paid households; Type II is the ratio of direct plus indirect plus induced income to direct income. Thus, while the business activity multipliers are related to changes in sales to final demand, the income multipliers are related to changes in income paid to the household sector. The Type I multiplier describes the direct plus indirect income increases emanating from an additional dollar of direct income paid to households. The Type II multiplier takes into account not only the direct plus indirect changes in income, but also the induced income increases generated by additional consumer spending. Accordingly, the Type II income multiplier identifies the direct plus indirect plus induced income generated by an additional dollar of income paid directly to households.

Attention is drawn to the comparatively higher income multiplier value estimates for the agriculture sector. (See Table 3-2.) The

TABLE 3-2
 INCOME MULTIPLIERS
 WORLAND REGION OF NORTHWEST WYOMING
 BY SECTOR, 1980

(In dollars of income generated per dollar
 of direct income paid to households)

Sector	Income Multipliers	
	Type II	Type I
1 CROP-LVSTK	2.6085	3.0427
2 MINING	2.1834	2.5470
3 O/G-SERV	1.6284	1.8995
4 CONSTRUCT	1.4492	1.6905
5 MFG	1.6361	1.9085
6 TRANS/COMM	1.2609	1.4709
7 UTILITIES	1.4499	1.6912
8 WAT/SEW/TR	1.0408	1.2141
9 WHOLESALE	2.5422	2.9654
10 EAT/DRINK	1.1455	1.3363
11 OTHER-RET	1.1913	1.3896
12 F/I/R/E	1.1400	1.3298
13 LODGING	1.3241	1.5445
14 HEALTH-SER	1.0690	1.2470
15 EDUCAT-SER	1.0680	1.2458
16 OTHER-SERV	1.1230	1.3100
17 LOC-GOVT	3.7640	4.3907

reason for this relatively high value is straightforward. The Worland region interindustry study allocated proprietorship and partnership net incomes to the profit account. As a result, labor inputs (household account) for agriculture and livestock, are somewhat understated because this sector is characterized by a relatively high incidence of proprietorship and partnership enterprises with relatively little hired help. By understating the value (contribution) of labor inputs for this sector, the value (contribution) of other inputs, relative to labor, became larger. And with direct income being the denominator of the Type I and Type II income multiplier ratios, the multiplier estimate for this sector is of the relatively high magnitude observed. By contrast, the relatively high multiplier values for LOC-GOVT, and WHOLESale exist because these sectors exhibit greater interdependence in the Worland region economy.

EMPLOYMENT ANALYSIS

Direct employment requirements, as is the case with direct business activity and direct income payments, are, by themselves, of limited use for assessing the impacts of various changes in economic activity in the Worland region. This limitation arises because direct requirements differ from total requirements, the difference being indirect requirements that emanate from sectoral interdependence. The interindustry model provides a framework within which both direct and indirect employment requirements can be addressed. Basic to the analysis are data on employment levels in the respective sectors and the table of direct plus indirect requirements per dollar of output delivered to final demand.

Before proceeding with the analysis some discussion on the table of direct and indirect requirements per dollar of delivery to final demand is warranted. When the household sector is included as a processing sector in the interindustry model it becomes simply another producer. To treat households in this manner is consistent with the interindustry framework, but it imposes a critical assumption on household purchase patterns. Specifically, household purchases are expressed as a linear function of income; the marginal and the average propensities to consume are assumed to be one and the same. To change this limiting assumption, the household sector has to be treated as a part of final demand.

Treating the household sector in this manner removes the assumption that household purchases are a linear function of income. Specifically, because the interindustry model is a final demand driven model, treating the household sector as any other producing sector implies the level of employment was dependent on the level of state and federal government expenditures, investment expenditures, inventory accumulation, and exports. By treating households exogenously this assumption is expanded to include a dependency on the level of household expenditures. Direct and indirect requirements (household exogenous) and direct, indirect and induced requirements (households endogenous) for the Worland region of Wyoming are shown in the appendix. The estimated employment levels and corresponding employment coefficients (expressed as the number of employees per dollar of total gross output) used in the analysis are presented in Table 3-3.

TABLE 3-3
 TOTAL EMPLOYMENT AND EMPLOYMENT COEFFICIENTS
 WORLAND REGION OF NORTHWEST WYOMING
 BY SECTOR, 1980

(In number of workers in the Worland region of Northwest Wyoming and workers per thousand dollars of output)

Sector	Total Employment	Workers Per Thousand \$ Total Output
1 CROP-LVSTK	1,710	.0132681
2 MINING	403	.0071155
3 O/G-SERV	1,883	.0014086
4 CONSTRUCT	1,592	.0114943
5 MFG	1,433	.0069608
6 TRANS/COMM	1,186	.0154434
7 UTILITIES	233	.0041908
8 WAT/SEW/TR	68	.0168029
9 WHOLESALE	640	.0080945
10 EAT/DRINK	1,038	.0842357
11 OTHER-RET	1,919	.0413370
12 F/I/R/E	575	.0078936
13 LODGING	610	.0524108
14 HEALTH-SER	1,206	.0544685
15 EDUCAT-SER	1,601	.0342944
16 OTHER-SERV	1,181	.0321546
17 LOC-GOVT	3,395	.0588400
18 HOUSEHOLDS	240	.0005400

To assess the total employment impacts of exogenous changes in final demand, the respective tables of direct and indirect requirements or direct, indirect and induced requirements per dollar of delivery to final demand, were pre-multiplied by a diagonal matrix of direct labor use requirements (where the elements of the diagonal are the employment coefficients shown in Table 3-3). Summing down the respective columns of the resulting matrix yields the estimates of the direct and indirect, or direct, indirect and induced labor requirements per dollar delivered to final demand. Table 3-4 presents the estimates.

The interpretation of the entries in Table 3-4 is demonstrated by an example from the EAT/DRINK sector. As the final demand for the output of EAT/DRINK expands by \$1, there will be a direct expansion of employment in that sector as well as those sectors responsible for supplying production ingredients to the restaurant sector. The sectors supplying ingredients to the EAT/DRINK sector will in turn require production ingredients from others and this will further expand indirect employment impacts; and so forth. The magnitude of the direct and indirect employment impacts, 0.09409, shows the total employment generated in the entire Worland region economy as this sector, EAT/DRINK, increases by \$1,000, its deliveries to final demand. That is to say that an increase of \$1 million in the final demands, e.g., exports to the rest of Wyoming or out of state, for EAT/DRINK would result in an estimated additional employment of 94 persons in the Worland region. All remaining entries in Table 3-4 have analogous interpretations for their respective sectors. Thus, the

TABLE 3-4

DIRECT PLUS INDIRECT LABOR REQUIREMENTS PER THOUSAND DOLLARS
 DELIVERED TO FINAL DEMAND AND PER ADDED WORKER HIRED
 WORLAND REGION OF NORTHWEST WYOMING
 BY SECTOR, 1980

Sector	Direct + Indirect Labor Requirement Per Thousand \$ of Final Demand		Direct + Indirect Labor Requirement Per Added Worker Hired	
	Type II	Type I	Type II	Type I
1 CROP-LVSTK	.02714	.02439	2.05	1.84
2 MINING	.02206	.01766	3.10	2.48
3 O/G-SERV	.005332	.004377	3.79	3.11
4 CONSTRUCT	.02268	.01828	1.97	1.59
5 MFG	.01523	.01243	2.19	1.79
6 TRANS/COMM	.03114	.02493	2.02	1.61
7 UTILITIES	.01012	.008049	2.41	1.92
8 WAT/SEW/TR	.02875	.01882	1.71	1.12
9 WHOLESALE	.03125	.02669	3.86	3.30
10 EAT/DRINK	.09409	.08783	1.12	1.04
11 OTHER-RET	.05539	.04783	1.34	1.16
12 F/I/R/E	.01122	.009312	1.42	1.18
13 LODGING	.06538	.05972	1.25	1.14
14 HEALTH-SER	.06752	.05809	1.24	1.07
15 EDUCAT-SER	.04413	.03645	1.29	1.06
16 OTHER-SERV	.04169	.03591	1.30	1.12
17 LOC-GOVT	.08576	.07985	1.46	1.36

leading sectors in terms of direct and indirect employment generation in the Worland region economy are EAT/DRINK, LOC-GOVT, HEALTH-SER, LODGING, and OTHER-RET. Table 3-4 also shows the total employment impact of exogenous changes in workers hired. This information is found simply by dividing the direct plus indirect labor requirements per thousand dollars of final demand (in Table 3-4) by the workers per thousand dollars of final demand shown in Table 3-3. The workers added per worker hired column shows that for each worker hired by EAT/DRINK, 1.12 workers are hired throughout the region's economy. Thus the multiplier for exogenous changes in EAT/DRINK employment is 1.12. The high direct labor requirement by restaurants accounts for the large direct plus indirect labor requirement per dollar of sale to final demand. The EAT/DRINK sector has the largest multiplier per dollar to sales to final demand but the smallest multiplier per added worker hired. WHOLESALE, O/G-SERV and MINING have the highest employment multipliers per workers hired. These sectors have large indirect employment impacts when they expand sales to final demand.

CHAPTER 4

EXTENSIONS OF THE BASIC ANALYSIS:
REGIONAL WATER REQUIREMENTSINTRODUCTION

The previous chapter presented what may be appropriately called the results of traditional applications of the Leontief interindustry model. In addition to the descriptive analysis and the attendant development of various multipliers, application of the model can be extended to other questions. The I-0 technique, because of the detailed analysis of interdependence among economic sectors, is readily adaptable to an examination of resource use associated with economic activity in the region. This chapter is concerned with an analysis of water withdrawal and consumptive use in the Worland region economy. Other resource impacts, e.g., water and air quality impacts, land use, and growth of various types of energy consumption, could also be studied, providing adequate data are available.

WATER USE ANALYSIS

The water use analysis requires data pertaining to water withdrawals and consumptive use on a sector-by-sector basis. It is further required that these data be related to economic activity on a per dollar sales basis. These data, particularly for consumptive use, are difficult to obtain on a sector-by-sector basis and for a rather small regional economy.

Water use by commercial establishments is very small relative to agriculture, the extractive industries, electricity generation, and manufacturing. Little detailed information is available from secondary sources for the commercial sectors and, thus most coefficients are based upon results from our Wyoming survey and past surveys and Water Resources Council (WRC)¹ estimates. The Water Resources Council Report provides no detail among commercial establishments. WRC data was also at variance with other data in the agricultural and manufacturing sectors. The primary data source for the agricultural sector was the Census of Agriculture.² The withdrawal rate per dollar of output estimates from Census data was almost twice the size of the rate estimated from Water Resources Council data. Because of the indirect procedure required to convert the secondary data to a useful form for the input-output analysis, the exact source of the discrepancy is not easily traced. Water use estimates for the extractive sectors are based mainly upon the Census of Mineral Industries.³ Unfortunately,

¹The Nation's Water Resources, 1975-2000, Vol. 3: Analytical Data Appendix II, Annual Water Supply and Use Analysis, Table II-4, Annual Water Requirements for Offstream Uses, Base Conditions, No/So Platte Region, Subregion 1007, Dec. 1978; and as above, Analytical Data Appendix I, Social, Economic and Environmental Data, and Table I-2, Earnings by Major Sectors, No/So Platte Region, Subregion 1007, December 1978, Second National Water Assessment by the U.S. Water Resources Council.

²1974 Census of Agriculture, Vol. 1, part 50, Wyoming, State and County Data, U.S. Dept. of Commerce, Bureau of the Census, Table 3, page IV-8; Table 13, page IV-12; Table 3, page IV-26, Table 13, page IV-30, Table 3, page IV-116, Table 13, page IV-120.

³1972 Census of Mineral Industries, Subject Series, Water Use in Mineral Industries, MIC72(1)-2, Sept. 1975, Table 2B, Gross Water Used and Water Intake, By Source and Kind, for Geographic Areas and Major Industry Groups; and as above, Table 2C, Gross Water Used and Water Intake, By source and Kind, for Water Use Regions and Major Industry Groups; and as above, Table 1C, Selected Water Use Statistics for Water Use Regions: 1972; Sept. 1975.

disclosure problems limit the available data to rather large regions in some cases. Withdrawal and consumptive use figures vary considerably among regions and their accuracy for a relatively small region is questionable. Water use in manufacturing is taken from the Census of Manufacturers.⁴ In a few cases, disclosure prevents the use of regional water data. However, the magnitude of the error involved in the computation of the weighted average coefficients for the region is probably quite small.

Estimates of withdrawal and consumptive use by sector are shown in Table 4-1. Where more than one data source is available, multiple estimates are shown. In most cases, the larger numbers are derived from the source which is considered to be more authoritative for the region. In each sector we have used the largest figure shown in Table 4-1 for the water analysis which follows.

Table 4-2 presents the estimated withdrawals and consumptive use for each of the processing sectors of the regional economy in millions of gallons. CROP-LVSTK and O/G-SERV account for over 91 percent of withdrawals and over 94 percent of consumptive use in the region.

It should be noted that the estimates presented in Tables 4-1 and 4-2 do not include water use in the final demand/final payments sector. In order to assess total water use, it is necessary to have some

¹1972 Census of Manufacturers, Water Use in Manufacturing, Special Report Series, Sept. 1975, Table 2C, Gross Water Used and Water Intake, by Source and Kind, For Water Use Regions and Major Industry Groups: 1973; and as above, Table 5C, Gross Water Used Including Recirculated, Total Water Intake, and Treated and Untreated Water Discharged, By Point of Discharge, For Water Use Regions and Major Industry Groups: 1973.

indication of requirements in the final demand sectors. e.g., households and governments. Aggregated data generally show depletions for irrigation as a separate category of water use and a second category consisting of municipal and industrial and domestic water use. Since industrial, commercial, mining, and agricultural water use has been estimated above, the final demand use of water could be computed as a residual if estimates of total withdrawal and total consumption were available.

Estimates of total withdrawal and total consumptive use of water are useful from a purely descriptive point of view. However, the model allows also the analysis of direct and indirect water use which parallels the previous discussion of direct and indirect production. The purpose of such analysis is to isolate the effect of economic interdependence on water requirements. The specific question to be addressed is that of determining the likely impact of expanding final demand in any or all processing sectors on the regional water requirements. The key element in the assessment is the derivation of the direct plus indirect water requirements per dollar of output delivered to final demand.

The calculation of water multipliers is not difficult once the direct water requirements and the table of direct plus indirect production requirements have been obtained. The matrix of direct and indirect production coefficients is premultiplied by a diagonal matrix consisting of the direct water requirements along the diagonal and zeros elsewhere. The columns of the resulting matrix are summed in order to obtain the direct plus indirect water requirements per dollar

of output delivered to final demand by each sector. These requirements for the Worland region economy are shown in Table 4-3. The importance of considering indirect as well as direct water requirements in the planning perspective can be readily seen by comparing Table 4-1 and Table 4-3. Consider, for example the direct withdrawal and consumptive use requirements for MFG in Table 4-1. The direct requirements are 27.6 and 8.9 gallons for each dollar of output. However, as the final demand for the output of the MFG sector expands by one dollar, there is a total direct plus indirect water requirement of 181.4 gallons (withdrawal) and 56.6 gallons (consumptive) generated throughout the economy. The indirect impacts, because of the significant interdependencies within and between MFG and other sectors, are far more important than the direct requirements. Applying only the direct water requirements to assumed increases in deliveries to final demand can obviously result in an understatement of water use.

TABLE 4-1
ESTIMATED WITHDRAWAL AND CONSUMPTIVE USE
REQUIREMENTS BY SECTOR, WORLAND REGION
OF NORTHWEST WYOMING

(In gallons per dollar of output)

Sector	Withdrawal		Consumptive Use	
1 CROP-LVSTK	792.7 ¹	1,550.0 ⁵	314.2 ¹	609.0 ⁶
2 MINING	306.1 ³	53.5 ¹	21.3 ¹	30.6 ⁴
3 O/G-SERV	77.6 ³		0.7 ³	
4 CONSTRUCT	4.0 ⁶		0.4 ⁶	
5 MFG	27.6 ²	6.4 ¹	8.9 ²	1.5 ¹ 3.7 ⁴
6 TRANS/COMM	2.1 ⁶		0.1 ⁶	
7 UTILITIES	26.7 ⁶		13.4 ⁶	13.6 ⁴
8 WAT/SEW/TR	0		0	
9 WHOLESALE	2.3 ⁶		0.6 ⁴	
10 EAT/DRINK	7.0 ⁶		2.1 ⁶	
11 OTHER-RET	3.9 ⁶		0.6 ⁶	1.0 ⁴
12 F/I/R/E	4.9 ⁶		0.2 ⁶	1.2 ⁴
13 LODGING	22.4 ⁶		2.0 ⁶	
14 HEALTH-SER	5.1 ⁶		0.5 ⁶	1.3 ⁴
15 EDUCAT-SER	1.5 ⁶		0.2 ⁶	0.4 ⁴
16 OTHER-SERV	3.5 ⁶		0.7 ⁶	0.9 ⁴
17 LOC-GOVT	1.0 ⁶		0.1 ⁶	

¹Water Resources Council, based on ratio of withdrawal to wages and profits.

²Census of Water Use in Manufacturing, ratio of withdrawal or consumptive use to value of shipments.

³Census of Mineral Industries, ratio of withdrawal to value of shipments.

⁴Water Resources Council, ratio of consumption to withdrawal.

⁵Census of Agriculture, ratio of consumptive use to value of shipments.

⁶Survey data or estimated on per capita basis.

TABLE 4-2
 TOTAL WATER USE BY PROCESSING SECTORS,
 WORLAND REGION OF NORTHWEST WYOMING

(In millions of gallons)

Sector	Withdrawal	Consumptive Use
1 CROP-LVSTK	199,800.0	78,490.0
2 MINING	17,340.0	1,733.0
3 O/G-SERV	103,700.0	935.7
4 CONSTRUCT	554.0	55.4
5 MFG	5,682.0	1,832.0
6 TRANS/COMM	161.3	7.7
7 UTILITIES	1,484.0	756.1
8 WAT/SEW/TR	0	0
9 WHOLESALE	181.9	47.4
10 EAT/DRINK	86.3	25.9
11 OTHER-RET	181.1	46.4
12 F/I/R/E	356.9	87.4
13 LODGING	260.7	23.3
14 HEALTH-SER	112.9	28.8
15 EDUCAT-SER	70.0	18.7
16 OTHER-SERV	128.6	33.1
17 LOC-GOVT	57.7	5.8

TABLE 4-3

DIRECT PLUS INDIRECT WATER REQUIREMENTS,
 WORLAND REGION OF NORTHWEST WYOMING, 1980

(Type II multipliers in gallons per dollar
 of output delivered to final demand)

Sector	Withdrawal	Consumptive Use
1 CROP-LVSTK	1,719.0	674.0
2 MINING	409.3	68.5
3 O/G-SERV	137.2	20.6
4 CONSTRUCT	71.0	24.9
5 MFG	181.4	56.6
6 TRANS/COMM	63.0	22.0
7 UTILITIES	110.5	29.7
8 WAT/SEW/TR	81.6	30.6
9 WHOLESALE	934.0	365.1
10 EAT/DRINK	86.3	30.0
11 OTHER-RET	108.5	40.1
12 F/I/R/E	20.3	6.9
13 LODGING	80.8	22.9
14 HEALTH-SER	77.0	28.0
15 EDUCAT-SER	70.2	25.6
16 OTHER-SERV	57.5	20.7
17 LOC-GOVT	64.1	23.5

APPENDICES

Appendix:

- A - Detailed Sector Identification, Worland Region, Wyoming, 1980
- B - Interindustry Tables for the Worland Region of Wyoming
 - Worland Region, Wyoming, Transactions Among Sectors, 1980
 - Worland Region, Wyoming, Direct Requirements Per Dollar of Output
 - Worland Region, Wyoming, Direct and Indirect Requirements Per Dollar of Output Delivered to Final Demand, 1980 (Households in Processing Sector)
 - Worland Region, Wyoming, Direct and Indirect Requirements Per Dollar of Output Delivered to Final Demand, 1980 (Households in Final Demand)
 - Worland Region, Wyoming, Sales Distribution Coefficients, 1980
- C - Survey Form Used for the Worland Region Interindustry Study
- D - Data Sources by Sector

APPENDIX A

DETAILED SECTOR IDENTIFICATION, WORLAND REGION,
WYOMING, 1980

Sector Number	Sector Description
1 CROP-LVSTK	Cash Grains, Field Crops, Horticultural Specialties, General Crop Farms, Livestock, Dairy, Poultry and Eggs, Animal Specialties, General Livestock Farms, Soil Preparation Services, Crop Services, Veterinary Services, Other Animal Services, Farm Labor and Management Services, Landscape and Horticultural Services, Timber Tracts, Forest Nurseries and Seed Gathering, Forestry Services, Fishing, Hunting and Trapping.
2 MINING	Metal Mining, Nonmetallic Minerals except Fuels and except Sand and Gravel.
3 O/G-SERV	Oil and Gas Exploration Services
4 CONSTRUCT	General Building Contractors, Heavy Construction Contractors, Special Trade Contractors. (To the extent possible the heavy construction which is not repair and replacement is shown as a final demand column.)
5 MFG	Food and Kindred Products, Textile and Apparel Products, Furniture and Fixtures, Paper or Paper Products, Printing and Publishing, Chemicals and Allied Products, Rubber and Plastic Products, Leather and Leather Products, Stone, Clay and Glass Products, Primary and Fabricated Metal Products, Machinery, Electric and Electronic Equipment, Transportation Equipment, Instruments and Miscellaneous Manufacturing Industries.
6 TRANS/COMM	Railroads, Local Transport, Trucking and Warehousing, U.S. Postal Services, Air Transportation, Transportation Services, Communication and Communication Services.

APPENDIX A
(continued)

Sector Number	Sector Description
7 UTILITIES	Electric Services, Natural Gas Distribution.
8 WAT/SEW/TR	Water Supply, Sanitary Services, Irrigation Systems.
9 WHOLESALE	Wholesale Trade, Durable Goods and Nondurable Goods.
10 EAT/DRINK	Eating and Drinking Places.
11 OTHER-RET	Building Supplies and Garden Supplies, General Merchandise, Food Stores, Automotive Dealers and Service Stations, Apparel and Accessory Stores, Furniture and Home Furnishing Stores, Miscellaneous Retail Stores.
12 F/I/R/E	Banking, Credit Agencies NEC, Security and Commodity Brokers, Insurance Carriers, Insurance Agents and Brokers, Real Estate, Holding and Other Investment Offices.
13 LODGING	Hotels, Motels, Tourist Courts, Rooming and Boarding Houses, Camps and Trailering Parks, Membership Basis Organization Hotels.
14 HEALTH-SER	Physicians, Dentists, Osteopaths, Nursing, Hospitals, Medical and Dental Laboratories, Outpatient Care Facilities, Other Health Practitioners.
15 EDUCAT-SER	Elementary and Secondary Schools, Universities, Libraries and Information Centers, Correspondence and Vocation Schools, Other Schools and Educational Services.

APPENDIX A
(continued)

Sector Number	Sector Description
16 OTHER-SERV	Personal Services, Business Services, Auto Repair, Miscellaneous Repair, Motion Pictures, Amusement and Recreation, Legal Services, Social Services, Museums, etc., Membership Organizations, Miscellaneous Services.
17 LOC-GOVT	Executive, Legislative and General Government, Justice, Public Order and Safety, Finance, Taxation and Monetary, Administration of Human Resources, Environmental Quality and Housing, Administration of Economic Programs.
18 HOUSEHOLDS	Personal Income or Spending.
19 STATE-GOVT	
20 FED-GOVT	

APPENDIX B

INTERINDUSTRY TABLES FOR THE WORLAND REGION, 1980

- B-1 - Worland Region, Wyoming, Transactions Among Sectors, 1980
- B-2 - Worland Region, Wyoming, Direct Requirements Per Dollar of Output
- B-3 - Worland Region, Wyoming, Direct and Indirect Requirements Per Dollar Delivered to Final Demand, 1980 (Households in Processing Sector)
- B-4 - Worland Region, Wyoming, Direct and Indirect Requirements Per Dollar Delivered to Final Demand, 1980 (Households in Final Demand)
- B-5 - Worland Region, Wyoming, Sales Distribution Coefficients, 1980

APPENDIX B-1

WORLAND REGION, WYOMING, TRANSACTIONS AMONG SECTORS, 1980

	DOLLARS									
	1	2	3	4	5	6	7	8	9	10
	CROP-LVSTK	MINING	O/G-SERV	CONSTRUCT	MFG	TRANS/COMM	UTILITIES	WAT/SEW/TR	WHOLESALE	EAT/DRINK
1 CROP-LVSTK	5566656.	488028.	27004997.	0.	9787500.	0.	0.	0.	41592523.	0.
2 MINING	0.	368068.	0.	27701.	1425363.	0.	0.	0.	0.	0.
3 O/G-SERV	0.	0.	127976327.	0.	68622500.	0.	27606995.	0.	0.	0.
4 CONSTRUCT	133137.	3224721.	5153457.	22368277.	646625.	7580198.	17131.	149750.	130461.	74219.
5 MFG	3040600.	27967.	2375907.	7071956.	895196.	1983672.	5843.	4913.	15968.	1343767.
6 TRANS/COMM	743444.	15419559.	2800626.	789469.	14647673.	2604663.	213495.	9217.	14949833.	141629.
7 UTILITIES	2275706.	3100903.	15451586.	332408.	5122860.	2643531.	26667.	7898.	302208.	763197.
8 WAT/SEW/TR	831064.	4000.	3581.	69252.	293732.	13003.	15993.	0.	31990.	108416.
9 WHOLESALE	9335868.	2660711.	5928310.	3011148.	591645.	345938.	248500.	48084.	114869.	155158.
10 EAT/DRINK	0.	0.	33396.	0.	7829.	5234.	0.	0.	0.	0.
11 OTHER-RET	6644506.	14713.	625311.	2685768.	357906.	17462.	14396.	12134.	39409.	85429.
12 F/I/R/E	20829901.	45310.	2066892.	2742365.	513414.	78342.	22803.	4024.	1434759.	296517.
13 LODGING	0.	0.	211443.	0.	39102.	15522.	0.	0.	2266.	0.
14 HEALTH-SER	0.	0.	7764.	0.	162975.	0.	0.	0.	6750.	0.
15 EDUCAT-SER	0.	0.	86093.	0.	807.	0.	0.	0.	0.	0.
16 OTHER-SERV	3611649.	144992.	5247526.	3656486.	410426.	486043.	164659.	88383.	618640.	0.
17 LOC-GOVT	3935274.	407465.	25254048.	664816.	787368.	5625587.	926692.	0.	453064.	43715.
18 subtotal	56947805.	25906437.	220227270.	43419646.	104312921.	21399195.	29263174.	324403.	59692740.	3012047.
19 HOUSEHOLDS	8233659.	6915506.	47509536.	25484600.	21320709.	22928239.	4810584.	2339188.	8593486.	4078519.
20 STATE-GOVT	1213423.	674000.	31991588.	1177278.	511565.	2176494.	197559.	0.	1075252.	130010.
21 FED-GOVT	6533080.	2959363.	463701400.	4058146.	5448992.	7574450.	456979.	0.	1620282.	1016900.
22 TRANSFERS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
23 PROFITS	20362631.	5893025.	512923292.	15055304.	14330346.	13599497.	4860344.	1346145.	2415029.	2968874.
24 IMP-WYOM	1704113.	5244795.	4392756.	12328718.	3024439.	2073429.	12869822.	6263.	657354.	412581.
25 IMP-WORLD	33885427.	9043674.	56038771.	36979571.	56919063.	7045451.	3139154.	30926.	5011483.	703641.
26 total	128880138.	56636800.	1336784608.	138503264.	205868038.	76796755.	55597616.	4046925.	79065626.	12322572.

1 EMPLOYMENT	0.1710E 04	0.4030E 03	0.1883E 04	0.1592E 04	0.1433E 04	0.1186E 04	0.2330E 03	0.6800E 02	0.6400E 03	0.1038E 04
2 WITHDRAWAL	0.1998E 12	0.1734E 11	0.1037E 12	0.5540E 09	0.5682E 10	0.1613E 09	0.1484E 10	0.	0.1819E 09	0.8626E 08
3 CONSUMP.	0.7849E 11	0.1733E 10	0.9357E 09	0.5540E 08	0.1832E 10	0.7680E 07	0.7561E 09	0.	0.4744E 08	0.2588E 08

APPENDIX B-1
(continued)

		DOLLARS									
		11	12	13	14	15	16	17	18	19	20
		OTHER-RET	F/I/R/E	LODGING	HEALTH-SER	EDUCAT-SER	OTHER-SER	LOC-GOVT	subtotal	HOUSEHOLDS	STATE-GOVT
1	CROP-LVSTK	0.	0.	0.	0.	16353.	0.	0.	84456057.	1654000.	228654.
2	MINING	0.	0.	0.	0.	0.	0.	0.	1821132.	0.	702423.
3	O/G-SERV	0.	0.	0.	0.	0.	0.	0.	224205824.	101631.	0.
4	CONSTRUCT	961232.	226818.	533298.	7624.	1021626.	106723.	833958.	43169255.	1713945.	0.
5	MFG	1252448.	331083.	86576.	104315.	745.	697188.	71135.	19309279.	23685994.	94401.
6	TRANS/COMM	2383765.	256736.	261251.	365838.	838029.	878416.	254285.	57557928.	11625064.	493140.
7	UTILITIES	1037992.	166247.	689503.	237488.	2187000.	591083.	160977.	35097254.	20454000.	10362.
8	WAT/SEW/TR	81143.	20726.	102647.	23980.	67374.	57466.	0.	1724367.	1797434.	26124.
9	WHOLESALE	2189501.	44886.	91567.	94207.	466341.	302092.	747274.	26376099.	34790247.	655278.
10	EAT/DRINK	2211.	5200.	0.	27506.	0.	28586.	9989.	119951.	5883194.	0.
11	OTHER-RET	202087.	108797.	98244.	52695.	1847.	464321.	22229.	11447254.	30249427.	25196.
12	F/I/R/E	1118597.	495649.	2091797.	262695.	2569622.	1473605.	567106.	36613398.	34617170.	545679.
13	LODGING	0.	0.	0.	6140.	0.	0.	0.	274473.	0.	0.
14	HEALTH-SER	0.	0.	0.	673009.	0.	0.	263438.	1113936.	20999206.	24663.
15	EDUCAT-SER	19077.	15305.	0.	10350.	2666.	57466.	29741116.	29932880.	2350466.	14362612.
16	OTHER-SERV	2616000.	1697373.	584034.	287140.	141806.	484360.	1459985.	21699502.	12178344.	169384.
17	LOC-GOVT	322158.	174656.	159145.	89621.	0.	418684.	117929.	39380222.	5858235.	9330540.
18	subtotal	12186211.	3543476.	4698062.	2242608.	7313409.	5559990.	34249421.	634298824.	207958358.	26668456.
19	HOUSEHOLDS	17840396.	7374077.	3013974.	11833955.	20334492.	11455866.	5490472.	229557262.	1417876.	6424874.
20	STATE-GOVT	225619.	39027.	119676.	66190.	2607363.	168294.	133419.	42506757.	24568683.	551141.
21	FED-GOVT	2068886.	3177496.	170764.	653817.	864950.	2335601.	666195.	503307312.	77833153.	77386.
22	TRANSFERS	0.	20864000.	0.	0.	557872.	0.	0.	21421872.	6060306.	1581415.
23	PROFITS	9461825.	8573616.	2114072.	2361165.	9682732.	10389114.	14815648.	651152664.	12355453.	979851.
24	IMP-WYOM	832584.	31914.	406669.	379805.	47591.	1368151.	81278.	45862262.	12061065.	295474.
25	IMP-WORLD	3807836.	29239802.	1115616.	4603693.	5275549.	5451775.	2264564.	260556004.	101498424.	562384.
26	total	46423357.	72843408.	11638833.	22141233.	46683958.	36728791.	57700997.	2388662976.	443753320.	37140981.

1	EMPLOYMENT	0.1919E 04	0.5750E 03	0.6100E 03	0.1206E 04	0.1601E 04	0.1181E 04	0.3395E 04	0.	0.2396E 03	0.
2	WITHDRAWAL	0.1811E 09	0.3569E 09	0.2607E 09	0.1129E 09	0.7003E 08	0.1286E 09	0.5770E 08	0.	0.	0.
3	CONSUMP.	0.4642E 08	0.8741E 08	0.2328E 08	0.2878E 08	0.1867E 08	0.3306E 08	0.5770E 07	0.	0.	0.

APPENDIX B-2

WORLAND REGION, WYOMING, DIRECT REQUIREMENTS
PER DOLLAR OF OUTPUT

	1	2	3	4	5	6	7	8	9	10
	CROP-LVSTK	MINING	O/G-SERV	CONSTRUCT	MFG	TRANS/COMM	UTILITIES	WAT/SEW/TR	WHOLESALE	EAT/DRINK
1 CROP-LVSTK	0.043193	0.008617	0.020201	0.	0.047543	0.	0.	0.	0.526051	0.
2 MINING	0.	0.006499	0.	0.000200	0.006924	0.	0.	0.	0.	0.
3 O/G-SERV	0.	0.	0.095734	0.	0.333332	0.	0.496550	0.	0.	0.
4 CONSTRUCT	0.001033	0.056937	0.003855	0.161500	0.003141	0.098705	0.000308	0.037003	0.001650	0.006023
5 MFG	0.023592	0.000494	0.001777	0.051060	0.004348	0.025830	0.000105	0.001214	0.000202	0.109049
6 TRANS/COMM	0.005768	0.272253	0.002095	0.005700	0.071151	0.033916	0.003840	0.002278	0.189081	0.011493
7 UTILITIES	0.017658	0.054751	0.011559	0.002400	0.024884	0.034422	0.000480	0.001952	0.003822	0.061935
8 WAT/SEW/TR	0.006448	0.000071	0.000003	0.000500	0.001427	0.000169	0.000288	0.	0.000405	0.008798
9 WHOLESALE	0.072438	0.046978	0.004435	0.021741	0.002874	0.004505	0.004470	0.011882	0.001453	0.012591
10 EAT/DRINK	0.	0.	0.000025	0.	0.000038	0.000068	0.	0.	0.	0.
11 OTHER-RET	0.051556	0.000260	0.000468	0.019391	0.001739	0.000227	0.000259	0.002998	0.000498	0.006933
12 F/I/R/E	0.161622	0.000800	0.001546	0.019800	0.002494	0.001020	0.000410	0.000994	0.018146	0.024063
13 LODGING	0.	0.	0.000158	0.	0.000190	0.000202	0.	0.	0.000029	0.
14 HEALTH-SER	0.	0.	0.000006	0.	0.000792	0.	0.	0.	0.000085	0.
15 EDUCAT-SER	0.	0.	0.000064	0.	0.000004	0.	0.	0.	0.	0.
16 OTHER-SERV	0.028023	0.002560	0.003925	0.026400	0.001994	0.006329	0.002962	0.021840	0.007824	0.
17 LOC-GOVT	0.030534	0.007194	0.018892	0.004800	0.003825	0.073253	0.016668	0.	0.005730	0.003548
18 HOUSEHOLDS	0.063886	0.122103	0.035540	0.184000	0.103565	0.298557	0.086525	0.578016	0.108688	0.330980
19 STATE-GOVT	0.009415	0.011900	0.023932	0.008500	0.002485	0.028341	0.003553	0.	0.013599	0.010551
20 FED-GOVT	0.050691	0.052252	0.346878	0.029300	0.026468	0.098630	0.008219	0.	0.020493	0.082523
21 TRANSFERS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
22 PROFITS	0.157997	0.104049	0.383699	0.108700	0.069609	0.177084	0.087420	0.332634	0.030545	0.240930
23 IMP-WYOM	0.013222	0.092604	0.003286	0.089014	0.014691	0.026999	0.231482	0.001548	0.008314	0.033482
24 IMP-WORLD	0.262922	0.159678	0.041921	0.266994	0.276483	0.091742	0.056462	0.007642	0.063384	0.057102

APPENDIX B-2
(continued)

	11	12	13	14	15	16	17	18	19	20
	OTHER-RET	F/I/R/E	LODGING	HEALTH-SER	EDUCAT-SER	OTHER-SER	LOC-GOVT	HOUSEHOLDS	STATE-GOVT	FED-GOVT
1 CROP-LVSTK	0.	0.	0.	0.	0.000350	0.	0.	0.003727	0.006156	0.
2 MINING	0.	0.	0.	0.	0.	0.	0.	0.	0.018912	0.
3 O/G-SERV	0.	0.	0.	0.	0.	0.	0.	0.000229	0.	0.
4 CONSTRUCT	0.020706	0.003114	0.045821	0.000344	0.021884	0.002906	0.014453	0.003862	0.	0.008064
5 MFG	0.026979	0.004545	0.007439	0.004711	0.000016	0.018982	0.001233	0.053376	0.002542	0.000963
6 TRANS/COMM	0.051348	0.003524	0.022446	0.016523	0.017951	0.023916	0.004407	0.026197	0.013278	0.047614
7 UTILITIES	0.022359	0.002282	0.059242	0.010726	0.046847	0.016093	0.002790	0.046093	0.000279	0.000347
8 WAT/SEW/TR	0.001748	0.000285	0.008819	0.001083	0.001443	0.001565	0.	0.004051	0.000703	0.004808
9 WHOLESALE	0.047164	0.000616	0.007867	0.004255	0.009989	0.008225	0.012951	0.078400	0.017643	0.003184
10 EAT/DRINK	0.000048	0.000071	0.	0.001242	0.	0.000778	0.000173	0.013258	0.	0.
11 OTHER-RET	0.004353	0.001494	0.008441	0.002380	0.000040	0.012642	0.000385	0.068167	0.000678	0.
12 F/I/R/E	0.024096	0.006804	0.179726	0.011865	0.055043	0.040121	0.009828	0.078010	0.014692	0.
13 LODGING	0.	0.	0.	0.000277	0.	0.	0.	0.	0.	0.
14 HEALTH-SER	0.	0.	0.	0.030396	0.	0.	0.004566	0.047322	0.000664	0.
15 EDUCAT-SER	0.000411	0.000210	0.	0.000467	0.000057	0.001565	0.515435	0.005297	0.386705	0.000366
16 OTHER-SERV	0.056351	0.023302	0.050180	0.012969	0.003038	0.013187	0.025303	0.027444	0.004561	0.019186
17 LOC-GOVT	0.006940	0.002398	0.013674	0.004048	0.	0.011399	0.002044	0.013202	0.251220	0.030177
18 HOUSEHOLDS	0.384298	0.101232	0.258958	0.534476	0.435578	0.311904	0.095154	0.003195	0.172986	0.242274
19 STATE-GOVT	0.004860	0.000536	0.010282	0.002989	0.055851	0.004582	0.002312	0.055366	0.014839	0.210337
20 FED-GOVT	0.044566	0.043621	0.014672	0.029529	0.018528	0.063590	0.011546	0.175397	0.002084	0.000204
21 TRANSFERS	0.	0.286423	0.	0.	0.011950	0.	0.	0.013657	0.042579	0.428566
22 PROFITS	0.203816	0.117699	0.181640	0.106641	0.207410	0.282860	0.256766	0.027843	0.026382	0.
23 IMP-WYOM	0.017935	0.000438	0.034941	0.017154	0.001019	0.037250	0.001409	0.027180	0.007955	0.001474
24 IMP-WORLD	0.082024	0.401406	0.095853	0.207924	0.113006	0.148433	0.039247	0.228727	0.015142	0.002437

APPENDIX B-2
(continued)

	21	22	23	24	25	26	27
	INVESTMENT	ROAD-CONST	COMM-CONST	HOUS-CONST	COAL-CONST	TRANSFERS	EXPORTS
1 CROP-LVSTK	0.	0.	.132923E	37.132923E	37.132923E	37 0.	0.029440
2 MINING	0.	0.067563.	.132923E	37.132923E	37.132923E	37 0.	0.037273
3 O/G-SERV	0.	0.	.132923E	37.132923E	37.132923E	37 0.	0.769876
4 CONSTRUCT	1.000000	0.	.132923E	37.132923E	37.132923E	37 0.	0.000515
5 MFG	0.	0.026316.	.132923E	37.132923E	37.132923E	37 0.	0.112511
6 TRANS/COMM	0.	0.	.132923E	37.132923E	37.132923E	37 0.	0.001508
7 UTILITIES	0.	0.	.132923E	37.132923E	37.132923E	37 0.	0.
8 WAT/SEW/TR	0.	0.	.132923E	37.132923E	37.132923E	37 0.	0.
9 WHOLESALE	0.	0.057040.	.132923E	37.132923E	37.132923E	37 0.	0.011556
10 EAT/DRINK	0.	0.	.132923E	37.132923E	37.132923E	37 0.	0.004373
11 OTHER-RET	0.	0.010812.	.132923E	37.132923E	37.132923E	37 0.	0.003225
12 F/I/R/E	0.	0.	.132923E	37.132923E	37.132923E	37 0.	0.000739
13 LODGING	0.	0.	.132923E	37.132923E	37.132923E	37 0.	0.007865
14 HEALTH-SER	0.	0.	.132923E	37.132923E	37.132923E	37 0.	0.000002
15 EDUCAT-SER	0.	0.	.132923E	37.132923E	37.132923E	37 0.	0.
16 OTHER-SERV	0.	0.	.132923E	37.132923E	37.132923E	37 0.	0.000478
17 LOC-GOVT	0.	0.	.132923E	37.132923E	37.132923E	37 0.	0.
18 HOUSEHOLDS	0.	0.398723.	.132923E	37.132923E	37.132923E	37 1.000000	0.
19 STATE-GOVT	0.	0.028030.	.132923E	37.132923E	37.132923E	37 0.	0.
20 FED-GOVT	0.	0.059330.	.132923E	37.132923E	37.132923E	37 0.	0.
21 TRANSFERS	0.	0.	.132923E	37.132923E	37.132923E	37 0.	0.
22 PROFITS	0.	0.090770.	.132923E	37.132923E	37.132923E	37 0.	0.
23 IMP-WYOM	0.	0.007025.	.132923E	37.132923E	37.132923E	37 0.	0.002777
24 IMP-WORLD	0.	0.254391.	.132923E	37.132923E	37.132923E	37 0.	0.017862

APPENDIX B-3

WORLAND REGION, WYOMING, DIRECT AND INDIRECT REQUIREMENTS
PER DOLLAR DELIVERED TO FINAL DEMAND, 1980

(Households in Processing Sector)

	1	2	3	4	5	6	7	8	9	10
	CROP-LVSTK	MINING	O/G-SERV	CONSTRUCT	MFG	TRANS/COMM	UTILITIES	WAT/SEW/TR	WHOLESALE	EAT/DRINK
1 CROP-LVSTK	1.1044	0.0589	0.0319	0.0378	0.0760	0.0330	0.0251	0.0479	0.5961	0.0411
2 MINING	0.0003	1.0068	0.0001	0.0008	0.0071	0.0005	0.0001	0.0003	0.0003	0.0010
3 O/G-SERV	0.0356	0.0601	1.1187	0.0445	0.4022	0.0584	0.5625	0.0414	0.0398	0.1022
4 CONSTRUCT	0.0122	0.1100	0.0077	1.2015	0.0197	0.1325	0.0072	0.0562	0.0360	0.0189
5 MFG	0.0426	0.0345	0.0076	0.0833	1.0223	0.0616	0.0113	0.0482	0.0432	0.1393
6 TRANS/COMM	0.0418	0.3155	0.0089	0.0380	0.0921	1.0672	0.0162	0.0464	0.2324	0.0499
7 UTILITIES	0.0362	0.0862	0.0183	0.0250	0.0461	0.0649	1.0168	0.0427	0.0433	0.0924
8 WAT/SEW/TR	0.0084	0.0021	0.0006	0.0025	0.0029	0.0026	0.0012	1.0036	0.0060	0.0113
9 WHOLESALE	0.1012	0.0830	0.0138	0.0572	0.0288	0.0491	0.0220	0.0762	1.0765	0.0551
10 EAT/DRINK	0.0027	0.0042	0.0009	0.0042	0.0027	0.0060	0.0020	0.0094	0.0044	1.0059
11 OTHER-RET	0.0719	0.0274	0.0071	0.0476	0.0202	0.0354	0.0123	0.0557	0.0552	0.0406
12 F/I/R/E	0.2029	0.0426	0.0143	0.0600	0.0345	0.0509	0.0197	0.0717	0.1486	0.0708
13 LODGING	0.0000	0.0001	0.0002	0.0000	0.0003	0.0002	0.0001	0.0000	0.0001	0.0001
14 HEALTH-SER	0.0097	0.0154	0.0034	0.0153	0.0106	0.0219	0.0073	0.0344	0.0161	0.0218
15 EDUCAT-SER	0.0234	0.0227	0.0130	0.0105	0.0139	0.0485	0.0174	0.0131	0.0271	0.0125
16 OTHER-SERV	0.0489	0.0231	0.0092	0.0478	0.0157	0.0305	0.0127	0.0517	0.0456	0.0208
17 LOC-GOVT	0.0431	0.0407	0.0244	0.0169	0.0248	0.0893	0.0320	0.0179	0.0489	0.0196
18 HOUSEHOLDS	0.1944	0.3110	0.0675	0.3110	0.1977	0.4391	0.1463	0.7018	0.3223	0.4423

	11	12	13	14	15	16	17	18
	OTHER-RET	F/I/R/E	LODGING	HEALTH-SER	EDUCAT-SER	OTHER-SER	LOC-GOVT	HOUSEHOLDS
1 CROP-LVSTK	0.0612	0.0087	0.0309	0.0414	0.0385	0.0304	0.0359	0.0664
2 MINING	0.0005	0.0001	0.0003	0.0003	0.0003	0.0003	0.0002	0.0005
3 O/G-SERV	0.0567	0.0111	0.0618	0.0454	0.0571	0.0406	0.0404	0.0632
4 CONSTRUCT	0.0426	0.0067	0.0669	0.0137	0.0378	0.0147	0.0403	0.0181
5 MFG	0.0662	0.0139	0.0389	0.0477	0.0365	0.0469	0.0307	0.0726
6 TRANS/COMM	0.0989	0.0128	0.0531	0.0577	0.0528	0.0533	0.0438	0.0660
7 UTILITIES	0.0585	0.0108	0.0862	0.0503	0.0792	0.0423	0.0527	0.0658
8 WAT/SEW/TR	0.0048	0.0010	0.0111	0.0045	0.0043	0.0038	0.0030	0.0058
9 WHOLESALE	0.0994	0.0132	0.0475	0.0644	0.0600	0.0467	0.0576	0.1034
10 EAT/DRINK	0.0072	0.0019	0.0054	0.0102	0.0073	0.0063	0.0058	0.0156
11 OTHER-RET	1.0465	0.0118	0.0403	0.0515	0.0407	0.0433	0.0326	0.0849
12 F/I/R/E	0.0855	1.0212	0.2255	0.0778	0.1098	0.0828	0.0830	0.1114
13 LODGING	0.0001	0.0000	1.0000	0.0003	0.0000	0.0000	0.0000	0.0001
14 HEALTH-SER	0.0263	0.0066	0.0197	1.0640	0.0266	0.0201	0.0252	0.0571
15 EDUCAT-SER	0.0178	0.0043	0.0172	0.0155	1.0114	0.0165	0.5257	0.0204
16 OTHER-SERV	0.0827	0.0295	0.0749	0.0409	0.0274	1.0325	0.0467	0.0458
17 LOC-GOVT	0.0278	0.0064	0.0290	0.0220	0.0163	0.0246	1.0153	0.0272
18 HOUSEHOLDS	0.5340	0.1346	0.4000	0.6665	0.5426	0.4086	0.4178	1.1665

APPENDIX B-4

WORLAND REGION, WYOMING, DIRECT AND INDIRECT REQUIREMENTS
PER DOLLAR DELIVERED TO FINAL DEMAND, 1980

(Households in Final Demand)

	1	2	3	4	5	6	7	8	9	10
	CROP-LVSTK	MINING	O/G-SERV	CONSTRUCT	MFG	TRANS/COMM	UTILITIES	WAT/SEW/TR	WHOLESALE	EAT/DRINK
1 CROP-LVSTK	1.0934	0.0412	0.0280	0.0201	0.0647	0.0081	0.0168	0.0080	0.5778	0.0159
2 MINING	0.0002	1.0067	0.0000	0.0007	0.0070	0.0003	0.0000	0.0000	0.0002	0.0008
3 O/G-SERV	0.0251	0.0433	1.1151	0.0277	0.3915	0.0347	0.5546	0.0034	0.0224	0.0783
4 CONSTRUCT	0.0092	0.1051	0.0066	1.1967	0.0167	0.1257	0.0049	0.0453	0.0310	0.0120
5 MFG	0.0305	0.0151	0.0034	0.0639	1.0100	0.0342	0.0022	0.0045	0.0232	0.1118
6 TRANS/COMM	0.0308	0.2979	0.0051	0.0204	0.0809	1.0424	0.0080	0.0067	0.2142	0.0248
7 UTILITIES	0.0252	0.0687	0.0145	0.0075	0.0349	0.0401	1.0085	0.0032	0.0252	0.0675
8 WAT/SEW/TR	0.0074	0.0006	0.0002	0.0010	0.0019	0.0004	0.0004	1.0001	0.0044	0.0091
9 WHOLESALE	0.0839	0.0555	0.0078	0.0297	0.0113	0.0102	0.0090	0.0140	1.0479	0.0159
10 EAT/DRINK	0.0001	0.0000	0.0000	0.0000	0.0001	0.0001	0.0000	0.0000	0.0001	1.0000
11 OTHER-RET	0.0578	0.0048	0.0022	0.0250	0.0058	0.0034	0.0016	0.0046	0.0318	0.0084
12 F/I/R/E	0.1844	0.0129	0.0078	0.0303	0.0156	0.0089	0.0057	0.0046	0.1178	0.0285
13 LODGING	0.0000	0.0001	0.0002	0.0000	0.0003	0.0002	0.0001	0.0000	0.0001	0.0000
14 HEALTH-SER	0.0002	0.0002	0.0001	0.0001	0.0009	0.0004	0.0001	0.0000	0.0003	0.0001
15 EDUCAT-SER	0.0200	0.0173	0.0118	0.0050	0.0104	0.0408	0.0148	0.0008	0.0214	0.0048
16 OTHER-SERV	0.0413	0.0109	0.0065	0.0356	0.0079	0.0133	0.0070	0.0242	0.0330	0.0034
17 LOC-GOVT	0.0386	0.0334	0.0228	0.0096	0.0202	0.0791	0.0286	0.0015	0.0414	0.0092
	11	12	13	14	15	16	17			
	OTHER-RET	F/I/R/E	LODGING	HEALTH-SER	EDUCAT-SER	OTHER-SER	LOC-GOVT			
1 CROP-LVSTK	0.0309	0.0010	0.0082	0.0035	0.0076	0.0072	0.0121			
2 MINING	0.0002	0.0000	0.0001	0.0000	0.0000	0.0002	0.0000			
3 O/G-SERV	0.0278	0.0038	0.0401	0.0093	0.0277	0.0185	0.0178			
4 CONSTRUCT	0.0343	0.0047	0.0607	0.0033	0.0293	0.0084	0.0338			
5 MFG	0.0330	0.0055	0.0140	0.0062	0.0028	0.0215	0.0047			
6 TRANS/COMM	0.0687	0.0052	0.0304	0.0200	0.0221	0.0302	0.0201			
7 UTILITIES	0.0284	0.0032	0.0637	0.0127	0.0486	0.0193	0.0292			
8 WAT/SEW/TR	0.0022	0.0004	0.0091	0.0012	0.0016	0.0017	0.0009			
9 WHOLESALE	0.0521	0.0012	0.0120	0.0054	0.0119	0.0104	0.0206			
10 EAT/DRINK	0.0001	0.0001	0.0001	0.0013	0.0000	0.0008	0.0002			
11 OTHER-RET	1.0076	0.0020	0.0112	0.0030	0.0012	0.0136	0.0022			
12 F/I/R/E	0.0344	1.0083	0.1873	0.0141	0.0580	0.0437	0.0431			
13 LODGING	0.0000	0.0000	1.0000	0.0003	0.0000	0.0000	0.0000			
14 HEALTH-SER	0.0001	0.0000	0.0001	1.0314	0.0000	0.0001	0.0047			
15 EDUCAT-SER	0.0084	0.0020	0.0103	0.0038	1.0020	0.0094	0.5184			
16 OTHER-SERV	0.0617	0.0243	0.0592	0.0147	0.0062	1.0165	0.0303			
17 LOC-GOVT	0.0154	0.0033	0.0196	0.0064	0.0036	0.0151	1.0055			

APPENDIX B-5

WORLAND REGION, WYOMING, SALES DISTRIBUTION
COEFFICIENTS, 1980

	1	2	3	4	5	6	7	8	9	10
	CROP-LVSTK	MINING	O/G-SERV	CONSTRUCT	MFG	TRANS/COMM	UTILITIES	WAT/SEW/TR	WHOLESALE	EAT/DRINK
1 CROP-LVSTK	0.043193	0.003787	0.209536	0.	0.075943	0.	0.	0.	0.322723	0.
2 MINING	0.	0.006499	0.	0.000489	0.025167	0.	0.	0.	0.	0.
3 O/G-SERV	0.	0.	0.095734	0.	0.051334	0.	0.020652	0.	0.	0.
4 CONSTRUCT	0.000961	0.023283	0.037208	0.161500	0.004669	0.054729	0.000124	0.001081	0.000942	0.000536
5 MFG	0.014770	0.000136	0.011541	0.034352	0.004348	0.009636	0.000028	0.000024	0.000078	0.006527
6 TRANS/COMM	0.009681	0.200784	0.036468	0.010280	0.190733	0.033916	0.002780	0.000120	0.194668	0.001844
7 UTILITIES	0.040932	0.055774	0.277918	0.005979	0.092142	0.047548	0.000480	0.000142	0.005436	0.013727
8 WAT/SEW/TR	0.205357	0.000988	0.000885	0.017112	0.072582	0.003213	0.003952	0.	0.007905	0.026790
9 WHOLESALE	0.118077	0.033652	0.074980	0.038084	0.007483	0.004375	0.003143	0.000608	0.001453	0.001962
10 EAT/DRINK	0.	0.	0.002710	0.	0.000635	0.000425	0.	0.	0.	0.
11 OTHER-RET	0.143129	0.000317	0.013470	0.057854	0.007710	0.000376	0.000310	0.000261	0.000849	0.001840
12 F/I/R/E	0.285955	0.000622	0.028374	0.037647	0.007048	0.001075	0.000313	0.000055	0.019696	0.004071
13 LODGING	0.	0.	0.018167	0.	0.003360	0.001334	0.	0.	0.000195	0.
14 HEALTH-SER	0.	0.	0.000351	0.	0.007361	0.	0.	0.	0.000305	0.
15 EDUCAT-SER	0.	0.	0.001844	0.	0.000017	0.	0.	0.	0.	0.
16 OTHER-SERV	0.098333	0.003948	0.142872	0.099554	0.011175	0.013233	0.004483	0.002406	0.016843	0.
17 LOC-GOVT	0.068201	0.007062	0.437671	0.011522	0.013646	0.097495	0.016060	0.	0.007852	0.000758
18 HOUSEHOLDS	0.018555	0.015584	0.107063	0.057430	0.048046	0.051669	0.010841	0.005271	0.019365	0.009191
19 STATE-GOVT	0.013548	0.007525	0.357199	0.013145	0.005712	0.024301	0.002206	0.	0.012006	0.001452
20 FED-GOVT	0.011236	0.005090	0.797475	0.006979	0.009371	0.013027	0.000786	0.	0.002787	0.001749
21 TRANSFERS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
22 PROFITS	0.030628	0.008864	0.771511	0.022645	0.021555	0.020456	0.007311	0.002025	0.003633	0.004466
23 IMP-WYOM	0.027304	0.084036	0.070384	0.197539	0.048460	0.033222	0.206209	0.000100	0.010533	0.006611
24 IMP-WORLD	0.086967	0.023211	0.143823	0.094908	0.146083	0.018082	0.008057	0.000079	0.012862	0.001806

APPENDIX B-5
(continued)

	11	12	13	14	15	16	17	18	19	20
	OTHER-RET	F/I/R/E	LODGING	HEALTH-SER	EDUCAT-SER	OTHER-SER	LOC-GOVT	HOUSEHOLDS	STATE-GOVT	FED-GOVT
1 CROP-LVSTK	0.	0.	0.	0.	0.000127	0.	0.	0.012834	0.001774	0.
2 MINING	0.	0.	0.	0.	0.	0.	0.	0.	0.012402	0.
3 O/G-SERV	0.	0.	0.	0.	0.	0.	0.	0.000076	0.	0.
4 CONSTRUCT	0.006940	0.001638	0.003850	0.000055	0.007376	0.000771	0.006021	0.012375	0.	0.006043
5 MFG	0.006084	0.001608	0.000421	0.000507	0.000004	0.003387	0.000346	0.115054	0.000459	0.000485
6 TRANS/COMM	0.031040	0.003343	0.003402	0.004764	0.010912	0.011438	0.003311	0.151374	0.006421	0.064348
7 UTILITIES	0.018670	0.002990	0.012402	0.004272	0.039336	0.010631	0.002895	0.367893	0.000186	0.000648
8 WAT/SEW/TR	0.020051	0.005121	0.025364	0.005925	0.016648	0.014200	0.	0.444148	0.006455	0.123303
9 WHOLESALE	0.027692	0.000568	0.001158	0.001192	0.005898	0.003821	0.009451	0.440017	0.008288	0.004180
10 EAT/DRINK	0.000179	0.000422	0.	0.002232	0.	0.002320	0.000811	0.477432	0.	0.
11 OTHER-RET	0.004353	0.002344	0.002116	0.001135	0.000040	0.010002	0.000479	0.651599	0.000543	0.
12 F/I/R/E	0.015356	0.006804	0.028716	0.003606	0.035276	0.020230	0.007785	0.475227	0.007491	0.
13 LODGING	0.	0.	0.	0.000528	0.	0.	0.	0.	0.	0.
14 HEALTH-SER	0.	0.	0.	0.030396	0.	0.	0.011898	0.948421	0.001114	0.
15 EDUCAT-SER	0.000409	0.000328	0.	0.000222	0.000057	0.001231	0.637074	0.050348	0.307656	0.000814
16 OTHER-SERV	0.071225	0.046214	0.015901	0.007818	0.003861	0.013187	0.039750	0.331575	0.004612	0.054215
17 LOC-GOVT	0.005583	0.003027	0.002758	0.001553	0.	0.007256	0.002044	0.101527	0.161705	0.054280
18 HOUSEHOLDS	0.040203	0.016618	0.006792	0.026668	0.045824	0.025816	0.012373	0.003195	0.014478	0.056665
19 STATE-GOVT	0.002519	0.000436	0.001336	0.000739	0.029112	0.001879	0.001490	0.274319	0.006154	0.243745
20 FED-GOVT	0.003558	0.005465	0.000294	0.001124	0.001488	0.004017	0.001146	0.133858	0.000133	0.000036
21 TRANSFERS	0.	0.283696	0.	0.	0.007586	0.	0.	0.082404	0.021503	0.604811
22 PROFITS	0.014232	0.012896	0.003180	0.003552	0.014564	0.015627	0.022285	0.018584	0.001474	0.
23 IMP-WYOM	0.013340	0.000511	0.006516	0.006085	0.000763	0.021921	0.001302	0.193250	0.004734	0.002451
24 IMP-WORLD	0.009773	0.075044	0.002863	0.011815	0.013540	0.013992	0.005812	0.260495	0.001443	0.000649

APPENDIX B-5
(continued)

	21	22	23	24	25	26	27
	INVESTMENT	ROAD-CONST	COMM-CONST	HOUS-CONST	COAL-CONST	TRANSFERS	EXPORTS
1 CROP-LVSTK	0.	0.	0.	0.	0.	0.	0.330085
2 MINING	0.	0.004484	0.	0.	0.	0.	0.950959
3 O/G-SERV	0.	0.	0.	0.	0.	0.	0.832204
4 CONSTRUCT	0.664528	0.	0.	0.	0.	0.	0.005371
5 MFG	0.	0.000480	0.	0.	0.	0.	0.789727
6 TRANS/COMM	0.	0.	0.	0.	0.	0.	0.028372
7 UTILITIES	0.	0.	0.	0.	0.	0.	0.
8 WAT/SEW/TR	0.	0.	0.	0.	0.	0.	0.
9 WHOLESALE	0.	0.002712	0.	0.	0.	0.	0.211206
10 EAT/DRINK	0.	0.	0.	0.	0.	0.	0.512833
11 OTHER-RET	0.	0.000875	0.	0.	0.	0.	0.100399
12 F/I/R/E	0.	0.	0.	0.	0.	0.	0.014650
13 LODGING	0.	0.	0.	0.	0.	0.	0.976417
14 HEALTH-SER	0.	0.	0.	0.	0.	0.	0.000155
15 EDUCAT-SER	0.	0.	0.	0.	0.	0.	0.
16 OTHER-SERV	0.	0.	0.	0.	0.	0.	0.018795
17 LOC-GOVT	0.	0.	0.	0.	0.	0.	0.
18 HOUSEHOLDS	0.	0.003377	0.	0.	0.	0.404976	0.
19 STATE-GOVT	0.	0.001176	0.	0.	0.	0.	0.
20 FED-GOVT	0.	0.000384	0.	0.	0.	0.	0.
21 TRANSFERS	0.	0.	0.	0.	0.	0.	0.
22 PROFITS	0.	0.000513	0.	0.	0.	0.	0.
23 IMP-WYOM	0.	0.000423	0.	0.	0.	0.	0.064306
24 IMP-WORLD	0.	0.002454	0.	0.	0.	0.	0.066242

APPENDIX C

SURVEY FORM USED FOR THE WORLAND REGION INTERINDUSTRY STUDY

Privacy Code No. _____

EXPENDITURES AND FLOW OF FUNDS

STEP I: SHOW LOCAL EXPENDITURES AND FLOW OF FUNDS MADE ONLY IN
BIG HORN, PARK, HOT SPRINGS, OR WASHAKIE COUNTIES:

1. Livestock Ranches, Farms, Reclamation and Seeding Services: \$ _____
2. Mining and Mining Services: bentonite, gypsum, etc. \$ _____
3. Oil and Gas Production and Related Services: \$ _____
4. Construction: (of a maintenance nature that is EXPENSED;
see "e" at end of survey for capitalized construction);
include here only repair work by plumbers, electricians,
painters, etc. \$ _____
5. Logging and Sawmills: \$ _____
6. Manufacturing: food processors, publishers, refineries,
ready-mix concrete, metal fabricators, furniture, etc. \$ _____
7. Transportation and Communication: trucking and storage,
bus, airlines, railroads, pipeline companies, telephone,
radio, TV, Post Office. \$ _____
8. Electric and Gas Utilities: \$ _____
9. Water, Sewer, Trash Removal: \$ _____
10. Wholesale: purchases from all firms that principally sell
to firms (as opposed to retail that sells to the general
public) \$ _____
11. Restaurants and Drinking Places: \$ _____
12. Other Retail: gas stations, auto dealers, hardware and
lumber, office supplies, grocery, liquor, pharmacy,
furniture, department, variety, jewelry and catalog
stores. \$ _____
13. Finance, Insurance, Real Estate: interest (no principal),
insurance premiums, real estate commissions. \$ _____
14. Lodging: motels, hotels, trailer parks, camps. \$ _____
15. Health: doctors, hospitals, clinics, retirement homes. \$ _____

APPENDIX C (continued)

16. Educational Services: \$ _____
17. All Other Services: business and computer services,
garages and repairs, leasing, legal, accounting, laundry,
engineering, etc. \$ _____
18. Local and County Government: real estate taxes, permits,
licenses. \$ _____
19. Salaries and Wages: \$ _____
20. Wyoming State Government: payroll taxes, licenses, royalties,
etc. \$ _____
21. Federal Government: payroll and income taxes, royalties,
etc. \$ _____
22. Property Rents, Depreciation, Dividends, Current Earnings: \$ _____

STEP II: SHOW RESIDUAL EXPENSES AND OUTLAYS NOT YET ASSIGNED ABOVE

23. Expenses and Outlays in the Rest of Wyoming: \$ _____
24. Expenses and Outlays in the Rest of U.S. and World: \$ _____
25. TOTAL (Should equal sales or gross revenues) \$ _____

STEP III:

- a) Please state your major business or product lines:

- b) What was your FTE (Full Time Equivalent) employment in 1980?
Average Number of Employees _____
- c) At what level of capacity did you operate in 1980? _____ %
- d) Water Intake, per day or per month or per year? _____ Gallons
- e) Amount of Capital Outlays (that were not expensed) in 1980: \$ _____
- f) Describe plans, if any, for future capital outlays (dollars? renovation?
expansion? etc.) The purpose of this question is to anticipate future
business activity in the region.

APPENDIX D

DATA SOURCES BY SECTOR

Agricultural Production and Livestock SIC 01, 02, 07, 08

Wyoming. Wyoming Crop and Livestock Reporting Service. Wyoming Agricultural Statistics. Annual.

Coal Production SIC 12
Mines N.E.C. SIC 10, 14 (except 144)
Oil and Natural Gas Production SIC 13

Barlow and Hanu, Inc. Oil and Gas Production, Reserves and Resources in Wyoming. (Prepared for Minerals Division, Department of Economic Planning and Development, State of Wyoming.) September, 1978.

Glass, Gary B. Wyoming Coal and Their Uses. (Information Circular.) Laramie, Wyoming: The Geological Survey of Wyoming, University of Wyoming. Circa. 1976.

Industry Survey Data.

Monteith, Bob. Oil and Gas in Wyoming. (Information Circular.) Laramie, Wyoming: The Geological Survey of Wyoming, University of Wyoming. Circa. 1976.

Wyoming. Department of Economic Planning and Development. Coal and Uranium Development of the Powder River Basin -- An Impact Analysis. June 1974.

Wyoming. Department of Economic Planning and Development. Minerals Division. Mineral Development Monitoring System. Designed and implemented by Stuart/Nichols Associates. Current.

Wyoming. Department of Economic Planning and Development. Minerals Division. Oil and Gas Production, Reserves and Resources in Wyoming. Prepared by Barlow and Haun, Inc. September 1978.

Wyoming. Department of Labor and Statistics. Wyoming Coal Strip Mining: A Wage and Employment Survey. 1979.

Wyoming. Department of Labor and Statistics. Wyoming Crude Petroleum and Natural Gas Production: A Manpower Survey. April 1977.

Wyoming. Department of Labor and Statistics. Wyoming Trona and Bentonite Industries: A Manpower Survey. April 1977.

Wyoming. Department of Labor and Statistics. Wyoming - The Uranium Industry: A Manpower Survey. October 1977.

Wyoming. Employment Security Commission. Data from Form 202 quarterly reports. 1980.

Construction SIC 144, 15, 16, 17

Industry Survey Data.

Wyoming. Department of Labor and Statistics. Building Trades Index: State of Wyoming. 1979.

Wyoming. Department of Labor and Statistics. Wyoming's Construction Industry: A Manpower Survey. September 1976.

Wyoming. Employment Security Commission. Data from Form 202 quarterly reports. 1980.

All Manufacturing SIC 20, 23, 24, 25, 26, 27, 28, 29, 31, 32, 33, 34, 35, 38, 39

Industry Survey Data.

Wyoming. Department of Labor and Statistics. A Manpower Study of the Logging and Sawmill Industries in Wyoming. January 1972.

Wyoming. Employment Security Commission. Data from Form 202 quarterly reports. 1980.

Transportation and Communication SIC 40, 41, 42, 44, 45, 46, 47, 48

Cramer, Curtis A. Pipeline Transportation in Wyoming. (Prepared for the Wyoming State Highway Department.) Laramie, Wyoming: Division of Business and Economic Research, College of Commerce and Industry, University of Wyoming. June 1973.

Industry Survey Data.

Wyoming. Employment Security Commission. Data from Form 202 quarterly reports. 1980.

Wyoming. Public Service Commission. Files.

Electricity and Natural Gas Utilities SIC 491, 492

Ackerman, Jean C., proj. mgr. The Rate Also Rises: An Analysis of Electric and Natural Gas Utilities in Wyoming. (Sponsored by Community Action of Laramie County, Inc.) January 1977.

Bickert, Brown, Coddington and Associates, Inc. Wyoming Energy Consumption: Minerals, Fuels, Electrical Generation and Agricultural Sectors. (Prepared for Mineral Development Division, Department of Economic Planning and Development, State of Wyoming.) June 1975.

Industry Survey Data.

Wyoming. Employment Security Commission. Data from Form 202 quarterly reports. 1980.

Wyoming. Public Service Commission. Files.

Wholesale Trade; also	SIC 50, 51
Retail Trade	SIC 52, 53, 54, 55, 56, 57, 58, 59

Industry Survey Data.

Wyoming. Department of Administration and Fiscal Control. Division of Research and Statistics. Sales and Use Tax Collections, by County, by Major Industries, for Fiscal Years 1970 through 1976. December 1976.

Wyoming. Department of Revenue and Taxation. Annual Report. 1980.

Wyoming. Employment Security Commission. Data from Form 202 quarterly reports. 1980.

Finance, Insurance, and Real Estate	SIC 60, 61, 62, 63, 64, 65, 66
-------------------------------------	--------------------------------

Denver Research Institute. Analysis of Financing Problems in Coal and Oil Shale Boomtowns. (Prepared for Federal Energy Administration NTIS PB-259 438.) July 1976.

Industry Survey Data.

Sheshunoff and Company, Inc. Banks of the Great Plains. (A private publication.) 1980.

Wyoming. Department of Insurance. Files.

Wyoming. Department of Labor and Statistics. Wyoming--The Banking Industry: A Manpower Survey. April 1978.

Wyoming. Employment Security Commission. Data from Form 202 quarterly reports. 1980.

Wyoming. State Examiner. Division of Banks. Annual Report. 1980.

Wyoming. State Examiner. Files.

Services SIC 70, 72, 73, 75, 76, 78, 79, 81, 84, 86, 88, 89

Industry Survey Data.

Wyoming. Department of Labor and Statistics. Data from Form 202 quarterly reports. 1980.

Medical SIC 80

Industry Survey Data.

Wyoming. Department of Health and Social Services. Division of Health and Medical Services. Directory of Medical Facilities.

Wyoming. Department of Health and Social Services. State Health Planning and Development Agency. Wyoming -- Health Profiles. 1980.

Wyoming. Department of Labor and Statistics. Wyoming's Hospitals: A Manpower Survey. October 1975.

Wyoming. Employment Security Commission. Data from Form 202 quarterly reports. 1980.

Education SIC 82

Industry Survey Data.

Wyoming. Department of Education. Files.

Wyoming. Employment Security Commission. Data from Form 202 quarterly reports. 1980.

Water and Sanitation; also
Local and County Roads; also
Local and County Government; also
State Government; also
Federal Government

Community Services Administration. Geographic Distribution of Federal Funds in Wyoming. Fiscal Years 1979 and 1980.

Industry Survey Data.

Thompson, Layton S. and Willard D. Schutz. Taxation and Revenue Systems in Wyoming. Laramie, Wyoming: Wyoming Agricultural Experiment Station, University of Wyoming. October 1978.

U.S. Department of the Interior. Bureau of Land Management. BLM in Wyoming: A Report to the Public. (1980 and 1981).

- Wyoming. Department of Administration and Fiscal Control. Division of Research and Statistics. Sales and Use Tax Collections, by County, by Major Industries, for Fiscal Years 1970 through 1976. December 1976.
- Wyoming. Department of Administration and Fiscal Control. Division of Research and Statistics. Wyoming Tax Revenue Report. 1980.
- Wyoming. Department of Economic Planning and Development. Division of Industrial Development. "Community Profile" series for various communities. 1977.
- Wyoming. Department of Revenue and Taxation. Annual Report. 1980.
- Wyoming. Department of Revenue and Taxation. Ad Valorem Tax Division. Annual Report. 1980.
- Wyoming. Employment Security Commission. Data from Form 202 quarterly reports. 1980.
- Wyoming. State Examiner. Cost of Maintaining County Government in Wyoming. Fiscal Years 1979 and 1980.
- Wyoming. State Examiner. Files.
- Wyoming Taxpayers Association. Wyoming Property Tax Rates. 1980.

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