THE IMPACTS OF THE FOREST PRODUCTS INDUSTRY ON THE ECONOMY OF OKLAHOMA

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1978

Submitted to the Faculty of the Graduate College
of the Oklahoma State University
in partial fulfillment of the requirements
for the Degree of
MASTER OF SCIENCE
May, 1981

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ACKNOWLEDGMENTS

An undertaking as large as this requires a great deal of guidance, patience, and encouragement to complete. Dr. Greg Jones provided all of these in great abundance for which I am truly grateful. I would like to thank Dr. Bob Latham, Dr. Gerald Doeksen, and Dr. Ed Langwig for serving on my graduate committee and counseling me in this endeavor. This type of project also requires a great deal of manpower and assistance for data collection, data analysis, and private consultation. I would like to thank Bruce Springer, Bill Hendrix, Dennis Martin, and Mike Woods for their invaluable assistance in these areas. I would also like to thank all the companies and individuals who allowed us to gather highly confidential information about their businesses for use in this research. Their friendship and assistance will always be appreciated.

To my wife, Maribeth, I wish to express my fondest thanks for her patience, love, and understanding during the duration of this project.

Finally, I wish to dedicate this work to my father, who taught me the values and work ethic necessary to complete such a project. His quiet love and understanding will sustain me now and forever.

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INTRODUCTION

Need for Economic Impact Analysis

The forest products industries (FPI) comprise an important portion of the Oklahoma economy. For example, they accounted for over $782 million in output, and directly employed over 8,800 Oklahomans in 1978. This represents some five and one-half percent of the total output of all manufacturing sectors and nearly four percent of the total manufacturing employment. Yet these figures still do not fully reveal the total impact forestry and the FPI have on the Oklahoma economy.

Input-output (I-O) analysis (Leontief, 1966), a widely accepted approach for estimating such economic impacts, has been applied in several states in which forestry and the FPI represent an important portion of the eocnomy, e.g., Mississippi (Terfehr, 1976) and Oregon (Youmans, Darr, Fight, and Schweitzer, 1979). These studies show that forestry and the FPI have some of the highest output and employment multipliers in the economies of these states. In Mississippi, for example, forestry and the sectors in the FPI ranked number four, five, and six in output multipliers and number one in income and employment multipliers. In Oregon forestry also ranked high with the fourth highest output multiplier in the state's economy.

Although forestry and the FPI have large multipliers in these states, little is known about the economic impacts of these industries in Oklahoma. Federal, state, and local governments need estimates of economic impacts of proposed legislation or regulation concerning forestry and the FPI. Legislators and planners need to know, for example, how a ban on clearcutting in the state might affect the total output, income, and employment of not only the forestry and FPI sectors, but the entire state as well.

Programs and policies of government and industry can best be served if the decision makers have access to reliable estimates of the economic interrelationships that exist in the state. Such information should be continuously updated and available for decision making in both government and industry.

Past Research in Oklahoma

Several authors have applied the I-O analysis in Oklahoma. Little and Doeksen (1968) divided the 1959 Oklahoma economy into nine endogenous (processing) sectors and seven exogenous (final demand) sectors, and determined the interindustry flow table and output, income, and employment multipliers for these sectors. This study revealed that the agriculture sector had the highest output multiplier with livestock and livestock products having the second largest and manufacturing the third largest.[1] Furthermore, it was found that agriculture also had the highest income multiplier followed first by manufacturing and second by livestock and livestock products. Of the employment multipliers, the manufacturing sector had the largest multiplier followed by agricultural processing and then mining.

Mapp and Badger (1970) used I-O techniques to analyze the impact of outdoor recreation on the economy. The region selected for this study was the Kiamichi Economic Development District. They adapted an interindustry model by Sand (1969), and developed output, income, and employment multipliers for 12 endogenous sectors with special emphasis on outdoor recreation. The objective was to analyze the potential benefits that increased outdoor recreation would bring to this economically depressed area of Oklahoma. They found that recreation ranked relatively low with respect to output, income, and employment multipliers.

Doeksen (1971) developed a social accounting system for Oklahoma which included an interindustry account, a capital account, and a human resource account. The objectives of the study were to use these accounts to develop a simulation model for Oklahoma which projected output, income, employment, revenue, and other economic variables to 1980. This simulation model was then used to evaluate various development plans as well as provide data for industrial and governmental planners. The interindustry account consisted of the transactions table, the direct coefficients, and the interdependence coefficients for the 12 endogenous and five exogenous sectors representing the 1963 Oklahoma economy.[2]

Sarigedik (1975) expanded Doeksen's social accounting system for Oklahoma by adding a government account. The objectives of this study were to develop an economic model to evaluate state planning strategies as well as project various economic variables from 1967 to 1985. The interindustry flow table was constructed from various secondary data sources to represent the 1967 Oklahoma economy. The table

consisted of 17 endogenous and five exogenous sectors. The direct coefficients matrix and the interdependence coefficients matrix were also calculated.

Need for This Study

Previous studies done in Oklahoma have provided valuable information concerning the interrelationships that exist in the Oklahoma economy. However, since the forest products industries have historically been aggregated into another manufacturing sector, the detailed role of these sectors cannot be determined from these models. (One assumption of I-O analysis is that all industries contained within a sector produce similar products and have homogeneous input requirements, i.e., there are no errors of aggregation.) The FPI must be disaggregated to some extent to obtain a more accurate picture of the interrelationships between these industries and the remainder of the Oklahoma economy.

The FPI in Oklahoma have been changing at a relatively rapid pace throughout the past decade. For example, since the latest I-O model for the state was developed, one of the largest pulp and paper mills in the United States began full operation in southeast Okalhoma. Second, some dramatic changes have occurred in the structure and operations of the lumber industry in the state. For example, capital expenditures in the lumber and wood products industry have increased from one million dollars in 1970 to over $10 million in 1976. Employment in this industry has increased from just over 1,500 to 3,250 during the same period (USDC Bureau of the Census, 1972 and 1978a). In addition, land management has apparently changed substantially as well,

as witnessed by the fact that sawtimber volume harvested has increased some 40 percent from 1966 to 1976, while the amount of commercial forestland has declined 12 percent over the same time period (Earles, 1976).

These changes in the structure and operations of the FPI in Oklahoma have no doubt caused the economic interrelationships of these industries to change. Incorporating these changes in a new I-O model would provide a clearer, more accurate description of the economic impacts of the FPI in Oklahoma on the state's economy. These impacts, as seen in other states, may prove to be substantial.

Objectives

The objective of this study was to quantify the economic impacts of the FPI in Oklahoma using I-O analysis. Specifically, the objectives were to:

1. Quantify the interrelationships that connect the FPI in Oklahoma with the rest of the Oklahoma economy, and
2. Estimate the FPI mutlipliers in terms of output, income, and employment, and, based on these,
3. Evaluate the relative importance of the FPI in the Oklahoma economy.

ENDNOTES

[1]FPI sectors were included in the manufacturing sector.

[2]Readers interested in the development of the simulation model used by Doeksen are referred to Doeksen (1971), and Doeksen and Schreiner (1971a).

CHAPTER II

METHODS

The Input-Output Technique

As stated previously, the I-O technique is especially useful in the analysis of the interrelationships that exist in the economy. The formal technique of I-O analysis is well documented by Leontief (1966), Miernyk (1965), Doeksen (1971), Curtis and Waldrop (1971), Isard (1960), and many others. The following discussion is but a brief overview of the I-O techniques presented by these scientists.

Transactions Matrix

The foundation for I-O analysis is the transactions matrix, or flow table. This matrix provides for the simultaneous description of the supply and demand relationships of an economy. As such, it represents the dollar value of all transactions which must occur at a given level of economic activity.

Assuming a four sector economy with three producing (endogenous) sectors and one final demand (exogenous) sector, the transactions matrix would appear as in Figure 1. Across the rows each x_{ij} gives the dollar amount of sales that the sector named at the beginning of the row makes to all other sectors in the matrix. Sales to final demand (Y) represent final consumption, i.e., goods do not reenter the production process. Reading down the columns, x_{ij} is interpreted as the

dollar amount of purchases made by sector j from sector i. Value added (VA) represents payments to households, depreciation, business taxes, and other non-primary type inputs. The sum of all x_{ij} and VA in a column equals the total purchases (X_j) necessary to produce total output of (X_i). That is, total sectoral inputs must equal total sectoral output, i.e., sum of the column for a given sector (X_j) equals the sum of the row (X_i) for that sector. This occurs because the inputs of a sector are defined as a linear homogenous production function of the output of that sector, with imports and exports figured as residuals. This relationship requires that inputs equal outputs for all processing (endogenous) sectors in the transactions matrix.

Producing Sectors	Purchasing Sectors 1	2	3	Final Demand	Total Output
1	x_{11}	x_{12}	x_{13}	Y_1	X_1
2	x_{21}	x_{22}	x_{23}	Y_2	X_2
3	x_{31}	x_{32}	x_{33}	Y_3	X_3
Value Added	VA_1	VA_2	VA_3	Y_4	VA
Total	X_1	X_2	X_3	Y	X

Figure 1. Transactions Matrix

Technical Coefficients Matrix

The transactions matrix serves as a foundation for the technical

coefficients matrix. This matrix is determined by dividing each column element (x_{ij}) in the transactions matrix by the total input (X_j) of that sector. Mathematically this can be expressed as:

$$\alpha_{ij} = \frac{x_{ij}}{X_j} \tag{2.1}$$

Where: α_{ij} = dollar value of the output of sector i required to produce one dollar's worth of output in sector j

x_{ij} = column element from the transactions matrix

X_j = Total input of sector j

The technical coefficients matrix is represented in Figure 2 for the three endogenous sectors.

Producing Sectors	Purchasing Sectors 1	2	3
1	α_{11}	α_{12}	α_{13}
2	α_{21}	α_{22}	α_{23}
3	α_{31}	α_{32}	α_{33}
VA	α_{41}	α_{42}	α_{43}
Total	1.00	1.00	1.00

Figure 2. Technical Coefficients Matrix

A technical coefficient (α_{ij}) represents the direct input requirements necessary to produce one dollar's worth of output. The sum of

each column in the technical coefficients matrix equals one, or 100 percent. These coefficients can only be interpreted down each column. There is no longer a direct relationship between a sector's row and column elements.

Interdependence Coefficients Matrix

The third matrix calculated in I-O analysis is the interdependence coefficients matrix. This matrix is the result of solving a set of simultaneous equations, each of which represents the gross output of each sector. In matrix notation the interdependence coefficients matrix is determined by subtracting the technical coefficents matrix from an identity matrix. The inverse of this provides the interdependence coefficients matrix.

$$(I-A)\ X = Y \qquad (2.2)$$

Where: I = identity matrix of same order as A

A = technical coefficients matrix

X = column vector of total sectoral output

Y = column vector of sectoral final demand

The (I-A) matrix is referred to as the Leontief matrix. All diagonal elements in this matrix are positive and all off diagonals are negative. The system of equations is solved for total outputs (X) by pre-multiplying both sides by the inverse of the (I-A) matrix:

$$X = (I-A)^{-1}Y \qquad (2.3)$$

The $(I-A)^{-1}$ matrix contains the interdependence coefficients (Figure 3).

Producing Sectors	Purchasing Sector 1	2	3
1	A_{11}	A_{12}	A_{13}
2	A_{21}	A_{22}	A_{23}
3	A_{31}	A_{32}	A_{33}

Figure 3. Interdependence Coefficients Matrix

Each A_{ij} element of the $(I-A)^{-1}$ matrix represents the dollar amount of commodity i that the economy is required to produce in order to deliver one dollar's worth of commodity j to final demand. In this manner both the direct and indirect requirements are described simultaneously.

The interdependence coefficients matrix is the foundation for the output, income, and employment multipliers. These multipliers are discussed in detail in Chapter 4.

Approaches to Data Gathering

The construction of a state or regional transactions matrix can be done in one of three ways. First, all primary data can be used. This requires that all industries in all sectors be interviewed so that the data represents the actual transactions, both sales and purchases, that occurred in a given year for the entire economy being studied.

The second method represents the opposite extreme in terms of data collection. Here all data used in the construction of the

transactions matrix is from secondary sources. These sources include the Detailed I-O Structure of the United States: 1972 (USDC, Bureau of Economic Analysis, 1979a), the Census of Manufacturers (USDC, Bureau of the Census, 1975), Statistical Abstract of the United States (USDC, Bureau of the Census, 1978b), Employment and Earnings, States and Areas (USDC, Bureau of Labor Statistics, 1978a), Survey of Current Business (USDC, Bureau of Economic Analysis, 1979b and 1979c), and other appropriate state and national data sources.

A third method used in the construction of the transactions matrix is to combine the first two approaches. Primary data is collected on sectors of particular interest and secondary data is utilized for the remainder of the economy.

I-O analysis in its purest sense should be performed using all primary data. That is, the transactions matrix should be constructed using the first method, wherein actual sales and purchase data is collected for all sectors. This method provides the researcher with the most precise picture of the interrelationships that exist in a given economic setting. There is no reliance on secondary and national data and therefore no need to adjust the data to represent a state or regional transactions matrix.

Such a precise picture, however, is often unwarranted for two basic reasons. First, the cost of collecting all primary data is extremely high. Second, research has shown that non-survey techniques yield a regional or state table which is close to a survey based table (Shaffer and Chu, 1969). Therefore, it is often the case that the disadvantages of collecting primary data for as large an area as Oklahoma far outweigh the increased accuracy such collection would allow.

On the other hand, using all secondary data to construct the transaction matrix is not nearly so expensive. Data is available from numerous state and national governmental agencies, and is obtained with only minimal travel. Thus, a state transactions matrix can be developed at a minimal cost and, as mentioned above, describe the econmic interrelationships that exist with sufficient accuracy for most purposes.

The use of all secondary data also has disadvantages. First, the data sources necessary to construct the transactions table are published a number of years after the data has been collected. For example, the data necessary to construct the 1972 transactions matrix for Oklahoma was not available until late 1979. If large changes in the economic structure of the state have occurred since 1972, then the interrelationships expressed in this model may not accurately describe the 1979 economy. Second, as will be discussed in more detail later, the use of I-O analysis requires the assumption of fixed, homogenous, production functions. This implies constant technology, no external economics or diseconomies, and no possibility of substitution due to relative price changes. These assumptions, and the lag in necessary data, are especially limiting in sectors of the economy which are new or rapidly expanding.

A compromise between the accuracy of the primary data and the lower cost, but less accurate secondary data, can be made by combining the two approaches. Richardson (1972) states:

> A crucial next step in regional I-O research is to use a non-survey technique systematically to estimate the elements in the I-O matrix but to replace the entries in the rows and columns relating to a few critical key or problem industries with survey based estimates (p. 129).

Procedure for This Study

The approach of combining survey and non-survey techniques was used in this study. The sectors chosen for survey were the forest products industries. These sectors, as described in the Introduction, represent a significant portion of the Oklahoma economy and have experienced numerous structural changes since 1972.

Collecting primary data on the FPI sectors kept the costs of building the transactions matrix down and also allowed the prediction of more accurate production functions for the FPI sectors. The remainder of the economy was determined from the various secondary sources mentioned previously to keep costs at an acceptable level.

The sectors for this model are based on Standard Industrial Classifications (SIC) (Executive Office of the President, Office of Management and Budget, 1972). To maximize use of the most recent data all manufacturing sectors were grouped by two digit SIC codes (Appendix A). The forest products industries were divided into seven sectors representing the major processing divisions.

The procedure for determining the 1972 Oklahoma transactions matrix began with the National I-O table for 1972 (USDC, Bureau of Economic Analysis, 1979a). This table shows the dollar value of inputs necessary to produce one dollar's worth of output for each of the 79 endogenous sectors that represent the United States economy (i.e., the technical coefficients matrix for the United States).

Next, the 1972 sector output estimates for Oklahoma were obtained from a study conducted simultaneously in Agriculture Economics (Ghebremedhin, 1981). These Oklahoma outputs were distributed into a requirements matrix by multiplying each column element of the national technical

coefficients matrix by the total Oklahoma output of that sector. This calculation assumes that the production functions in Oklahoma are the same as those in the United States, i.e., input requirements per dollar output are the same. The sum of each column equals the total output of that sector (since each column of the technical coefficients matrix for the United States sums to one). However, because each column was determined independently as a linear function of national output, the elements in a given row do not sum to the Oklahoma total output of that sector. Instead, the row sums represent the requirements of the processing sectors of Oklahoma for the goods and services produced by each sector without regard for imports and exports.

The accounting for imports and exports will be formally addressed in the discussion of location quotient. It is sufficient to say here that imports will alter the national production function such that sector outputs will indeed equal sector inputs for the endogenous sectors.

An estimate of final demand was then added to the requirements matrix. Final demand was broken down into personal consumption expenditures, private capital formation, change in business inventories, federal government expenditures, and state and local government expenditures. The addition of these five final demand columns yields a total requirements matrix.

If all the data used were secondary, the requirements matrix would be developed at this point. However, as mentioned previously, 1978 primary data were collected for the FPI sectors in Oklahoma. Therefore, two additonal tasks are necessary. First, the primary data must be incorporated into the secondary model described above and second, the

1972 requirements matrix must be adjusted to represent 1978 dollars and 1978 production levels. The procedures used to collect data for the FPI are described below. The updating procedures used for the secondary data is described in the next chapter.

Data Collection for the Forest Products Industry

The FPI was delineated into the following six sectors. The standard industrial classifications (SIC) included in these sectors are listed in Appendix A. These sectors were:

1. Logging
2. Sawmills
3. Other lumber and wood products
4. Wooden furniture and fixtures
5. Paper and allied products
6. Paper containers and boxes

A sample was drawn from each of these six sectors to estimate their total input requirements for 1978. Each of the firms chosen for the sample were then interviewed in person or by phone, using the appropriate questionnaire given in Appendix B.

The questionnaires are based on similar questionnaires used in Minnesota (Hughes, 1970), Kansas (Emerson, Atencio, Brooks, and Reed, 1969), and Oklahoma City (Department of Planning, 1977), and were designed to collect as much information as possible in what was perceived to be the longest acceptable length of interview. The

extensive data requirements of these questionnaires made it necessary for each firm to be interviewed in person with the interviewer aiding in the gathering of the data. This insured that all firms answered the questions correctly and in a similar manner, thus minimizing the possibility of miscommunication.

Since the forest products industries were to be personally interviewed for this study, a decision was made to collect the data necessary for updating the Oklahoma Forest Industries, 1975 (Bertelson, 1977) at the same time. This required data on the amount of roundwood received and the products produced, of all forest industry firms in Oklahoma (Forest Service Questionnaire, Appendix B). The Forest Service's survey of Oklahoma Forest Industry required that every firm which processed roundwood in Oklahoma during 1978 be interviewed. This sample requirement influenced the sample size of the sawmills, other lumber and wood products, and paper and allied products sectors of this study as well.

Sawmills

The first problem in surveying the sawmills was to obtain an accurate list of the mills in production in 1978. Because of the relative ease with which firms may enter and exit the sawmilling sector, such a list did not already exist. It was therefore necessary to compile such a list from two major sources. First, the firms identified in the 1975 Oklahoma Forest Industries survey (Bertelson, 1977) were used as a first approximation of all the sawmills operating in 1978. Each of the sawmills listed here was visited and the operators were

asked the questions on the Primary Manufacturer's questionnaire as well as the previously mentioned Forest Service questionnaire, both in Appendix B.

Second, upon completion of the interview, the respondent was asked to examine the list of sawmills operating in his area, and add the mills which came into existence since 1975. In this manner it was felt that a complete listing of all mills operational in 1978 was obtained.

The data obtained from the interviews of the operators who responded was then used to represent the total input requirements of the sawmills sector in the following manner. The mills were first separated into categories according to the amount of roundwood received in 1978. The categories were as follows:

1. <100 MBF (1000 board feet, Doyle log scale)
2. 100<500 MBF
3. 500<1000 MBF
4. 1000<2000 MBF
5. $\geq$2000 MBF

All sawmills were visited so that a brief on-site inspection of the plant and facilities could be made, even if an interview was not granted. Such inspections were used to determine the proper category for non-response firms by comparing the physical facilities and method of operation of the non-response firms with those of the responding firms.

Some firms, for one reason or another, were unable to permit an interview at the time they were visited, but indicated a willingness to help at a later date. Because of the expense involved in returning to the firm for a personal interview, these firms were interviewed

over the phone using the In State Manufacturer questionnaire (Appendix B). This questionnaire is an abbreviated form of the questionnaire used in the personal interviews. The long form questionnaire was felt to be too extensive to lend itself to a phone interview. Therefore, the abbreviated form was used to more accurately determine the proper roundwood received category the firm belonged in. This allowed for a better estimation of the input requirements of all firms in the sawmills sector.

The personal interviews, phone interviews, and on-site inspections gave what was believed to be an accurate account of the total number of firms in each of the roundwood received categories. For each category, the total number of firms was divided into the total number of firms responding to the personal interviews to determine the actual sample size. The data collected on each category was then expanded to represent the total input requirements of the sector based on this estimate of sample size. The input requirements of the entire sawmills sector was determined by summing the input totals of each of the five categories. This yielded a column vector of inputs for the sawmill sector for 1978. This column was inserted into the Oklahoma requirements matrix as column number eight (Table I).

The row vector representing the sales of the sawmills sector to other sectors was not determined from primary data. This would have required interviewing all other sectors in the economy since sawmill operators do not know the final destination and use of their outputs. The output row of the sawmills sector was estimated along with (and as) the inputs for the other endogenous sectors. For the other FPI, primary input data for these sectors was used and secondary data was used to estimate the rows.

TABLE I

REQUIREMENTS MATRIX FOR THE FOREST PRODUCTS INDUSTRY SECTORS, 1978

	PRODUCING SECTOR	PURCHASING SECTOR						
		7	8	9	10	11	12	13
		THOUSANDS OF DOLLARS						
1	AGRICULTURE	19100	0	0	0	0	0	0
2	MINING	0	0	0	0	20	0	0
3	CONSTRUCTION	0	9530	1130	200	50	9050	760
4	FOOD & KINDRED PROD.	0	0	30	0	90	0	0
5	TEXTILES & FABRICS	0	0	0	7330	1000	0	0
6	APPAREL	0	0	0	70	130	0	0
7	LOGGING	0	34390	43020	0	0	12270	0
8	SAWMILLS	0	0	51660	5370	500	34520	0
9	OTHER LUMBER & WOOD PROD.	0	0	17410	1160	950	0	0
10	WOODEN FURNITURE & FIXT.	0	0	0	0	0	0	0
11	OTHER FURNITURE & FIXT.	0	0	150	0	70	0	0
12	PAPER & ALLIED PROD.	0	0	9230	1410	10	9230	40030
13	PAPER CONTAINERS & BOXES	0	0	880	0	370	0	0
14	PRINTING & PUBLISHING	0	0	0	10	50	0	0
15	CHEMICALS & ALLIED PROD.	0	0	7630	2810	270	15740	2580
16	PETROLEUM REFINING & PROD.	2970	710	4010	60	100	4830	580
17	RUBBER & PLASTIC PROD.	380	0	0	2910	1370	30	0
18	LEATHER & LEATHER PROD.	0	0	0	0	0	0	0
19	STONE, CLAY, & GLASS PROD.	0	0	140	0	220	0	0
20	METAL & METAL PROD.	0	300	6250	4180	4700	0	1340
21	MACHINERY & EQUIPMENT	6540	9750	3730	230	100	1530	1120
22	TRANSPORTATION EQUIPMENT	2870	370	2500	530	0	30	120
23	MISCELLANEOUS MFG.	1210	1470	2190	840	40	12460	1160
24	TRANSPORTATION	0	1630	4460	490	660	14180	2690
25	COMMUNICATION	0	50	640	220	50	190	220
26	UTILITIES	240	2440	4040	340	140	25450	540
27	WHOLESALE & RETAIL TRADE	7200	2200	9670	1940	1050	13410	2540
28	FINANCE, INS., & REAL EST.	6770	870	3200	2170	660	680	1710
29	SERVICES	4670	3770	2250	1090	880	19020	2360
30	FEDERAL GOVT. ENTERPRISE	0	0	0	0	40	0	0
31	S. & L. GOVT. ENTERPRISE	0	0	0	0	0	0	0
32	HOUSEHOLDS	15800	24550	50640	16490	8670	26380	12530
33	VALUE ADDED	6660	11670	20670	5140	1100	17340	16770
34	SCRAP	0	0	0	0	10	0	0
35	WORLD INDUSTRY & INV. ADJ.	0	0	0	0	0	0	0
	TOTAL INPUT	74400	103700	245520	55000	23300	216720	87040

Logging

The logging sector is comprised of all persons involved in the harvesting and hauling of roundwood. As was the case with sawmills, a list of loggers again had to be developed since no formal list is published in Oklahoma. This list was developed by asking each of the roundwood using firms to provide a list of all loggers which supplied them with roundwood in 1978. The list obtained in this fashion contained some 70 names from which a random sample of 30 was chosen. These 30 loggers were interviewed by telephone using the Timber Operator Questionnaire in Appendix B.

The inputs required from each sector by the logging sector were estimated by multiplying the average inputs per unit volume of wood produced by the loggers surveyed, times the total amount of wood logged in Oklahoma in 1978. The total amount of wood logged was determined by summing the amount of in-state roundwood received by Oklahoma mills and Oklahoma roundwood exported to out-of-state mills. This information was obtained from the Forest Service Questionnaire (Appendix B). This column of inputs was added to the requirements matrix (Table I) for logging (column seven).

Other Lumber and Wood Products

The other lumber and wood products sector is comprised of roundwood users other than sawmills (e.g., post operations, charcoal plants, and handle mills) and secondary manufacturers. As for the sawmills sector, a census survey was conducted for the primary manufacturers. The initial list came from the Oklahoma Forest Industries, 1975 (Bertelson, 1977).

Firms classified in SIC 243-49 comprised the secondary manufacturers of this sector. A firm is classified under the SIC system by the product it produces. If a firm produces more than one product it is classified by the product which accounts for the greatest dollar volume of sales. For I-O analysis, the secondary products produced by a sector must be removed from that sector's output if the secondary products produced by the sector are the primary products of another sector in the model. In such cases the dollar value of the secondary products are removed from the sector in which they are secondary and added to the sector in which they are primary. Ritz (1979) and Parker (1979) describe the procedure used in the 1972 National input-output model. However, the disaggregation of forest industry into the seven sectors mentioned previously has minimized the problems normally associated with secondary products.

Due to budget and time constraints, a sampling procedure was used to collect data for the secondary firms of this sector. In this procedure, firms were grouped into the following categories: 0-19 employees (77 firms), 20-49 employees (23 firms), and 50+ employees (8 firms). The sampling intensity was 13% and 26% respectively for the first two categories and all firms were surveyed in the 50+ category. The larger firms were sampled with a greater intensity since they represent a larger portion of the total production in the sector.

Information about the total number of firms was obtained from the Oklahoma Employment Security Commission (OESC, Research and Planning Division, 1979c). However, since the information the OESC has on individual firms is confidential, the actual sample was drawn randomly from the Directory of Manufacturers for Oklahoma, 1978 (Oklahoma

Industrial Development Department, 1978). This publication is only a partial listing of firms, and lists firms by SIC code corresponding to each type of product produced, instead of by primary product as needed. To ensure firms were properly classified by primary product, the procedure used was to draw a firm's name randomly from the Directory of Manufacturers and have the OESC confirm the SIC classification and employment category.

This procedure, while not perfect, was found to be the best available. Since there were no identificable biases concerning the firms listed in the Directory of Manufacturers, it was assumed that the sample was a reasonable representation of the industry.

The data was summed and adjusted by employment category to estimate the total input requirements per employment category. The adjusted data from the three employee categories was summed to determine the total input requirements of all secondary manufacturing firms in the sector. To this was added the previously determined primary manufacturers' data to yield a column vector of total inputs which was then added to the requirements matrix as column number nine (Table I).

Wooden Furniture and Fixtures

This sector is represented by all secondary firms in SIC 2511, 2517, 2521, and 2541. The sample for this sector was conducted in the same manner as the secondary firms of the other lumber and wood products sector. The sector was also delineated into the same employee categories and the same sampling intensities were used.

Upon completion of the sampling, the data from each category was summed and adjusted to represent all firms in each category. Then

all three categories were added together to give the total input requirements of the wooden furniture and fixtures sector. These inputs were added in the requirements matrix as a column vector represented by column number 10 (Table I).

Paper and Allied Products; Paper Containers and Boxes

The remaining two forest industry sectors were paper and allied products and paper containers and boxes. The former includes industries in SIC 261-64 and the latter SIC 265. These two sectors were sampled, adjusted, and added to the Oklahoma requirements matrix in exactly the same manner as the secondary firms in the other lumber and wood products sector. The paper and allied products sector was represented in the requirements matrix by row and column 12, while the paper containers and boxes sector was represented by the 13th row and column (Table I).

Sampling Results

Of the 105 primary manufacturing firms in Oklahoma, 84 were contacted for a personal interview. Of these 84, only 10 refused to respond, making the response rate a little over 89%. The remaining 21 primary manufacturers were contacted by telephone. Of these, only six refused to help, making the percent response by telephone 71%. This resulted in a combined response rate of just over 83%. One hundred and eighty firms comprise the secondary manufacturers of forest industry in Oklahoma. Sixty-seven of these firms were contacted for interviews and only 19 refused, providing a response rate of just

over 71%. This speaks highly of those people in the forest industry sectors who allowed us access to highly confidential information. Their cooperation in this study is deeply appreciated.

CHAPTER III

MATRIX ADJUSTMENTS FOR SECONDARY DATA

The requirements matrix for all non-FPI sectors was calculated initially using 1972 national coefficients and 1972 sector outputs. It therefore represents the 1972 dollar value of sales and purchases required to produce 1972 total output for each sector. These 1972 data were updated to reflect 1978 prices and 1978 production levels by the procedure described below.

Inflation Adjustments

The adjustment for the change in the price level was made by first determining a ratio between a 1978 Producers Price Index (PPI) and a 1972 PPI (USDL, Bureau of Labor Statistics, 1979c and 1973b, respectively) for each producing sector in the matrix. These include agriculture, mining, construction, and all manufacturing sectors (i.e., sectors 1-23 in Table II). A similar ratio for the trade, service, and government sectors (sectors 24-31) was calculated using a Consumer Price Index (CPI) (USDL, Bureau of Labor Statistics, 1979b and 1973a). These ratios represent the change in the real price level for the output in each sector over the six year period from 1972 to 1978 (Table II).

Reading across a row in a requirements matrix tells how the output, in dollar terms, of a sector is distributed among other sectors

TABLE II

ESTIMATE OF SECTOR INFLATION MULTIPLIERS

Sector	1978(a) Price Index (1967=100)	1972(b) Price Index (1967=100)	Inflation(c) Multiplier[1]
1. Agriculture	212.5	125.0	1.7000
2. Mining	406.1	142.9	2.8418
3. Consturction	214.8	123.0	1.7463
4. Food & Kindred Prod.	200.5	119.1	1.6833
5. Textiles & Fabrics	152.4	114.8	1.3275
6. Apparel	152.4	114.8	1.3275
7. Logging	276.0	176.8	1.5609
8. Sawmills	322.4	159.4	2.0226
9. Other Lumber & Wood Prod.	227.6	127.9	1.7795
10. Wooden Furniture & Fixts.	188.5	119.9	1.5721
11. Other Furniture & Fixts.	191.5	117.1	1.6354
12. Paper & Allied Prod.	195.6	113.4	1.7249
13. Paper Containers & Boxes	174.6	115.9	1.5065
14. Printing & Publishing	209.4	117.9	1.7761
15. Chemicals & Allied Prod.	198.8	104.2	1.9079
16. Petroleum Refining & Prod.	322.5	118.6	2.7192
17. Rubber & Plastic Prod.	174.8	109.3	1.5993
18. Leather & Leather Prod.	200.0	131.3	1.5232
19. Stone, Clay, & Glass Prod.	222.8	126.1	1.7668
20. Metal & Metal Prod.	227.1	123.5	1.8389
21. Machinery & Equipment	196.1	117.9	1.6633
22. Transportation Equipment	173.5	113.7	1.5259
23. Misc. Manufacturing	167.7	112.1	1.4959
24. Transportation	189.9	122.1	1.5554
25. Communication	132.8	113.5	1.1700
26. Utilities	219.9	121.9	1.8039
27. Wholesale & Retail Trade	202.9	127.3	1.5939
28. Finance, Ins. & Real Est.	229.0	133.0	1.7218
29. Services	219.2	135.4	1.6189
30. Fed. Govt. Enterprise	257.3	146.6	1.7551
31. S. & L. Govt. Enterprise	257.3	146.6	1.7551
32. Households	-[2]	-	-
33. Value Added	-	-	-
34. Scrap	233.2	112.4	2.0761
35. World Industry & Inv. Adj.	-	-	-
36. Imports	-	-	-

[1]Calculations are as follows: $c = a/b$

[2]Indicates no inflation multiplier calculated.

in the economy. These were adjusted to 1978 dollars by multiplying each row (a sector's sales) by its corresponding 1978 to 1972 price ratio. This gives a 1972 requirements matrix in terms of 1978 dollars.

The exogenous sectors in the model are represented by sectors 32-36 (Table II). The households sector (row 32) is comprised of wages, tips, and salaries. Data for this sector was obtained from an unpublished Bureau of Economic Analysis report of 1978 Oklahoma household income by place of work. Therefore, no inflation adjustment was necessary.

The value added sector (row 33) is comprised of business taxes and depreciation. It is difficult to calculate a defendable price ratio for this sector. The approach taken assumes that the direct coefficient of value added in each sector was the same in 1978 as in 1972. The value added direct coefficient for each sector was multiplied by the 1978 total outputs to yield a 1978 value added row. As household income is included in the value added coefficient used, it was subtracted from this row to give the appropriate 1978 value added row.

Sector 34 was adjusted in the same manner as the other non-manufacturing sectors. That is, a ratio of the 1978 CPI to the 1972 CPI was calculated and multiplied across the respective row. It was not necessary to determine an inflation multiplier for the world industry sector (row 35), because the endogenous portion of this row is all zeros. It is normal I-O procedure to determine imports as residuals; therefore, no adjustment was necessary for the imports row (row 36, Table II).

Production Adjustments

The procedure used to update the requirements matrix included an adjustment for production differences between 1972 and 1978. An adjustment was made to each column of the requirements matrix under the assumption that any change in real production levels (output) would require a simultaneous increase in all the factors of production necessary to produce a sector's output.

Estimate of 1978 Sector Outputs

The procedure for adjusting the matrix for changes in production first requires an estimate of 1978 total output for each sector. These estimates are presented in Table III.

The 1978 output was estimated using output/employment ratios. First, the 1972 total output (Ghebremedhin, 1981) was converted to 1978 dollars by multiplying by a PPI ratio representative of the agriculture sector. Then the ratio of 1972 output in 1978 dollars (Ghebremedhin, 1981) to 1972 employment (OESC, Research and Planning Division, 1979a) was calculated. Then this output/employment ratio was multiplied by 1978 employment to estimate 1978 output. This estimate obviously assumes productivity per employee was constant between 1972 and 1978. The estimated 1978 total output of the agriculture sector was $4,630,800,000. The estimate of 1978 total output for the mining sector was obtained directly from USDI, Bureau of Mines (1979), and was $3,500,000,000.

Output for the construction sector was estimated using output-employment ratios. The assumption is that output per employee for

TABLE III

ESTIMATES OF 1978 SECTOR OUTPUT

Sector	1978 Output
	(Millions of Dollars)
1. Agriculture	4,603.8
2. Mining	3,500.0
3. Construction	2,703.9
4. Food & Kindred Prod.	1,802.2
5. Textiles & Fabrics	100.6
6. Apparel	330.0
7. Logging	74.4
8. Sawmills	103.7
9. Other Lumber & Wood Prod.	245.5
10. Wooden Furniture & Fixts.	55.0
11. Other Furniture & Fixts.	23.3
12. Paper & Allied Prod.	216.7
13. Paper Containers & Boxes	87.0
14. Printing & Publishing	376.2
15. Chemicals & Allied Prod.	399.2
16. Petroleum Refining & Prod.	3,415.3
17. Rubber & Plastic Prod.	829.0
18. Leather & Leather Prod.	24.3
19. Stone, Clay, & Glass Prod.	720.4
20. Metal & Metal Prod.	1,556.8
21. Machinery & Equipment	2,926.2
22. Transportation Equipment	648.1
23. Misc. Manufacturing	327.3
24. Transportation	1,809.1
25. Communication	621.0
26. Utilities	2,085.7
27. Wholesale & Retail Trade	4,606.7
28. Finance, Ins., & Real Est.	5,446.9
29. Services	6,877.6
30. Fed. Govt. Enterprise	504.9
31. S. & L. Govt. Enterprise	290.0

Oklahoma is the same as that for the nation as a whole. Data for the U.S. output and employment in construction are found in the Survey of Current Business (USDC, Bureau of Economic Analysis, 1979c), while the Oklahoma construction employment figures are found in the Handbook of Oklahoma Employment Statistics (OESC, Research and Planning Division, 1979b). Solving for 1979 Oklahoma output yields an estimate of $2,703,900,000.

With the exception of the FPI sectors, estimates of the 1978 total output for the manufacturing sectors (sectors 4-23) were made in the same manner. First, data in the Census of Manufacturers (USDC, Bureau of the Census, 1979) provided an estimate of the 1977 total output of all Oklahoma manufacturing sectors. These data were then adjusted for inflation by multiplying by the 1978 to 1977 PPI ratio for each sector (USDL, Bureau of Labor Statistics, 1979c and 1978b, respectively). Changes in production between 1977 and 1978 were accounted for by using employment ratios (OESC, Research and Planning Division, 1979b), which measured the change in the production level of a sector assuming constant output per employee. A ratio of 1978 to 1977 employment was calculated for each sector. This ratio was multiplied by the inflation adjusted output data to estimate 1978 total output for each individual manufacturing sector.

The 1978 total output for the transportation sector was estimated by multiplying 1976 U.S. output (USDL, Bureau of Labor Statistics, 1979d) by a 1978 to 1976 CPI ratio (USDL, Bureau of Labor Statistics, 1979d and 1977, respectively). The inflation adjusted U.S. output was then multiplied by a 1978 to 1976 U.S. employment ratio (USDL, Bureau of Labor Statistics, 1979d) to yield an estimate of 1978 U.S. output

for the transportation sector. Oklahoma output was determined by multiplying U.S. output by Oklahoma's share of U.S. employment in this sector (USDC, Bureau of Economic Analysis, 1980). The resulting estimate of Oklahoma's total output for transportation was $1,809,130,000.

The estimate of the 1978 total output for the communications sector was made in the same manner as the estimate for transportation. Utilizing the same ratios and data sources as above, the 1978 output of the communications sector was estimated to be $621,020,000.

An estimate of the 1978 total output for the utilities sector was made in two steps. First, data on water, sewer, and garbage usage was obtained from telephone interviews with the city managers of 45 Oklahoma cities and towns. Total output for these services were then estimated by multiplying the ratio of total dollar output/population calculated from the sample times the total Oklahoma population. Second, estimates of the 1978 use of electricity and gas were obtained from personal conversations with state Department of Energy personnel and representatives of the various public utility corporations in Oklahoma. The combination of the gas and electric utilities' estimate with that of water, sewer, and garbage services yielded an estimate of 1978 total output in the utilities sector of $2,085,700,000.

Total output for the wholesale and retail trade sector is defined as the margin obtained by this sector in its transactions. This margin (as a percentage) is found by subtracting cost of goods sold from sales and dividing the difference by sales. Data for calculating the 1975 margin for the U.S. (the most recent available) came from the Statistics of Income for Business, Corporations, and Individual Income Tax Returns (USDT, Internal Revenue Service, 1978a, 1980, and 1978b, respectively).

An estimate of the total U.S. margin (in dollars) was made by applying the 1975 margin to the 1978 total sales of wholesale and retail trade (USDC, Bureau of Economic Analysis, 1979c). Oklahoma's total output for the wholesale and retail trade sector was estimated using output/employment ratios. Total output for this sector was estimated to be $4,606,700,000. Once again it is assumed that technology and productivity is the same in Oklahoma as in the U.S.

Output for the finance, insurance, and real estate sector was estimated from data from the USDC, Bureau of Economic Analysis (1976), USDT, Internal Revenue Service (1978a, 1978b, and 1980), and OESC, Research and Planning Division (1979b). Output per employee was calculated by using a ratio of 1975 U.S. output to 1975 U.S. employment. This was multiplied by the number of Oklahoma employees in 1978 to yield an estimate of Oklahoma total output. This estimate was then adjusted for inflation by multiplying by the ratio of a 1978 CPI to a 1975 CPI (USDL, Bureau of Labor Statistics, 1979a and 1976a, respectively), to yield a 1978 total output estimate of $5,446,900,000. This assumes that technology and productivity is the same in the U.S. as in Oklahoma and that productivity per employee has been constant from 1975 to 1978.

An estimate of the total output for the services sector was determined in much the same manner as the finance, insurance, and real estate sector. The same data sources were used to estimate the output/employment ratio for the U.S. in 1975. This ratio was then multiplied by the 1978 total employment in the services sector in Oklahoma. This estimate of total output was adjusted for inflation by multiplying it by the ratio of the 1978 CPI to the 1975 CPI for the services sector

(USDL, Bureau of Labor Statistics, 1979a and 1976a, respectively). This yielded an estimate of 1978 total output of $2,244,000,000. This estimate obviously requires the same assumptions as that of the finance, insurance, and real estate sector.

The 1978 total outputs for both the federal government and state government enterprise sectors were estimated by multiplying the 1972 total output of these sectors (Ghebremedhin, 1980), by the ratio of 1978 CPI to 1972 CPI for each sector (USDL, Bureau of Labor Statistics, 1979b and 1973a, respectively). Because of data limitations, the CPI ratio used was that of "all items." The inflation adjusted output was further adjusted for changes in production by multiplying it by the ratio of 1978 to 1972 productivity (Board of Governors of the Federal Reserve System, 1979 and 1973, respectively). Again, this index was that of "all items," because a separate productivity index for government enterprise was not available. The estimated total outputs were $504,950,000 and $290,009,000, respectively, for federal government and state government enterprise.

Estimate of Real Change in Sector Outputs

An estimate of the real change in total output between 1972 and 1978 was also needed for the production adjustment. First, the 1978 dollar value of the 1972 total output was estimated for each processing sector (sectors 1-31) by multiplying by the same ratios used to adjust the requirements matrix for inflation. A production multiplier for each sector was then calculated by first subtracting the 1972 production in 1978 dollars from the estimate of 1978 total output. This gives the real change in dollar value of production from 1972 to 1978

(Table IV). This real change in production was then divided by 1972 production in 1978 dollars, giving the percent change in production occurring in each sector from 1972 to 1978. The production multipliers in Table IV are this number plus one. This multiplier was then used to adjust the column elements of the requirements matrix to reflect changes in the actual level of production between 1972 and 1978.

The new requirements matrix resulting from these adjustments for inflation and changes in production, represents the estimated 1978 demand relationships that exist in the Oklahoma economy (Table V).

Final Demand

The final demand portion of the requirements matrix represents the final disposition of the goods and services produced in the economy, i.e., those goods and services purchased by the final consumers which do not reenter the manufacturing process. Final demand is comprised of personal consumption expenditures, private capital formation, change in business inventories, federal government purchases, state and local government purchases, and exports.

The data requirements for the estimation of these final demand sectors is quite extensive. Most of the data for Oklahoma is only as recent as 1972. Therefore, the final demand sector estimates were obtained from state projections of final demand which have been reconciled with the national final demand projections published by the Bureau of Labor Statistics (Scheppach, 1972). This model utilizes numerous equations and data sources to project final demand from 1970 to 1980. The 1978 final demand was obtained by deflating the 1980

TABLE IV

ESTIMATE OF SECTOR PRODUCTION MULTIPLIERS

Sector	1978(a) Total Output	1972 Total(b) Output in 1978 Dollars	Real Change(c) in Production from 1972	Production(d) Multiplier
	Millions of Dollars			
1. Agriculture	4,630.8	3,080.5	1,550.3	1.5033[1]
2. Mining	3,500.0	4,275.8	- 775.8	.8186
3. Construction	3,703.9	2,801.0	- 97.1	.9653
4. Food & Kindred Prod.	1,802.2	1,583.9	218.3	1.1378
5. Textiles & Fabrics	100.6	111.4	- 10.8	.9030
6. Apparel	330.0	203.9	126.1	1.6184
7. Logging	74.4	-[2]	-	-
8. Sawmills	103.7	-	-	-
9. Other Lumber & Wood Prod.	245.5	-	-	-
10. Wooden Furniture & Fixts.	55.0	-	-	-
11. Other Furniture & Fixts.	23.3	-	-	-
12. Paper & Allied Prod.	280.0	-	-	-
13. Paper Containers & Boxes	87.0	-	-	-
14. Printing & Publishing	376.2	344.5	31.7	1.0920
15. Chemicals & Allied Prod.	399.2	127.7	271.5	3.1261
16. Petroleum Refining & Prod.	3,415.3	2,433.7	981.6	1.4033
17. Rubber & Plastic Prod.	829.1	440.4	388.7	1.8826
18. Leather & Leather Prod.	24.4	37.2	- 12.8	.6559
19. Stone, Clay, & Glass Prod.	720.5	499.3	221.2	1.4430
20. Metal & Metal Prod.	1,556.8	1,109.6	447.2	1.4030
21. Machinery & Equipment	2,926.2	2,053.7	872.5	1.4248
22. Transportation Equipment	648.1	467.1	181.0	1.3875

TABLE IV (Continued)

Sector	1978(a) Total Output	1972 Total(b) Output in 1978 Dollars	Real Change(c) in Production from 1972	Production(d) Multiplier
23. Misc. Manufacturing	327.4	144.2	183.2	2.2704
24. Transportation	1,809.4	1,417.7	391.7	1,2763
25. Communication	621.0	429.1	191.9	1.4472
26. Utilities	2,085.7	1,365.4	720.3	1.5275
27. Wholesale & Retail Trade	4,606.7	4,092.8	513.9	1.1256
28. Finance, Ins., & Real Est.	5,446.9	4,934.4	512.5	1.1039
29. Services	6,877.6	4,773.8	2,103.8	1.4407
30. Fed. Govt. Enterprise	505.0	390.8	114.2	1.2922
31. S. & L. Govt. Enterprise	290.1	205.1	85.0	1.4144

[1]Calculations are as follows: (a) - (b) = (c) (c) ÷ (b) = (d)

[2]1978 primary data; no production multiplier necessary

TABLE V

OKLAHOMA REQUIREMENTS MATRIX, 1978

	PRODUCING SECTOR	PURCHASING SECTOR							
		1	2	3	4	5	6	7	8
		THOUSANDS OF DOLLARS							
1	AGRICULTURE	1726510	60	4620	552820	2310	970	19100	0
2	MINING	9160	186430	35750	1260	70	70	0	0
3	CONSTRUCTION	30540	132710	710	3680	200	290	0	9530
4	FOOD & KINDRED PROD.	370050	850	730	330100	170	330	0	0
5	TEXTILES & FABRICS	4380	70	10210	200	30060	80070	0	0
6	APPAREL	1190	350	350	570	1230	69120	0	0
7	LOGGING	0	290	250	0	0	0	0	34390
8	SAWMILLS	140	10	54120	40	0	0	0	0
9	OTHER LUMBER & WOOD PROD.	6160	0	124920	1450	210	400	0	0
10	WOODEN FURNITURE & FIXT.	0	0	3700	0	0	0	0	0
11	OTHER FURNITURE & FIXT.	0	0	3010	0	0	0	0	0
12	PAPER & ALLIED PROD.	5690	710	7040	15550	310	1680	0	0
13	PAPER CONTAINERS & BOXES	3660	0	80	33300	830	3170	0	0
14	PRINTING & PUBLISHING	1350	420	550	10720	40	480	0	0
15	CHEMICALS & ALLIED PROD.	153750	24460	28420	13660	18610	8580	0	0
16	PETROLEUM REFINING & PROD.	81770	22280	71460	7020	560	1130	2970	710
17	RUBBER & PLASTIC PROD.	17210	1750	21990	16110	2540	2680	380	0
18	LEATHER & LEATHER PROD.	1080	90	50	20	0	1760	0	0
19	STONE, CLAY, & GLASS PROD.	1030	1760	185740	28260	520	140	0	0
20	METAL & METAL PROD.	10110	44820	283780	67060	70	3050	0	300
21	MACHINERY & EQUIPMENT	21120	83060	113210	3210	1000	900	6540	9750
22	TRANSPORTATION EQUIPMENT	3350	1200	750	200	0	20	2870	370
23	MISCELLANEOUS MFG.	780	2330	11340	310	170	4770	1210	1470
24	TRANSPORTATION	64590	18340	61010	44580	2570	5280	0	1630
25	COMMUNICATION	8710	5650	4890	1580	290	1050	0	50
26	UTILITIES	38470	47130	3400	14620	1540	2320	240	2440
27	WHOLESALE & RETAIL TRADE	153300	18210	188710	74390	4610	13980	7200	2200
28	FINANCE, INS., & REAL EST.	284970	505570	31160	17430	1840	6980	6770	870
29	SERVICES	36450	43180	155890	62850	3330	11110	4670	3770
30	FEDERAL GOVT. ENTERPRISE	830	1860	800	1620	120	930	0	0
31	S. & L. GOVT. ENTERPRISE	40	1330	140	230	0	10	0	0
32	HOUSEHOLDS	433200	1295480	1007480	225570	15470	93950	15800	24550
33	VALUE ADDED	1151170	1058690	187180	271310	11300	14720	6660	11670
34	SCRAP	60	910	470	1240	640	120	0	0
35	WORLD INDUSTRY & INV. ADJ.	0	0	0	0	0	0	0	0
	TOTAL INPUT	4630800	3500000	2703900	1802240	100600	330050	74400	103700

TABLE V (Continued)

	PRODUCING SECTOR	PURCHASING SECTOR							
		9	10	11	12	13	14	15	16
		THOUSANDS OF DOLLARS							
1	AGRICULTURE	0	0	0	0	0	70	1140	140
2	MINING	0	0	20	0	0	10	15590	1651480
3	CONSTRUCTION	1130	200	50	9050	760	1370	2780	40920
4	FOOD & KINDRED PROD.	30	0	90	0	0	270	4340	3170
5	TEXTILES & FABRICS	0	7330	1000	0	0	430	0	590
6	APPAREL	0	70	130	0	0	200	150	90
7	LOGGING	43020	0	0	12270	0	0	220	0
8	SAWMILLS	51660	5370	500	34520	0	0	390	80
9	OTHER LUMBER & WOOD PROD.	17410	1160	950	0	0	0	50	390
10	WOODEN FURNITURE & FIXT.	0	0	0	0	0	0	0	0
11	OTHER FURNITURE & FIXT.	150	0	70	0	0	0	0	0
12	PAPER & ALLIED PROD.	9230	1410	10	9230	40030	55740	2230	7180
13	PAPER CONTAINERS & BOXES	880	0	370	0	0	760	2380	6820
14	PRINTING & PUBLISHING	0	10	50	0	0	39250	890	240
15	CHEMICALS & ALLIED PROD.	7630	2810	270	15740	2580	6300	92250	77000
16	PETROLEUM REFINING & PROD.	4010	60	100	4830	580	720	6860	273480
17	RUBBER & PLASTIC PROD.	0	2910	1370	30	0	2190	3490	3710
18	LEATHER & LEATHER PROD.	0	0	0	0	0	60	60	60
19	STONE, CLAY, & GLASS PROD.	140	0	220	0	0	330	1690	7070
20	METAL & METAL PROD.	6250	4180	4700	0	1340	1530	13790	31020
21	MACHINERY & EQUIPMENT	3730	230	100	1930	1120	1320	4610	3920
22	TRANSPORTATION EQUIPMENT	2500	530	0	30	120	30	10	140
23	MISCELLANEOUS MFG.	2190	840	40	12460	1160	3370	550	1520
24	TRANSPORTATION	4460	490	660	14180	2690	11580	14860	118880
25	COMMUNICATION	640	220	50	190	220	2830	950	2900
26	UTILITIES	4040	340	140	25450	540	2430	15070	49660
27	WHOLESALE & RETAIL TRADE	9670	1940	1050	13410	2540	9400	9720	20470
28	FINANCE, INS., & REAL EST.	3200	2170	660	680	1710	19630	11410	36610
29	SERVICES	2250	1090	880	19020	2360	29020	23950	55190
30	FEDERAL GOVT. ENTERPRISE	0	0	40	0	0	5490	500	1860
31	S. & L. GOVT. ENTERPRISE	0	0	0	0	0	40	390	930
32	HOUSEHOLDS	50640	16490	8670	26380	12530	122460	59200	193970
33	VALUE ADDED	20670	5140	1100	17340	16770	59280	109220	625820
34	SCRAP	0	0	10	0	0	130	460	30
35	WORLD INDUSTRY & INV. ADJ.	0	0	0	0	0	0	0	0
	TOTAL INPUT	245520	55000	23300	216720	87040	376240	399200	3415360

TABLE V (Continued)

	PRODUCING SECTOR	PURCHASING SECTOR							
		17	18	19	20	21	22	23	24
		THOUSANDS OF DOLLARS							
1	AGRICULTURE	240	0	400	720	360	90	440	390
2	MINING	2820	0	48840	54810	910	240	510	1340
3	CONSTRUCTION	4300	30	5320	6600	8460	1580	1100	57730
4	FOOD & KINDRED PROD.	310	110	340	820	1890	520	790	4250
5	TEXTILES & FABRICS	32220	1660	1100	330	1540	2930	4420	750
6	APPAREL	660	110	340	660	1010	3530	600	1870
7	LOGGING	0	0	0	0	0	0	70	0
8	SAWMILLS	140	30	1800	3180	5050	5390	4400	0
9	OTHER LUMBER & WOOD PROD.	2920	220	6050	4210	2620	7100	4370	180
10	WOODEN FURNITURE & FIXT.	0	0	0	0	0	1140	0	0
11	OTHER FURNITURE & FIXT.	0	0	150	0	20	2000	0	0
12	PAPER & ALLIED PROD.	7510	230	7120	2120	4250	620	8720	1830
13	PAPER CONTAINERS & BOXES	10610	320	14230	6620	7300	450	5300	740
14	PRINTING & PUBLISHING	530	20	720	650	5500	850	350	3570
15	CHEMICALS & ALLIED PROD.	174050	350	22870	26720	15710	4940	12200	3020
16	PETROLEUM REFINING & PROD.	4000	90	7450	8530	16550	3030	2890	103710
17	RUBBER & PLASTIC PROD.	33900	1690	14250	10920	38070	8750	11600	11010
18	LEATHER & LEATHER PROD.	70	4690	10	30	140	40	980	30
19	STONE, CLAY, & GLASS PROD.	5590	10	73870	12750	15940	5620	2400	890
20	METAL & METAL PROD.	23140	650	10480	533800	419790	102980	38060	11760
21	MACHINERY & EQUIPMENT	8760	180	7120	44630	600480	63960	9150	13580
22	TRANSPORTATION EQUIPMENT	790	0	130	1250	9990	95200	150	32030
23	MISCELLANEOUS MFG.	2100	340	1970	4260	8830	4310	16750	1780
24	TRANSPORTATION	27690	420	43200	42550	38080	10620	7560	200260
25	COMMUNICATION	2280	70	1560	3420	10970	1440	1370	15000
26	UTILITIES	13630	140	26040	24170	21990	4140	2660	15280
27	WHOLESALE & RETAIL TRADE	20950	940	18320	48810	91910	23490	12780	42540
28	FINANCE, INS., & REAL EST.	14590	530	14910	27060	70690	6450	9690	74650
29	SERVICES	36960	1040	25260	46170	132990	28250	9210	67500
30	FEDERAL GOVT. ENTERPRISE	850	120	810	1540	4560	980	800	2650
31	S. & L. GOVT. ENTERPRISE	60	0	110	390	110	20	160	2700
32	HOUSEHOLDS	166970	4810	169320	440600	729060	226100	50070	727380
33	VALUE ADDED	229420	5580	193790	179470	654860	30480	107100	410550
34	SCRAP	1000	10	2610	18920	6590	870	720	180
35	WORLD INDUSTRY & INV. ADJ.	0	0	0	0	0	0	0	0
	TOTAL INPUT	829060	24390	720490	1556800	2926210	648100	327360	1809130

TABLE V (Continued)

	PRODUCING SECTOR	PURCHASING SECTOR						
		25	26	27	28	29	30	31
		THOUSANDS OF DOLLARS						
1	AGRICULTURE	1650	2560	2580	16500	49490	20	370
2	MINING	0	340320	0	70	1290	13630	5020
3	CONSTRUCTION	18240	62460	19220	254210	71520	5670	56590
4	FOOD & KINDRED PROD.	170	250	3020	1860	477340	170	20
5	TEXTILES & FABRICS	0	0	260	0	2630	150	30
6	APPAREL	200	270	2160	710	24680	880	650
7	LOGGING	0	0	0	0	0	0	0
8	SAWMILLS	0	0	0	0	850	0	0
9	OTHER LUMBER & WOOD PROD.	0	0	790	0	1190	0	0
10	WOODEN FURNITURE & FIXT.	0	0	0	0	0	0	0
11	OTHER FURNITURE & FIXT.	0	0	0	0	0	0	0
12	PAPER & ALLIED PROD.	490	900	25170	7160	20130	890	370
13	PAPER CONTAINERS & BOXES	0	0	7020	0	11880	140	0
14	PRINTING & PUBLISHING	2130	2460	9060	27010	44590	2810	1160
15	CHEMICALS & ALLIED PROD.	20	4490	2840	1890	85610	2440	6340
16	PETROLEUM REFINING & PROD.	540	74430	53480	20960	56770	3900	8560
17	RUBBER & PLASTIC PROD.	180	1590	9570	5630	42260	1120	240
18	LEATHER & LEATHER PROD.	20	30	290	170	4200	110	0
19	STONE, CLAY, & GLASS PROD.	30	180	1660	100	19180	150	210
20	METAL & METAL PROD.	380	770	1570	350	37290	820	570
21	MACHINERY & EQUIPMENT	13190	7780	5870	2430	88500	500	2300
22	TRANSPORTATION EQUIPMENT	250	370	1560	530	155370	750	1390
23	MISCELLANEOUS MFG.	560	1020	2760	2600	68860	590	240
24	TRANSPORTATION	2520	14660	54660	11610	85500	32720	4080
25	COMMUNICATION	7270	5030	45630	28880	50900	1070	1350
26	UTILITIES	5430	410180	75430	35440	109370	12230	33450
27	WHOLESALE & RETAIL TRADE	1400	13530	61160	17950	189780	1760	2930
28	FINANCE, INS., & REAL EST.	25100	35730	261500	700730	460740	19540	6810
29	SERVICES	34390	21610	189520	153060	604690	22330	11310
30	FEDERAL GOVT. ENTERPRISE	2710	5800	22510	41790	37590	1190	400
31	S. & L. GOVT. ENTERPRISE	420	370	3580	1910	4520	310	50
32	HOUSEHOLDS	300210	238070	2296410	771980	2452650	396150	67630
33	VALUE ADDED	203540	840260	1447230	3341390	1615990	-17680	77980
34	SCRAP	0	0	170	0	2240	0	0
35	WORLD INDUSTRY & INV. ADJ.	0	0	0	0	0	0	0
	TOTAL INPUT	621020	2085700	4606700	5446900	6877600	504950	290090

TABLE V (Continued)

	PRODUCING SECTOR	FINAL DEMAND						
		PERSONAL CONSUMPTION	PRIVATE CAPITAL FORMATION	CHANGE IN BUSINESS INVENTORY	FEDERAL GOVERNMENT	STATE GOVERNMENT	EXPORTS OUTPUT	TOTAL OUTPUT
		- - - - - - - - - - - - - - - - THOUSANDS OF DOLLARS- - - - - - - - - - - - - - - -						
1	AGRICULTURE	91030	0	17480	4890	-6220	0	2491100
2	MINING	7310	0	19360	9210	13870	0	2615240
3	CONSTRUCTION	0	1803660	0	337010	1133000	0	4080600
4	FOOD & KINDRED PROD.	2055340	0	10	11160	37090	0	3305290
5	TEXTILES & FABRICS	71430	1810	60	240	910	0	256820
6	APPAREL	490970	0	6860	2750	10230	0	623200
7	LOGGING	840	0	0	0	20	0	91370
8	SAWMILLS	4420	10	0	10	110	0	172260
9	OTHER LUMBER & WOOD PROD.	6600	20	10	20	170	0	189640
10	WOODEN FURNITURE & FIXT.	126540	34260	390	1430	21920	0	189410
11	OTHER FURNITURE & FIXT.	46870	12700	150	530	8120	0	73780
12	PAPER & ALLIED PROD.	61510	0	1160	2710	1000	0	310330
13	PAPER CONTAINERS & BOXES	2370	0	350	400	800	0	120610
14	PRINTING & PUBLISHING	141450	0	1200	3270	32440	0	333570
15	CHEMICALS & ALLIED PROD.	334630	0	3280	3180	53140	0	1205780
16	PETROLEUM REFINING & PROD.	585760	0	26300	130460	100700	0	1686640
17	RUBBER & PLASTIC PROD.	86560	840	3930	5870	11750	0	376100
18	LEATHER & LEATHER PROD.	91440	0	990	130	160	0	106730
19	STONE, CLAY, & GLASS PROD.	20060	0	4050	520	1240	0	391320
20	METAL & METAL PROD.	69620	50140	28440	49950	59300	0	2011670
21	MACHINERY & EQUIPMENT	533540	950770	48750	319050	61780	0	3048670
22	TRANSPORTATION EQUIPMENT	675080	294090	9880	109710	58170	0	1456600
23	MISCELLANEOUS MFG.	261290	95250	2160	3650	39230	0	563080
24	TRANSPORTATION	492030	44740	90	46790	55440	0	1581420
25	COMMUNICATION	246230	30640	20	19870	21210	0	524820
26	UTILITIES	634350	0	0	26530	68260	0	1726550
27	WHOLESALE & RETAIL TRADE	3878930	257340	21270	29930	37560	0	5304050
28	FINANCE, INS., & REAL EST.	4507290	159770	0	21980	99560	0	7446970
29	SERVICES	3093920	0	280	202930	166950	0	5303280
30	FEDERAL GOVT. ENTERPRISE	51030	0	0	10300	20	0	155690
31	S. & L. GOVT. ENTERPRISE	41480	0	0	34660	193190	0	287150
32	HOUSEHOLDS	0	0	0	0	0	0	12639260
33	VALUE ADDED	0	0	0	0	0	0	12687970
34	SCRAP	-1450	23060	-53880	3360	43480	0	51950
35	WORLD INDUSTRY & INV. ADJ.	130680	0	0	1172480	1427670	0	2730840
	TOTAL INPUT	18639070	3759150	142590	2564580	3752290	0	

projection assuming a linear growth rate for all sectors. The following is a brief overview of the simulation technique used.

Personal Consumption Expenditures

Personal consumption expenditures (PCE) were determined as a function of average expenditures by consumer units on various commodities, income, and population. Expenditures by consumer units on various commodities (USDL, Bureau of Labor Statistics, 1966) were classified by eight income groups according to four population characteristics. Multiplying the average expenditure per consumer unit by the number of consumer units in each population/income group, provided an estimate of the total expenditures by all state residents on the various commodity groups. The total expenditures for 1980 were distributed to the relevant I-O sector by multiplying the total expenditures on each commodity by the proportion of each commodity which is distributed to each I-O sector. Data for this distribution is provided in Polenske (1972).

For the purposes of this study it was necessary to adjust the 1980 PCE estimates to 1978. This was accomplished by assuming a linear growth rate between 1970 and 1980 and reducing the 1980 PCE estimates accordingly. The 1978 estimates were then adjusted to represent 1978 dollars using appropriate price indices for each sector. This adjustment procedure was used for all final demand sectors. The 1978 estimate of PCE is contained in Table V.

Private Capital Formation

Private capital formation (PCF) represents both investment in new plants and equipment, and the capital used in production processes.

Total PCF was estimated by multiplying state estimates of total expenditures on capital by a national capital coefficients matrix. This provided the base year estimate of capital flows from which 1970 and 1980 projections could be made. Capital was divided into four categories and output for each category was projected from estimates of the variables that affect investment. Total capital output was then distributed by the base year capital flows for each sector. The 1980 projection of PCF was adjusted to 1978 in the same manner as PCE (Table V).

Change in Business Inventory

Change in business inventories represents the accumulation or reduction in the finished products of an industry. The level of inventory of a sector is determined from the previous year's output. Base year estimates of inventory change were based on the previous year's change in inventory and sector output lagged. Projections were made based on the inventory/output lagged ratio assuming a constant linear relationship between inventory and the previous year's output. The 1980 projection for Change in Business Inventories was adjusted to 1978 and is contained in Table V.

Federal Government Purchases

Federal government purchases includes both military and nonmilitary expenditures. Net expenditures for the base year are distributed to the I-O sectors from the national I-O account. Nonmilitary expenditures were allocated to the states using federal civilian employment/output ratios. Military expenditures were allocated

directly from contract data. The 1980 projection of federal government purchases was made on the basis of expected changes in state output shares and was adjusted to 1978 (Table V).

State and Local Government Purchases

State and local government purchases consist of expenditures on education, highways, hospitals, health and sanitation, natural resources, local parks and recreation, and public enterprises. Estimates of the expenditures on these functional categories were transformed into expenditures on an I-O basis. Projections for 1970 and 1980 were made using time series data and regression analysis. The 1978 data was estimated from these projections (Table V).

Exports

The export column of final demand was not determined from the projected data. Instead it was calculated as a residual in the location quotient technique described below.

Location Quotient

The Oklahoma requirements matrix in Table V has the same technical coefficients as the national model for the non-FPI sectors. In this matrix the production functions of each sector are assumed to be the same as in the U.S. Furthermore, it has been assumed that each sector has purchased all of its inputs inside Oklahoma, i.e., there are no imports in the model as yet.

The transactions matrix is obtained by adjusting the requirements matrix to account for interregional trade and differences in

production levels. This adjustment can be accomplished in one of many ways (Richardson, 1972). This study used the Supply-Demand Pool (SDP) method. This method has its origins in the regional commodity balances approach advanced by Isard (1960). It involves subtracting total regional requirements from total regional output for each endogenous sector of the economy to obtain the net surplus (or deficit).

The total regional requirements for Oklahoma are the sum of each row in the requirements matrix (Table V). Total regional outputs used are the 1978 total outputs presented previously in Table III. The difference between the two represents the trade requirements. Here, negative numbers represent deficits in the commodity balances (imports), and positive numbers represent a surplus in the commodity balances (exports).

In the SDP approach when the commodity balance showed that a sector produces a surplus, imports were assumed to be zero, exports were equal to the surplus, and the regional technical coefficients were equal to those of the U.S.

When the commodity balance showed a deficit, exports were assumed to be zero. Imports were then allocated across the row based on the requirements of each purchasing sector relative to the total requirements of all purchasing sectors. In these cases the regional or state technical coefficients would be different from those of the U.S.

A transactions table was determined by subtracting imports directly from the requirements matrix. The first step was to divide the elements of each row in the requirements matrix by the sum of the row.

The result was a matrix, read across each row, which specified the percentage requirements of each purchasing sector of the goods and services of the sector named at the beginning of each row.

In the SDP method each processing sector is assumed to share in the total imports of the products of the producing sector according to the ratio of its use to the total use. Therefore, imports were distributed across each row by multiplying each row of the above described matrix by total imports. The resulting matrix is an import flow table which specifies the dollar value of goods and services each purchasing sector had to import in 1978. This import flow table was subtracted from the requirements matrix to yield a 1978 Oklahoma transaction matrix.

Exports, surpluses in the commodity balances, were added as a column vector in final demand. The import row of the transactions matrix is merely the sum of each column of import flow matrix and represents the total value of all goods and services each purchasing sector imported in 1978. The entire 1978 Oklahoma transactions matrix is presented in Table VI in the following chapter.

The calculation of the transactions matrix in this manner requires the assumption that local trade was maximized. That is, all goods produced by a sector are consumed in the state first and only the surplus production is exported. In the same manner only the deficits in production are imported. While this is rarely the case in the real world transactions of a region, it is a necessary assumption in I-O models where survey data is not collected on all sectors of the economy. Furthermore, as Shaffer and Chu (1969) found in their study of non-survey techniques, the technique presented here yields a better

estimate of the regional I-O model than one obtained through the use of national coefficients alone. Therefore, this Oklahoma transactions matrix should provide a sound estimate of the supply and demand relationships that existed in the economy of Oklahoma in 1978.

CHAPTER IV

RESULTS AND DISCUSSION

Input-Output Model for Oklahoma, 1978

Transactions Matrix

The 1978 transactions matrix is presented in Table VI. It represents the sum total of all sales and purchases by sector that occurred in the 1978 Oklahoma economy. As described previously in the four sector economy of Figure 1, sales of a sector are found by reading across a row and purchases by reading down a column. For example, the logging sector (row 7) sold 240 thousand dollar's worth of output to the mining sector, 210 thousand dollars to construction, and so on across row 7 for a total of 74.4 million dollars worth of sales in 1978. The logging sector (column 7) purchased 19.1 million dollar's worth of goods from the agriculture sector, 2.9 million dollars from the petroleum refining and products sector, 380 thousand dollars from the rubber and plastic products sector, and so on down column 7 for a total of 74.4 million dollars worth of purchases in 1978. The transactions of all endogenous sectors are interpreted in the same manner. Total output equals total input for all endogenous sectors, since all the economic transactions of a sector are accounted for in I-O analysis.

Total output is not equal to total input for all exogenous sectors since there is no direct relationship between these rows and

TABLE VI

OKLAHOMA TRANSACTIONS MATRIX, 1978

	PRODUCING SECTOR	PURCHASING SECTOR							
		1	2	3	4	5	6	7	8
		THOUSANDS OF DOLLARS							
1	AGRICULTURE	1726510	60	4620	552820	2310	970	19100	0
2	MINING	9160	186430	35750	1260	70	70	0	0
3	CONSTRUCTION	20240	87930	470	2440	130	190	0	6320
4	FOOD & KINDRED PROD.	201770	460	400	179590	90	180	0	0
5	TEXTILES & FABRICS	1720	30	4000	80	11780	31370	0	0
6	APPAREL	630	190	180	510	650	36610	0	0
7	LOGGING	0	240	210	0	0	0	0	28000
8	SAWMILLS	90	10	32580	30	0	0	0	0
9	OTHER LUMBER & WOOD PROD.	6160	0	124920	1450	210	400	0	0
10	WOODEN FURNITURE & FIXT.	0	0	1070	0	0	0	0	0
11	OTHER FURNITURE & FIXT.	0	0	950	0	0	0	0	0
12	PAPER & ALLIED PROD.	3980	500	4920	11140	220	1170	0	0
13	PAPER CONTAINERS & BOXES	2630	0	60	23590	600	2290	0	0
14	PRINTING & PUBLISHING	1350	420	550	10720	40	480	0	0
15	CHEMICALS & ALLIED PROD.	50730	8070	9380	4510	6140	2830	0	0
16	PETROLEUM REFINING & PROD.	81770	22280	71460	7020	560	1130	2970	710
17	RUBBER & PLASTIC PROD.	17210	1750	21990	16110	2540	2680	380	0
18	LEATHER & LEATHER PROD.	250	20	10	0	0	400	0	0
19	STONE, CLAY, & GLASS PROD.	1030	1760	185740	28260	520	140	0	0
20	METAL & METAL PROD.	7830	34680	296970	51690	50	2360	0	230
21	MACHINERY & EQUIPMENT	29870	79730	108660	3080	560	870	6280	9360
22	TRANSPORTATION EQUIPMENT	1490	530	330	90	0	10	1270	160
23	MISCELLANEOUS MFG.	460	1350	6590	180	100	2780	700	860
24	TRANSPORTATION	64590	18340	61010	44980	2570	5280	0	1630
25	COMMUNICATION	8710	5650	4890	1980	290	1050	0	50
26	UTILITIES	38470	47130	3400	14620	1540	2320	240	2440
27	WHOLESALE & RETAIL TRADE	133140	15820	163900	64610	4000	12140	6250	1910
28	FINANCE, INS., & REAL EST.	208380	369690	22790	12750	1340	5100	4950	630
29	SERVICES	36450	43180	155890	62550	3330	11110	4670	3770
30	FEDERAL GOVT. ENTERPRISE	830	1860	800	1620	120	930	0	0
31	S. & L. GOVT. ENTERPRISE	40	1330	140	230	0	10	0	0
32	HOUSEHOLDS	433200	1295480	1007480	225570	15470	93950	15800	24550
33	VALUE ADDED	1151170	1058690	187180	271310	11300	14720	6660	11670
34	SCRAP	60	910	470	1240	640	120	0	0
35	WORLD INDUSTRY & INV. ADJ.	0	0	0	0	0	0	0	0
36	IMPORTS	390920	215480	184150	205230	33030	96410	5130	11400
	TOTAL INPUT	4630800	3500000	2703900	1802240	100600	330050	74400	103700

TABLE VI (Continued)

	PRODUCING SECTOR	PURCHASING SECTOR							
		9	10	11	12	13	14	15	16
		THOUSANDS OF DOLLARS							
1	AGRICULTURE	0	0	0	0	0	70	1140	140
2	MINING	0	0	20	0	0	10	15590	1E51480
3	CONSTRUCTION	750	140	40	6000	500	910	1840	27120
4	FOOD & KINDRED PROD.	10	0	50	0	0	150	2370	1730
5	TEXTILES & FABRICS	0	2870	390	0	0	170	0	230
6	APPAREL	0	40	70	0	0	110	80	50
7	LOGGING	35030	0	0	9990	0	0	180	0
8	SAWMILLS	31100	3240	300	20780	0	0	240	50
9	OTHER LUMBER & WOOD PROD.	17410	1160	950	0	0	0	50	390
10	WOODEN FURNITURE & FIXT.	0	0	0	0	0	0	0	0
11	OTHER FURNITURE & FIXT.	50	0	20	0	0	0	0	0
12	PAPER & ALLIED PROD.	6450	980	10	6450	27960	38930	1560	5020
13	PAPER CONTAINERS & BOXES	640	0	270	0	0	550	1720	4920
14	PRINTING & PUBLISHING	0	10	50	0	0	39250	890	240
15	CHEMICALS & ALLIED PROD.	2520	930	90	5190	850	2080	30440	25410
16	PETROLEUM REFINING & PROD.	4010	60	100	4630	580	720	6860	273480
17	RUBBER & PLASTIC PROD.	0	2910	1370	30	0	2190	3490	3710
18	LEATHER & LEATHER PROD.	0	0	0	0	0	10	10	10
19	STONE, CLAY, & GLASS PROD.	140	0	220	0	0	330	1690	7070
20	METAL & METAL PROD.	4840	3240	3640	0	1040	1180	10670	24010
21	MACHINERY & EQUIPMENT	3580	220	100	1650	1070	1260	4430	3770
22	TRANSPORTATION EQUIPMENT	1110	230	0	10	50	20	10	60
23	MISCELLANEOUS MFG.	1270	490	20	7240	670	1960	320	880
24	TRANSPORTATION	4460	490	660	14180	2690	11580	14860	118880
25	COMMUNICATION	640	220	50	190	220	2830	950	2900
26	UTILITIES	4040	340	140	25450	540	2430	15070	49660
27	WHOLESALE & RETAIL TRADE	8400	1680	910	11650	2200	8170	8440	17780
28	FINANCE, INS., & REAL EST.	2340	1590	480	490	1250	14350	8340	26770
29	SERVICES	2250	1090	880	19020	2360	29020	23950	55190
30	FEDERAL GOVT. ENTERPRISE	0	0	40	0	0	5490	500	1860
31	S. & L. GOVT. ENTERPRISE	0	0	0	0	0	40	390	930
32	HOUSEHOLDS	50640	16490	8670	26380	12530	122460	59200	193970
33	VALUE ADDED	20670	5140	1100	17340	16770	59280	109220	625820
34	SCRAP	0	0	10	0	0	130	460	30
35	WORLD INDUSTRY & INV. ADJ.	0	0	0	0	0	0	0	0
36	IMPORTS	43190	11450	2660	39650	15750	30570	74260	91820
	TOTAL INPUT	245520	55000	23300	216720	87040	376240	399200	3415360

TABLE VI (Continued)

	PRODUCING SECTOR	PURCHASING SECTOR							
		17	18	19	20	21	22	23	24
		THOUSANDS OF DOLLARS							
1	AGRICULTURE	240	0	400	720	360	90	440	390
2	MINING	2820	0	48840	54510	910	240	510	1340
3	CONSTRUCTION	2850	20	3520	4370	5600	1040	730	38250
4	FOOD & KINDRED PROD.	170	60	190	280	1030	280	430	2320
5	TEXTILES & FABRICS	12620	650	430	130	600	1150	1730	300
6	APPAREL	350	60	180	450	540	1870	320	990
7	LOGGING	0	0	0	0	0	0	50	0
8	SAWMILLS	80	20	1090	1910	3040	3250	2650	0
9	OTHER LUMBER & WOOD PROD.	2920	220	6050	4310	2620	7100	4370	180
10	WOODEN FURNITURE & FIXT.	0	0	0	0	0	330	0	0
11	OTHER FURNITURE & FIXT.	0	0	50	0	10	630	0	0
12	PAPER & ALLIED PROD.	5240	160	4970	1480	2970	430	6090	1280
13	PAPER CONTAINERS & BOXES	7640	230	10250	4770	5260	320	3820	530
14	PRINTING & PUBLISHING	530	20	720	850	5500	850	350	3570
15	CHEMICALS & ALLIED PROD.	57430	120	7550	8820	5190	1630	4020	1000
16	PETROLEUM REFINING & PRCD.	4000	90	7450	8530	16550	3030	2890	103710
17	RUBBER & PLASTIC PROD.	33900	1690	14250	10920	38070	8750	11600	11010
18	LEATHER & LEATHER PROD.	20	1070	0	10	30	10	220	10
19	STONE, CLAY, & GLASS PROD.	5590	10	73870	12750	15940	5620	2400	890
20	METAL & METAL PROD.	17910	510	8110	413060	324830	79690	29450	9100
21	MACHINERY & EQUIPMENT	8410	180	6830	43030	576360	61390	8780	13030
22	TRANSPORTATION EQUIPMENT	350	0	60	560	4440	42290	70	14230
23	MISCELLANEOUS MFG.	1220	200	1140	2480	5140	2510	9740	1030
24	TRANSPORTATION	27690	420	43200	42550	38080	10620	7560	200260
25	COMMUNICATION	2280	70	1560	3420	10970	1440	1370	15000
26	UTILITIES	13630	140	26040	24170	21990	4140	2660	15280
27	WHOLESALE & RETAIL TRADE	18200	810	15910	42390	79830	20400	11100	36940
28	FINANCE, INS., & REAL EST.	10670	390	10900	19790	51690	4710	7080	54580
29	SERVICES	36960	1040	25260	46170	132990	28250	9210	67500
30	FEDERAL GOVT. ENTERPRISE	850	120	810	1540	4560	980	800	2650
31	S. & L. GOVT. ENTERPRISE	60	0	110	390	110	20	160	2700
32	HOUSEHOLDS	166970	4810	169320	440600	729060	226100	50070	727380
33	VALUE ADDED	229420	5580	193790	179470	654860	30480	107100	410550
34	SCRAP	1000	10	2610	18520	6590	870	720	180
35	WORLD INDUSTRY & INV. ADJ.	0	0	0	0	0	0	0	0
36	IMPORTS	157040	5710	35030	163460	180520	97580	38860	72970
	TOTAL INPUT	829060	24390	720490	1556790	2926210	648100	327360	1809130

TABLE VI (Continued)

	PRODUCING SECTOR	PURCHASING SECTOR						
		25	26	27	28	29	30	31
		THOUSANDS OF DOLLARS						
1	AGRICULTURE	1650	2560	2580	16500	49490	20	370
2	MINING	0	340320	0	70	1290	13830	5020
3	CONSTRUCTION	12090	41390	12740	168440	47390	3750	37500
4	FOOD & KINDRED PROD.	90	140	1650	1010	260270	90	10
5	TEXTILES & FABRICS	0	0	100	0	1030	60	10
6	APPAREL	110	140	1140	380	13070	470	340
7	LOGGING	0	0	0	0	0	0	0
8	SAWMILLS	0	0	0	0	510	0	0
9	OTHER LUMBER & WOOD PROD.	0	0	790	0	1190	0	0
10	WOODEN FURNITURE & FIXT.	0	0	0	0	0	0	0
11	OTHER FURNITURE & FIXT.	0	0	0	0	0	0	0
12	PAPER & ALLIED PROD.	340	630	17580	5000	14060	620	260
13	PAPER CONTAINERS & BOXES	0	0	5060	0	8560	100	0
14	PRINTING & PUBLISHING	2130	2460	9060	27010	44590	2810	1160
15	CHEMICALS & ALLIED PROD.	10	1480	940	620	28250	810	2090
16	PETROLEUM REFINING & PROD.	540	74430	53480	20960	56770	3900	8560
17	RUBBER & PLASTIC PROD.	180	1550	9570	5630	42260	1120	240
18	LEATHER & LEATHER PROD.	10	10	70	40	960	20	0
19	STONE, CLAY, & GLASS PROD.	30	160	1660	100	19180	150	210
20	METAL & METAL PROD.	290	600	1220	270	28850	640	440
21	MACHINERY & EQUIPMENT	12660	7470	5640	2330	84950	670	2210
22	TRANSPORTATION EQUIPMENT	110	160	690	240	69030	330	620
23	MISCELLANEOUS MFG.	320	590	1600	1510	40030	340	140
24	TRANSPORTATION	2520	14660	54660	11610	85500	32720	4080
25	COMMUNICATION	7270	5030	45630	28880	50900	1070	1350
26	UTILITIES	5430	410180	75430	35440	109370	12230	33450
27	WHOLESALE & RETAIL TRADE	1220	11750	53120	15590	164830	1530	2550
28	FINANCE, INS., & REAL EST.	18350	26120	191220	512400	336910	14290	4980
29	SERVICES	34390	21810	189520	153060	604690	22330	11310
30	FEDERAL GOVT. ENTERPRISE	2710	5800	22510	41790	37590	1150	400
31	S. & L. GOVT. ENTERPRISE	420	370	3580	1510	4520	310	50
32	HOUSEHOLDS	300210	238070	2296410	771980	2452650	396150	67630
33	VALUE ADDED	203540	840260	1447230	3341390	1615990	-17680	77580
34	SCRAP	0	0	170	0	2240	0	0
35	WORLD INDUSTRY & INV. ADJ.	0	0	0	0	0	0	0
36	IMPORTS	14420	37110	101650	282760	600680	10890	27100
	TOTAL INPUT	621020	2085700	4606700	5446500	6877600	504550	290090

TABLE VI (Continued)

	PRODUCING SECTOR	FINAL DEMAND						
		PERSONAL CONSUMPTION	PRIVATE CAPITAL FORMATION	CHANGE IN BUSINESS INVENTORY	FEDERAL GOVERNMENT	STATE GOVERNMENT	EXPORTS OUTPUT	TOTAL OUTPUT
		- - - - - - - - - - - - - - - - THOUSANDS OF DOLLARS- - - - - - - - - - - - - - - -						
1	AGRICULTURE	91030	0	17480	4890	-6220	2139710	4630800
2	MINING	7310	0	19360	9210	13870	880760	3500000
3	CONSTRUCTION	0	1195150	0	223310	750750	0	2703500
4	FOOD & KINDRED PROD.	1120650	0	10	6090	20230	0	1802240
5	TEXTILES & FABRICS	27980	710	20	100	360	0	100600
6	APPAREL	260020	0	3630	1450	5420	0	330050
7	LOGGING	680	0	0	0	20	0	74400
8	SAWMILLS	2660	10	0	10	70	0	103700
9	OTHER LUMBER & WOOD PROD.	6600	20	10	20	170	55680	245520
10	WOODEN FURNITURE & FIXT.	36740	9550	110	420	6370	0	55000
11	OTHER FURNITURE & FIXT.	14800	4010	50	170	2560	0	23300
12	PAPER & ALLIED PROD.	42960	0	810	1890	700	0	216720
13	PAPER CONTAINERS & BOXES	1710	0	250	290	580	0	87040
14	PRINTING & PUBLISHING	141450	0	1200	3270	32440	42260	376240
15	CHEMICALS & ALLIED PROD.	110420	0	1080	1050	17540	0	399200
16	PETROLEUM REFINING & PROD.	585760	0	26300	130460	100700	1728720	3415360
17	RUBBER & PLASTIC PROD.	86560	640	3930	5870	11750	452970	829060
18	LEATHER & LEATHER PROD.	20900	0	230	30	40	0	24390
19	STONE, CLAY, & GLASS PROD.	20060	0	4050	520	1240	329160	720450
20	METAL & METAL PROD.	53870	38800	22010	38660	45880	0	1556790
21	MACHINERY & EQUIPMENT	512110	912590	46790	306230	59300	0	2926210
22	TRANSPORTATION EQUIPMENT	299920	130660	4390	48740	25850	0	648100
23	MISCELLANEOUS MFG.	151910	55400	1260	2120	22810	0	327360
24	TRANSPORTATION	492030	44740	90	46790	55440	227720	1809130
25	COMMUNICATION	246230	30640	20	19870	21210	96200	621020
26	UTILITIES	634350	0	0	26530	68260	359160	2085700
27	WHOLESALE & RETAIL TRADE	3368950	223500	18480	25990	32620	0	4606700
28	FINANCE, INS., & REAL EST.	3295660	116830	0	16070	72800	0	5446900
29	SERVICES	3093920	0	280	202930	166950	1574320	6877600
30	FEDERAL GOVT. ENTERPRISE	51030	0	0	10300	20	305270	504950
31	S. & L. GOVT. ENTERPRISE	41480	0	0	34660	193190	2940	290090
32	HOUSEHOLDS	0	0	0	0	0	0	12639260
33	VALUE ADDED	0	0	0	0	0	0	12887970
34	SCRAP	-1450	23080	-53880	3360	43480	0	51950
35	WORLD INDUSTRY & INV. ADJ.	130680	0	0	1172480	1427670	0	2730840
36	IMPORTS	3889920	972270	24640	221220	558250	0	8943190
	TOTAL INPUT	18639100	3759190	142590	2564580	3752300	8195050	

columns. For example, the amount of value added (row 33) purchased by all sectors is not directly related to the amount of private capital formation (column 33) produced for any year. However, the differences between the exogenous rows and columns compensate one another so that total state output equals total state input.

Technical Coefficients Matrix

The technical coefficients matrix identifies the direct input requirements per dollar output for all endogenous sectors (Table VII). This matrix is sometimes called the direct coefficients matrix because it identifies the direct linkage of a purchasing sector with all sectors of the economy. For example, for each dollar's worth of output produced, the paper and allied products sector (column 12) purchased $.02768 worth of products from the construction sector, $.04609 from the logging sector, $.09588 from the sawmills sector, etc.

The household sector (row 32) identifies the amount of each dollar's worth of output that is paid to households in the form of wages, salaries, rents, and proprietors' income. Small numbers in this row do not necessarily indicate that wages, salaries, etc. are small for a sector. Rather, it may be reflective of a capital intensive sector, where the number of people employed is small relative to the level of output (as measured in dollar terms). This is the case for petroleum refining and products, paper and allied products, and utilities. Agriculture also has a low coefficient for households, but this is reflective of the fact that 1978 was a poor year for agriculture.

Multiplier Analysis

Besides describing the flow of goods and services throughout an

TABLE VII

OKLAHOMA TECHNICAL COEFFICIENTS MATRIX, 1978

	PRODUCING SECTOR	PURCHASING SECTOR							
		1	2	3	4	5	6	7	8
1	AGRICULTURE	0.37283	0.00002	0.00171	0.30674	0.02299	0.00293	0.25669	0.0
2	MINING	0.00198	0.05326	0.01322	0.00070	0.00065	0.00020	0.0	0.0
3	CONSTRUCTION	0.00437	0.02512	0.00017	0.00135	0.00129	0.00058	0.0	0.06050
4	FOOD & KINDRED PROD.	0.04357	0.00013	0.00015	0.09987	0.00090	0.00054	0.0	0.0
5	TEXTILES & FABRICS	0.00037	0.00001	0.00148	0.00004	0.11705	0.09503	0.0	0.0
6	APPAREL	0.00014	0.00005	0.00007	0.00028	0.00649	0.11091	0.0	0.0
7	LOGGING	0.0	0.00007	0.00008	0.0	0.0	0.0	0.0	0.27005
8	SAWMILLS	0.00002	0.00000	0.01205	0.00001	0.0	0.0	0.0	0.0
9	OTHER LUMBER & WOOD PROD.	0.00133	0.00000	0.04620	0.00060	0.00210	0.00120	0.0	0.0
10	WOODEN FURNITURE & FIXT.	0.0	0.0	0.00040	0.0	0.0	0.0	0.0	0.0
11	OTHER FURNITURE & FIXT.	0.0	0.0	0.00035	0.0	0.0	0.0	0.0	0.0
12	PAPER & ALLIED PROD.	0.00086	0.00014	0.00182	0.00618	0.00217	0.00355	0.0	0.0
13	PAPER CONTAINERS & BOXES	0.00057	0.0	0.00002	0.01331	0.00595	0.00693	0.0	0.0
14	PRINTING & PUBLISHING	0.00029	0.00012	0.00020	0.00595	0.00043	0.00146	0.0	0.0
15	CHEMICALS & ALLIED PROD.	0.01096	0.00231	0.00347	0.00250	0.06103	0.00857	0.0	0.0
16	PETROLEUM REFINING & PROD.	0.01766	0.00637	0.02643	0.00350	0.00552	0.00341	0.03986	0.00688
17	RUBBER & PLASTIC PROD.	0.00372	0.00050	0.00813	0.00894	0.02527	0.00811	0.00516	0.0
18	LEATHER & LEATHER PROD.	0.00005	0.00001	0.00000	0.00000	0.00000	0.00122	0.0	0.0
19	STONE, CLAY, & GLASS PROD.	0.00022	0.00050	0.06869	0.01568	0.00514	0.00043	0.0	0.0
20	METAL & METAL PROD.	0.00169	0.00991	0.10983	0.02879	0.00052	0.00714	0.0	0.00224
21	MACHINERY & EQUIPMENT	0.00645	0.02278	0.04019	0.00171	0.00951	0.00262	0.08436	0.09022
22	TRANSPORTATION EQUIPMENT	0.00032	0.00015	0.00012	0.00005	0.00001	0.00002	0.01712	0.00157
23	MISCELLANEOUS MFG.	0.00010	0.00039	0.00244	0.00010	0.00096	0.00841	0.00943	0.00826
24	TRANSPORTATION	0.01395	0.00524	0.02256	0.02496	0.02559	0.01600	0.0	0.01575
25	COMMUNICATION	0.00188	0.00161	0.00181	0.00110	0.00292	0.00318	0.0	0.00046
26	UTILITIES	0.00831	0.01347	0.00126	0.00811	0.01527	0.00703	0.00320	0.02358
27	WHOLESALE & RETAIL TRADE	0.02875	0.00452	0.06062	0.03585	0.03976	0.03678	0.08404	0.01843
28	FINANCE, INS., & REAL EST.	0.04500	0.10562	0.00843	0.00707	0.01337	0.01546	0.06653	0.00611
29	SERVICES	0.00787	0.01234	0.05765	0.03470	0.03314	0.03366	0.06278	0.03632
30	FEDERAL GOVT. ENTERPRISE	0.00018	0.00053	0.00029	0.00050	0.00123	0.00282	0.0	0.0
31	S. & L. GOVT. ENTERPRISE	0.00001	0.00038	0.00005	0.00013	0.00004	0.00004	0.0	0.0
32	HOUSEHOLDS	0.05355	0.37014	0.37260	0.12516	0.15378	0.28466	0.21242	0.23674
33	VALUE ADDED	0.24859	0.30248	0.06923	0.15054	0.11229	0.04460	0.08952	0.11253
34	SCRAP	0.00001	0.00026	0.00017	0.00069	0.00633	0.00036	0.0	0.0
35	WORLD INDUSTRY & INV. ADJ.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
36	IMPORTS	0.06442	0.06157	0.06811	0.11368	0.32831	0.29212	0.06891	0.10997
	TOTAL INPUT	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

TABLE VII (Continued)

	PRODUCING SECTOR	PURCHASING SECTOR							
		9	10	11	12	13	14	15	16
1	AGRICULTURE	0.0	0.0	0.0	0.0	0.0	0.00019	0.00286	0.00004
2	MINING	0.0	0.0	0.00106	0.0	0.0	0.00002	0.03906	0.54210
3	CONSTRUCTION	0.00306	0.00246	0.00153	0.02768	0.00576	0.00242	0.00461	0.00794
4	FOOD & KINDRED PROD.	0.00006	0.0	0.00212	0.0	0.0	0.00039	0.00593	0.00051
5	TEXTILES & FABRICS	0.0	0.05219	0.01681	0.0	0.0	0.00045	0.00000	0.00007
6	APPAREL	0.0	0.00072	0.00289	0.0	0.0	0.00029	0.00020	0.00001
7	LOGGING	0.14269	0.0	0.0	0.04609	0.0	0.0	0.00044	0.0
8	SAWMILLS	0.12668	0.05882	0.01288	0.09588	0.0	0.0	0.00059	0.00001
9	OTHER LUMBER & WOOD PROD.	0.07091	0.02117	0.04067	0.0	0.0	0.0	0.00012	0.00011
10	WOODEN FURNITURE & FIXT.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	OTHER FURNITURE & FIXT.	0.00020	0.0	0.00099	0.0	0.0	0.0	0.0	0.0
12	PAPER & ALLIED PROD.	0.02625	0.01788	0.00026	0.02975	0.32120	0.10346	0.00391	0.00147
13	PAPER CONTAINERS & BOXES	0.00259	0.0	0.01151	0.0	0.0	0.00145	0.00430	0.00144
14	PRINTING & PUBLISHING	0.0	0.00021	0.00198	0.0	0.0	0.10432	0.00224	0.00007
15	CHEMICALS & ALLIED PROD.	0.01025	0.01687	0.00382	0.02396	0.00977	0.00552	0.07626	0.00744
16	PETROLEUM REFINING & PROD.	0.01632	0.00114	0.00409	0.02229	0.00664	0.00190	0.01718	0.08007
17	RUBBER & PLASTIC PROD.	0.0	0.05298	0.05892	0.00013	0.0	0.00582	0.00873	0.00109
18	LEATHER & LEATHER PROD.	0.0	0.0	0.0	0.0	0.0	0.00004	0.00003	0.00000
19	STONE, CLAY, & GLASS PROD.	0.00056	0.0	0.00947	0.0	0.0	0.00088	0.00422	0.00207
20	METAL & METAL PROD.	0.01971	0.05885	0.15617	0.0	0.01191	0.00314	0.02673	0.00703
21	MACHINERY & EQUIPMENT	0.01458	0.00403	0.00415	0.00853	0.01233	0.00336	0.01109	0.00110
22	TRANSPORTATION EQUIPMENT	0.00452	0.00427	0.00003	0.00005	0.00060	0.00004	0.00002	0.00002
23	MISCELLANEOUS MFG.	0.00519	0.00886	0.00093	0.03342	0.00773	0.00520	0.00079	0.00026
24	TRANSPORTATION	0.01815	0.00890	0.02846	0.06542	0.03088	0.03078	0.03721	0.03481
25	COMMUNICATION	0.00259	0.00396	0.00209	0.00066	0.00258	0.00751	0.00238	0.00085
26	UTILITIES	0.01645	0.00613	0.00612	0.11744	0.00625	0.00647	0.03775	0.01454
27	WHOLESALE & RETAIL TRADE	0.03419	0.03060	0.03908	0.05374	0.02532	0.02171	0.02114	0.00521
28	FINANCE, INS., & REAL EST.	0.00953	0.02884	0.02064	0.00228	0.01435	0.03815	0.02090	0.00784
29	SERVICES	0.00916	0.01979	0.03786	0.08776	0.02708	0.07713	0.06000	0.01616
30	FEDERAL GOVT. ENTERPRISE	0.0	0.0	0.00157	0.0	0.0	0.01460	0.00125	0.00054
31	S. & L. GOVT. ENTERPRISE	0.0	0.0	0.00004	0.0	0.0	0.00009	0.00097	0.00027
32	HOUSEHOLDS	0.20625	0.29982	0.37215	0.12174	0.14398	0.32549	0.14830	0.05679
33	VALUE ADDED	0.08418	0.09338	0.04709	0.08061	0.19267	0.15757	0.27358	0.18324
34	SCRAP	0.0	0.0	0.00036	0.0	0.0	0.00036	0.00116	0.00001
35	WORLD INDUSTRY & INV. ADJ.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
36	IMPORTS	0.17593	0.20814	0.11425	0.18255	0.18095	0.08126	0.18603	0.02689
	TOTAL INPUT	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

TABLE VII (Continued)

	PRODUCING SECTOR	PURCHASING SECTOR							
		17	18	19	20	21	22	23	24
1	AGRICULTURE	0.00029	0.00002	0.00055	0.00046	0.00012	0.00014	0.00135	0.00022
2	MINING	0.00340	0.00008	0.06778	0.03501	0.00031	0.00036	0.00156	0.00074
3	CONSTRUCTION	0.00344	0.00092	0.00489	0.00261	0.00191	0.00161	0.00222	0.02114
4	FOOD & KINDRED PROD.	0.00021	0.00235	0.00026	0.00018	0.00035	0.00043	0.00132	0.00128
5	TEXTILES & FABRICS	0.01522	0.02673	0.00060	0.00008	0.00021	0.00177	0.00529	0.00016
6	APPAREL	0.00042	0.00241	0.00025	0.00029	0.00018	0.00288	0.00097	0.00055
7	LOGGING	0.0	0.0	0.0	0.0	0.0	0.0	0.00016	0.0
8	SAWMILLS	0.00010	0.00068	0.00151	0.00123	0.00104	0.00501	0.00809	0.0
9	OTHER LUMBER & WOOD PROD.	0.00353	0.00907	0.00839	0.00277	0.00090	0.01096	0.01334	0.00010
10	WOODEN FURNITURE & FIXT.	0.0	0.0	0.0	0.0	0.00000	0.00051	0.0	0.0
11	OTHER FURNITURE & FIXT.	0.0	0.0	0.00007	0.0	0.00000	0.00097	0.0	0.0
12	PAPER & ALLIED PROD.	0.00632	0.00651	0.00690	0.00055	0.00101	0.00066	0.01859	0.00071
13	PAPER CONTAINERS & BOXES	0.00922	0.00956	0.01423	0.00306	0.00180	0.00050	0.01167	0.00030
14	PRINTING & PUBLISHING	0.00064	0.00068	0.00100	0.00055	0.00188	0.00131	0.00106	0.00197
15	CHEMICALS & ALLIED PROD.	0.06927	0.00475	0.01047	0.00566	0.00177	0.00252	0.01229	0.00055
16	PETROLEUM REFINING & PROD.	0.00482	0.00379	0.01034	0.00548	0.00566	0.00467	0.00884	0.05733
17	RUBBER & PLASTIC PROD.	0.04088	0.06940	0.01978	0.00701	0.01301	0.01351	0.03545	0.00609
18	LEATHER & LEATHER PROD.	0.00002	0.04399	0.00000	0.00001	0.00001	0.00002	0.00068	0.00000
19	STONE, CLAY, & GLASS PROD.	0.00674	0.00031	0.10253	0.00819	0.00545	0.00867	0.00734	0.00049
20	METAL & METAL PROD.	0.02160	0.02077	0.01126	0.26533	0.11101	0.12296	0.08996	0.00503
21	MACHINERY & EQUIPMENT	0.01014	0.00723	0.00948	0.02764	0.19696	0.09473	0.02682	0.00720
22	TRANSPORTATION EQUIPMENT	0.00042	0.00002	0.00008	0.00036	0.00152	0.06526	0.00020	0.00787
23	MISCELLANEOUS MFG.	0.00147	0.00803	0.00159	0.00159	0.00176	0.00387	0.02975	0.00057
24	TRANSPORTATION	0.03340	0.01725	0.05996	0.02733	0.01301	0.01639	0.02309	0.11069
25	COMMUNICATION	0.00276	0.00271	0.00216	0.00219	0.00375	0.00222	0.00419	0.00829
26	UTILITIES	0.01643	0.00563	0.03614	0.01553	0.00751	0.00639	0.00812	0.00845
27	WHOLESALE & RETAIL TRADE	0.02195	0.03337	0.02208	0.02723	0.02728	0.03148	0.03390	0.02042
28	FINANCE, INS., & REAL EST.	0.01287	0.01593	0.01513	0.01271	0.01766	0.00727	0.02164	0.03617
29	SERVICES	0.04458	0.04249	0.03507	0.02966	0.04545	0.04359	0.02813	0.03731
30	FEDERAL GOVT. ENTERPRISE	0.00102	0.00484	0.00112	0.00059	0.00156	0.00151	0.00245	0.00146
31	S. & L. GOVT. ENTERPRISE	0.00007	0.00002	0.00015	0.00025	0.00004	0.00003	0.00048	0.00149
32	HOUSEHOLDS	0.20140	0.19720	0.23501	0.28302	0.24915	0.34886	0.15295	0.40206
33	VALUE ADDED	0.27673	0.22873	0.26897	0.11528	0.22379	0.04703	0.32717	0.22693
34	SCRAP	0.00121	0.00025	0.00362	0.01215	0.00225	0.00134	0.00220	0.00010
35	WORLD INDUSTRY & INV. ADJ.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
36	IMPORTS	0.18942	0.23428	0.04862	0.10500	0.06169	0.15056	0.11870	0.04033
	TOTAL INPUT	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

TABLE VII (Continued)

	PRODUCING SECTOR	PURCHASING SECTOR						
		25	26	27	28	29	30	31
1	AGRICULTURE	0.00265	0.00142	0.00056	0.00303	0.00720	0.00003	0.00129
2	MINING	0.0	0.16317	0.0	0.00001	0.00019	0.02738	0.01731
3	CONSTRUCTION	0.01946	0.01984	0.00276	0.03052	0.00689	0.00744	0.12926
4	FOOD & KINDRED PROD.	0.00015	0.00007	0.00036	0.00019	0.03784	0.00019	0.00005
5	TEXTILES & FABRICS	0.0	0.0	0.00002	0.0	0.00015	0.00012	0.00004
6	APPAREL	0.00017	0.00007	0.00025	0.00007	0.00190	0.00092	0.00119
7	LOGGING	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	SAWMILLS	0.0	0.0	0.0	0.0	0.00007	0.0	0.0
9	OTHER LUMBER & WOOD PROD.	0.0	0.0	0.00017	0.0	0.00017	0.0	0.0
10	WOODEN FURNITURE & FIXT.	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	OTHER FURNITURE & FIXT.	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	PAPER & ALLIED PROD.	0.00055	0.00030	0.00382	0.00092	0.00204	0.00123	0.00090
13	PAPER CONTAINERS & BOXES	0.0	0.0	0.00110	0.0	0.00124	0.00021	0.00001
14	PRINTING & PUBLISHING	0.00342	0.00118	0.00197	0.00456	0.00648	0.00556	0.00400
15	CHEMICALS & ALLIED PROD.	0.00001	0.00071	0.00020	0.00011	0.00411	0.00160	0.00721
16	PETROLEUM REFINING & PROD.	0.00087	0.03568	0.01161	0.00385	0.00825	0.00773	0.02952
17	RUBBER & PLASTIC PROD.	0.00028	0.00076	0.00208	0.00103	0.00614	0.00223	0.00082
18	LEATHER & LEATHER PROD.	0.00001	0.00000	0.00001	0.00001	0.00014	0.00005	0.00000
19	STONE, CLAY, & GLASS PROD.	0.00004	0.00008	0.00036	0.00002	0.00279	0.00030	0.00073
20	METAL & METAL PROD.	0.00047	0.00029	0.00026	0.00005	0.00420	0.00126	0.00151
21	MACHINERY & EQUIPMENT	0.02038	0.00358	0.00122	0.00043	0.01235	0.00172	0.00761
22	TRANSPORTATION EQUIPMENT	0.00018	0.00008	0.00015	0.00004	0.01004	0.00066	0.00213
23	MISCELLANEOUS MFG.	0.00052	0.00028	0.00035	0.00028	0.00582	0.00068	0.00049
24	TRANSPORTATION	0.00406	0.00703	0.01187	0.00213	0.01243	0.06479	0.01408
25	COMMUNICATION	0.01171	0.00241	0.00991	0.00530	0.00740	0.00212	0.00467
26	UTILITIES	0.00875	0.19666	0.01638	0.00651	0.01590	0.02421	0.11530
27	WHOLESALE & RETAIL TRADE	0.00196	0.00563	0.01153	0.00286	0.02397	0.00303	0.00878
28	FINANCE, INS., & REAL EST.	0.02955	0.01252	0.04151	0.09407	0.04899	0.02830	0.01717
29	SERVICES	0.05537	0.01046	0.04114	0.02810	0.08792	0.04422	0.03899
30	FEDERAL GOVT. ENTERPRISE	0.00436	0.00279	0.00489	0.00767	0.00546	0.00235	0.00137
31	S. & L. GOVT. ENTERPRISE	0.00068	0.00018	0.00078	0.00035	0.00066	0.00061	0.00018
32	HOUSEHOLDS	0.48341	0.11414	0.49849	0.14173	0.35661	0.78453	0.23313
33	VALUE ADDED	0.32775	0.40287	0.31416	0.61345	0.23496	-0.03502	0.26882
34	SCRAP	0.0	0.0	0.00004	0.0	0.00033	0.0	0.00001
35	WORLD INDUSTRY & INV. ADJ.	0.0	0.0	0.0	0.0	0.0	0.0	0.0
36	IMPORTS	0.02323	0.01779	0.02207	0.05191	0.08734	0.02157	0.09343
	TOTAL INPUT	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

economy, I-O analysis is useful for evaluating the total effects which result from a change in the economic activity of a given sector. Such effects can be measured in terms of output, income, and employment.

Output Multiplier

Output multipliers measure the total amount of output generated in all sectors resulting from a one dollar increase in the final demand for a particular sector's output. These multipliers are directly computed from the interdependence coefficients matrix. The interdependence coefficients matrix (Table VIII) represents the total direct and indirect requirements necessary to deliver one dollar's worth of output to final demand. (The mathematical derivation of the interdependence matrix was presented earlier in Chapter III.) This matrix can perhaps best be explained by discussing a particular sector, e.g., the agriculture sector (column 1).

If the demand for agricultural products increases, the agriculture sector will increase its total output to satisfy the demand. As shown by the direct requirements matrix (Table VII), for every dollar increase in output, agriculture directly requires $.37283 worth of inputs from itself, $.00198 from mining, $.00437 construction, and so on down the column (excluding households). This generates successive rounds of production since each of the sectors which provide goods and services to agriculture must themselves purchase more inputs. For example, for agriculture to supply itself with $.37283 worth of agriculture products as inputs, it must produce .37283 x $.37283 worth of additional output, purchase an additional .37283 x $.00198 from mining, and so on. For the mining sector to provide agriculture with $.00198 in output it will require .00002 x $.00198 worth of additional

TABLE VIII

OKLAHOMA INTERDEPENDENCE COEFFICIENTS MATRIX, HOUSEHOLDS EXOGENOUS, 1978

	PRODUCING SECTOR	PURCHASING SECTOR 1	2	3	4	5	6	7	8
1	AGRICULTURE	1.02548	0.00211	0.01212	0.56010	0.04670	0.01328	0.42365	0.11729
2	MINING	0.02129	1.06843	0.05238	0.02469	0.02008	0.01168	0.03941	0.02798
3	CONSTRUCTION	0.01338	0.03222	1.00788	0.00969	0.00654	0.00463	0.00934	0.00694
4	FOOD & KINDRED PROD.	0.08074	0.00144	0.00479	1.14104	0.00654	0.00411	0.02478	0.00937
5	TEXTILES & FABRICS	0.00094	0.00015	0.00216	0.00071	1.13412	0.12158	0.00061	0.00048
6	APPAREL	0.00043	0.00017	0.00046	0.00070	0.00852	1.12585	0.00046	0.00034
7	LOGGING	0.00094	0.00059	0.01306	0.00168	0.00116	0.00111	1.00065	0.27127
8	SAWMILLS	0.00104	0.00079	0.01975	0.00211	0.00126	0.00133	0.00097	1.00191
9	OTHER LUMBER & WOOD PROD.	0.00326	0.00179	0.05164	0.00279	0.00330	0.00233	0.00180	0.00418
10	WOODEN FURNITURE & FIXT.	0.00001	0.00001	0.00040	0.00000	0.00000	0.00000	0.00001	0.00003
11	OTHER FURNITURE & FIXT.	0.00001	0.00001	0.00037	0.00001	0.00000	0.00000	0.00002	0.00003
12	PAPER & ALLIED PROD.	0.00383	0.00091	0.00603	0.01521	0.00669	0.00872	0.00271	0.00207
13	PAPER CONTAINERS & BOXES	0.00250	0.00033	0.00251	0.01646	0.00796	0.00922	0.00153	0.00116
14	PRINTING & PUBLISHING	0.00219	0.00127	0.00181	0.00859	0.00182	0.00289	0.00231	0.00166
15	CHEMICALS & ALLIED PROD.	0.02132	0.00357	0.00896	0.01287	0.07909	0.02087	0.00782	0.00390
16	PETROLEUM REFINING & PROD.	0.03775	0.01140	0.03948	0.02361	0.01574	0.01056	0.05819	0.03052
17	RUBBER & PLASTIC PROD.	0.00864	0.00210	0.01404	0.01521	0.03247	0.01464	0.01118	0.00671
18	LEATHER & LEATHER PROD.	0.00010	0.00001	0.00003	0.00005	0.00003	0.00146	0.00005	0.00003
19	STONE, CLAY, & GLASS PROD.	0.00352	0.00370	0.07987	0.02154	0.00828	0.00244	0.00314	0.00726
20	METAL & METAL PROD.	0.01437	0.02532	0.16736	0.05257	0.01086	0.01717	0.02820	0.04144
21	MACHINERY & EQUIPMENT	0.01758	0.03402	0.06631	0.01361	0.01916	0.00945	0.11647	0.15129
22	TRANSPORTATION EQUIPMENT	0.00129	0.00064	0.00221	0.00152	0.00115	0.00100	0.01990	0.00815
23	MISCELLANEOUS MFG.	0.00080	0.00090	0.00456	0.00163	0.00218	0.01083	0.01099	0.01245
24	TRANSPORTATION	0.03444	0.01075	0.04510	0.05110	0.04343	0.03049	0.01809	0.03066
25	COMMUNICATION	0.00518	0.00319	0.00512	0.00478	0.00562	0.00578	0.00427	0.00355
26	UTILITIES	0.02448	0.02166	0.01851	0.02761	0.03235	0.01917	0.01887	0.04009
27	WHOLESALE & RETAIL TRADE	0.05581	0.01051	0.07888	0.06630	0.05512	0.05295	0.10834	0.05966
28	FINANCE, INS., & REAL EST.	0.05343	0.12914	0.03422	0.05160	0.03303	0.03220	0.11476	0.05001
29	SERVICES	0.03083	0.02558	0.08897	0.06500	0.05901	0.05747	0.09520	0.08232
30	FEDERAL GOVT. ENTERPRISE	0.00183	0.00197	0.00206	0.00268	0.00270	0.00445	0.00252	0.00175
31	S. & L. GOVT. ENTERPRISE	0.00023	0.00052	0.00036	0.00040	0.00031	0.00024	0.00029	0.00023
	TOTAL INPUT	2.12763	1.39517	1.83138	2.19726	1.64520	1.59790	2.12652	2.03471

TABLE VIII (Continued)

	PRODUCING SECTOR	PURCHASING SECTOR							
		9	10	11	12	13	14	15	16
1	AGRICULTURE	0.06341	0.01385	0.01015	0.03722	0.01373	0.00909	0.01273	0.00296
2	MINING	0.03200	0.01511	0.02395	0.05917	0.02949	0.01590	0.07473	0.03787
3	CONSTRUCTION	0.01827	0.01143	0.00864	0.04488	0.02302	0.01271	0.01253	0.03030
4	FOOD & KINDRED PROD.	0.00649	0.00304	0.00600	0.00784	0.00438	0.00620	0.01154	0.00277
5	TEXTILES & FABRICS	0.00030	0.06044	0.02069	0.00054	0.00031	0.00095	0.00036	0.00027
6	APPAREL	0.00026	0.00150	0.00374	0.00048	0.00031	0.00074	0.00054	0.00022
7	LOGGING	0.19311	0.02185	0.01224	0.07523	0.02442	0.00898	0.00148	0.00074
8	SAWMILLS	0.14009	0.06438	0.01989	0.10046	0.03267	0.01204	0.00179	0.00102
9	OTHER LUMBER & WOOD PROD.	1.07792	0.02433	0.04549	0.00313	0.00170	0.00100	0.00116	0.00187
10	WOODEN FURNITURE & FIXT.	0.00001	1.00001	0.00000	0.00002	0.00001	0.00001	0.00001	0.00001
11	OTHER FURNITURE & FIXT.	0.00023	0.00002	1.00101	0.00002	0.00001	0.00001	0.00001	0.00001
12	PAPER & ALLIED PROD.	0.03164	0.02127	0.00792	1.03342	0.33275	0.12107	0.00748	0.00318
13	PAPER CONTAINERS & BOXES	0.00369	0.00180	0.01370	0.00124	1.00086	0.00234	0.00548	0.00203
14	PRINTING & PUBLISHING	0.00125	0.00137	0.00359	0.00211	0.00139	1.11825	0.00410	0.00134
15	CHEMICALS & ALLIED PROD.	0.01557	0.02902	0.01370	0.03009	0.02111	0.01190	1.08539	0.01159
16	PETROLEUM REFINING & PROD.	0.03826	0.01014	0.01483	0.04747	0.02716	0.01383	0.02951	1.09881
17	RUBBER & PLASTIC PROD.	0.00443	0.05966	0.06581	0.00563	0.00341	0.00936	0.01226	0.00348
18	LEATHER & LEATHER PROD.	0.00002	0.00002	0.00002	0.00005	0.00003	0.00007	0.00006	0.00002
19	STONE, CLAY, & GLASS PROD.	0.00364	0.00324	0.01458	0.00524	0.00304	0.00310	0.00741	0.00595
20	METAL & METAL PROD.	0.04737	0.05258	0.22386	0.02325	0.03043	0.01311	0.04865	0.02910
21	MACHINERY & EQUIPMENT	0.06358	0.02390	0.02237	0.04152	0.03214	0.01383	0.02292	0.02432
22	TRANSPORTATION EQUIPMENT	0.01002	0.00604	0.00185	0.00395	0.00271	0.00207	0.00153	0.00110
23	MISCELLANEOUS MFG.	0.01067	0.01156	0.00301	0.03848	0.02076	0.01133	0.00208	0.00123
24	TRANSPORTATION	0.03673	0.02516	0.05003	0.09088	0.06788	0.05524	0.05415	0.05187
25	COMMUNICATION	0.00541	0.00636	0.00512	0.00452	0.00551	0.01113	0.00496	0.00377
26	UTILITIES	0.03978	0.02263	0.02256	0.16552	0.06494	0.03426	0.05971	0.03557
27	WHOLESALE & RETAIL TRADE	0.06893	0.04767	0.05760	0.07958	0.05573	0.03994	0.03237	0.01572
28	FINANCE, INS., & REAL EST.	0.04567	0.04764	0.04232	0.03787	0.03583	0.06357	0.04579	0.09119
29	SERVICES	0.05001	0.04698	0.06740	0.13146	0.08009	0.11994	0.08573	0.04058
30	FEDERAL GOVT. ENTERPRISE	0.00145	0.00137	0.00320	0.00237	0.00153	0.01805	0.00286	0.00226
31	S. & L. GOVT. ENTERPRISE	0.00023	0.00021	0.00032	0.00043	0.00029	0.00038	0.00130	0.00072
	TOTAL INPUT	2.03044	1.67455	1.78555	2.07458	1.91761	1.73040	1.63059	2.10188

TABLE VIII (Continued)

	PRODUCING SECTOR	PURCHASING SECTOR							
		17	18	19	20	21	22	23	24
1	AGRICULTURE	0.00542	0.00675	0.00549	0.00440	0.00425	0.00560	0.00892	0.00396
2	MINING	0.02343	0.01220	0.10656	0.06756	0.02078	0.02095	0.02402	0.04828
3	CONSTRUCTION	0.00881	0.00538	0.01452	0.00992	0.00721	0.00686	0.00895	0.02898
4	FOOD & KINDRED PROD.	0.00407	0.00609	0.00346	0.00317	0.00418	0.00421	0.00457	0.00435
5	TEXTILES & FABRICS	0.01821	0.03349	0.00135	0.00050	0.00079	0.00310	0.00716	0.00057
6	APPAREL	0.00088	0.00334	0.00058	0.00067	0.00057	0.00383	0.00145	0.00091
7	LOGGING	0.00183	0.00317	0.00359	0.00170	0.00118	0.00436	0.00726	0.00063
8	SAWMILLS	0.00211	0.00360	0.00481	0.00295	0.00239	0.00809	0.01327	0.00092
9	OTHER LUMBER & WOOD PROD.	0.00479	0.01121	0.01113	0.00452	0.00245	0.01413	0.01608	0.00188
10	WOODEN FURNITURE & FIXT.	0.00000	0.00000	0.00001	0.00000	0.00000	0.00055	0.00000	0.00002
11	OTHER FURNITURE & FIXT.	0.00001	0.00001	0.00008	0.00001	0.00001	0.00105	0.00001	0.00002
12	PAPER & ALLIED PROD.	0.01168	0.01276	0.01486	0.00413	0.00394	0.00342	0.02610	0.00222
13	PAPER CONTAINERS & BOXES	0.01067	0.01159	0.01663	0.00493	0.00351	0.00224	0.01353	0.00089
14	PRINTING & PUBLISHING	0.00200	0.00194	0.00248	0.00157	0.00387	0.00303	0.00246	0.00349
15	CHEMICALS & ALLIED PROD.	0.08122	0.01514	0.01660	0.01066	0.00618	0.00740	0.02012	0.00292
16	PETROLEUM REFINING & PROD.	0.01428	0.01085	0.02434	0.01583	0.01417	0.01349	0.01878	0.07432
17	RUBBER & PLASTIC PROD.	1.04584	0.07865	0.02529	0.01239	0.01998	0.02031	0.04156	0.00883
18	LEATHER & LEATHER PROD.	0.00004	1.04603	0.00002	0.00002	0.00003	0.00004	0.00075	0.00002
19	STONE, CLAY, & GLASS PROD.	0.00993	0.00257	1.11652	0.01418	0.01060	0.01426	0.01152	0.00378
20	METAL & METAL PROD.	0.04061	0.03892	0.02814	1.37444	0.19430	0.20516	0.13931	0.01895
21	MACHINERY & EQUIPMENT	0.02021	0.01644	0.02258	0.05302	1.25635	0.13873	0.04640	0.01684
22	TRANSPORTATION EQUIPMENT	0.00177	0.00122	0.00169	0.00175	0.00328	1.07141	0.00158	0.01025
23	MISCELLANEOUS MFG.	0.00288	0.01009	0.00332	0.00315	0.00345	0.00584	1.03283	0.00143
24	TRANSPORTATION	0.05001	0.03164	0.08461	0.04914	0.03020	0.03457	0.04169	1.13251
25	COMMUNICATION	0.00503	0.00503	0.00497	0.00516	0.00701	0.00525	0.00686	0.01099
26	UTILITIES	0.03274	0.01741	0.06077	0.03399	0.02156	0.02043	0.02480	0.01838
27	WHOLESALE & RETAIL TRADE	0.03311	0.04591	0.03508	0.04512	0.04541	0.05003	0.04948	0.02988
28	FINANCE, INS., & REAL EST.	0.02953	0.03151	0.04304	0.03740	0.03914	0.02687	0.04096	0.05095
29	SERVICES	0.06850	0.06581	0.06072	0.05844	0.07856	0.07511	0.05483	0.05779
30	FEDERAL GOVT. ENTERPRISE	0.00230	0.00631	0.00264	0.00260	0.00338	0.00319	0.00393	0.00283
31	S. & L. GOVT. ENTERPRISE	0.00035	0.00022	0.00047	0.00056	0.00027	0.00028	0.00073	0.00184
	TOTAL INPUT	1.53225	1.53529	1.71633	1.82470	1.78902	1.77379	1.66993	1.53959

TABLE VIII (Continued)

	PRODUCING SECTOR	PURCHASING SECTOR						
		25	26	27	28	29	30	31
1	AGRICULTURE	0.00727	0.00456	0.00351	0.00740	0.03750	0.00277	0.00631
2	MINING	0.00606	0.24801	0.01414	0.00771	0.01592	0.04538	0.07548
3	CONSTRUCTION	0.02250	0.03407	0.00679	0.03574	0.01254	0.01328	0.13769
4	FOOD & KINDRED PROD.	0.00346	0.00157	0.00283	0.00232	0.04865	0.00297	0.00328
5	TEXTILES & FABRICS	0.00015	0.00015	0.00016	0.00015	0.00076	0.00040	0.00058
6	APPAREL	0.00039	0.00021	0.00043	0.00021	0.00252	0.00125	0.00157
7	LOGGING	0.00044	0.00056	0.00051	0.00062	0.00073	0.00040	0.00199
8	SAWMILLS	0.00066	0.00082	0.00068	0.00091	0.00108	0.00057	0.00298
9	OTHER LUMBER & WOOD PROD.	0.00127	0.00183	0.00061	0.00188	0.00136	0.00080	0.00720
10	WOODEN FURNITURE & FIXT.	0.00001	0.00001	0.00000	0.00001	0.00001	0.00001	0.00006
11	OTHER FURNITURE & FIXT.	0.00001	0.00001	0.00000	0.00001	0.00002	0.00001	0.00005
12	PAPER & ALLIED PROD.	0.00163	0.00127	0.00510	0.00219	0.00516	0.00269	0.00293
13	PAPER CONTAINERS & BOXES	0.00032	0.00033	0.00134	0.00023	0.00255	0.00053	0.00070
14	PRINTING & PUBLISHING	0.00479	0.00235	0.00310	0.00662	0.00914	0.00722	0.00570
15	CHEMICALS & ALLIED PROD.	0.00098	0.00277	0.00123	0.00105	0.00716	0.00298	0.01037
16	PETROLEUM REFINING & PROD.	0.00426	0.05349	0.01628	0.00758	0.01558	0.01655	0.04646
17	RUBBER & PLASTIC PROD.	0.00176	0.00235	0.00306	0.00219	0.00937	0.00385	0.00407
18	LEATHER & LEATHER PROD.	0.00002	0.00001	0.00003	0.00002	0.00018	0.00006	0.00002
19	STONE, CLAY, & GLASS PROD.	0.00238	0.00338	0.00131	0.00309	0.00595	0.00190	0.01236
20	METAL & METAL PROD.	0.00968	0.01273	0.00343	0.00710	0.01786	0.00737	0.03015
21	MACHINERY & EQUIPMENT	0.02908	0.01604	0.00430	0.00429	0.02225	0.00689	0.02338
22	TRANSPORTATION EQUIPMENT	0.00108	0.00064	0.00091	0.00059	0.01224	0.00203	0.00339
23	MISCELLANEOUS MFG.	0.00123	0.00091	0.00099	0.00084	0.00722	0.00139	0.00174
24	TRANSPORTATION	0.00866	0.01680	0.01715	0.00665	0.02319	0.07716	0.02803
25	COMMUNICATION	1.01304	0.00448	0.01121	0.00665	0.00985	0.00392	0.00701
26	UTILITIES	0.01455	1.25269	0.02450	0.01172	0.02787	0.03511	0.15128
27	WHOLESALE & RETAIL TRADE	0.00741	0.01330	1.01527	0.00752	0.03465	0.00887	0.02445
28	FINANCE, INS., & REAL EST.	0.04019	0.05099	0.05334	1.10963	0.06966	0.04465	0.03971
29	SERVICES	0.06842	0.02641	0.05204	0.04014	1.11106	0.05833	0.06418
30	FEDERAL GOVT. ENTERPRISE	0.00536	0.00440	0.00590	0.00961	0.00728	1.00348	0.00295
31	S. & L. GOVT. ENTERPRISE	0.00078	0.00042	0.00090	0.00046	0.00087	0.00083	1.00040
	TOTAL INPUT	1.25783	1.75755	1.25106	1.28493	1.52021	1.35363	1.69646

agriculture output, .05326 x $.00198 of additional output from itself, and so on. For the construction sector to provide $.00437 worth of output to agriculture, it will require .00171 x $.00437 worth of additional output from agriculture, .01322 x $.00437 from mining, .00017 x $.00437 from itself, and so on.

As successive rounds of purchases occur, the increases in required output eventually approach zero. The total direct and indirect requirements of the agriculture sector are presented in column one of Table VIII. The interpretation of this column is that for agriculture to deliver one dollar's worth of output to final demand, it must itself produce $1.63548 of output, the mining sector must produce $0.03129, construction must produce $0.01338, and so on down column one.

The Type I output multiplier is defined as the total change in the output of all sectors as a result of a one dollar change in final demand in a given sector. Therefore, the Type I output multiplier for any given sector is equal to the sum of that column in the interdependence coefficients matrix (Table III). They are also presented in Table X.

The Type I output multipliers ranged from a high of 2.19 for the food and kindred products sector to a low of 1.25 for the wholesale and retail trade sector. A large Type I output multiplier indicates that a sector has a high degree of interdependence with the economy. Sectors with large output multipliers are characterized as purchasing many of their inputs from Oklahoma industries. The agriculture, logging, petroleum refining and products, paper and allied products, saw mills, other lumber and wood products, and paper containers and boxes sectors ranked second through eighth, respectively, in Type I output multipliers.

Sectors with small Type I output multipliers, on the other hand, indicate little interaction with industries outside the sector and relatively higher levels of imports. The communications sector; the finance, insurance, and real estate sector; and the federal government enterprise sector are good examples, with output multipliers of only 1.26, 1.28, and 1.35, respectively.

Type I output multipliers do not account for changes in household expenditures that would be expected to accompany a change in final demand (and therefore a change in household income) in a sector. This change is called the induced effect. It was included by recalculating the interdependence matrix with households included as an endogenous sector (Table IX).

Type II output multipliers are defined as the direct, indirect, and induced requirements of a sector per dollar increase in final demand. They are calculated by summing the columns of the interdependence coefficients matrix presented in Table IX and are presented in Table X.

The Type II output multipliers ranged from a high of 4.27 for the federal government enterprise sector, to a low of 1.99 for the finance, insurance, and real estate sector. Federal government enterprise was followed by construction, other furniture and fixtures, transportation equipment, sawmills, logging, metal and metal products, and other lumber and wood products. These sectors will generate the greatest amount of economic activity per dollar increase in final demand.

The FPI sectors produced $782 million in output in 1978. The total effect of this level of output on the output of the rest of the economy can be calculated by multiplying the output for each sector by

TABLE IX

OKLAHOMA INTERDEPENDENCE COEFFICIENTS MATRIX,
HOUSEHOLDS ENDOGENOUS, 1978

	PRODUCING SECTOR	PURCHASING SECTOR							
		1	2	3	4	5	6	7	8
1	AGRICULTURE	1.65616	0.03784	0.05830	0.58567	0.06984	0.04673	0.45755	0.15451
2	MINING	0.04795	1.09720	0.08958	0.04545	0.03871	0.03862	0.06672	0.05796
3	CONSTRUCTION	0.01931	0.04246	1.02112	0.01729	0.01317	0.01422	0.01906	0.07761
4	FOOD & KINDRED PROD.	0.11255	0.05640	0.07584	1.18070	0.04214	0.05557	0.07694	0.06664
5	TEXTILES & FABRICS	0.00258	0.00298	0.00583	0.00276	1.13596	0.12423	0.00329	0.00343
6	APPAREL	0.00707	0.01165	0.01531	0.00859	0.01596	1.13660	0.01136	0.01231
7	LOGGING	0.00140	0.00139	0.01410	0.00225	0.00168	0.00186	1.00141	0.27210
8	SAWMILLS	0.00174	0.00199	0.02130	0.00257	0.00204	0.00246	0.00211	1.00316
9	OTHER LUMBER & WOOD PROD.	0.00409	0.00323	0.05351	0.00363	0.00424	0.00368	0.00317	0.00568
10	WOODEN FURNITURE & FIXT.	0.00081	0.00140	0.00219	0.00100	0.00090	0.00130	0.00133	0.00148
11	OTHER FURNITURE & FIXT.	0.00034	0.00058	0.00111	0.00042	0.00038	0.00054	0.00057	0.00063
12	PAPER & ALLIED PROD.	0.00681	0.00605	0.01268	0.01892	0.01002	0.01353	0.00759	0.00743
13	PAPER CONTAINERS & BOXES	0.00349	0.00204	0.00472	0.01769	0.00906	0.01082	0.00315	0.00295
14	PRINTING & PUBLISHING	0.00739	0.01024	0.01342	0.01546	0.00763	0.01130	0.01083	0.01102
15	CHEMICALS & ALLIED PROD.	0.02577	0.01126	0.01890	0.01841	0.08407	0.02807	0.01512	0.01191
16	PETROLEUM REFINING & PROD.	0.05734	0.04524	0.08323	0.04803	0.03766	0.04224	0.09031	0.06578
17	RUBBER & PLASTIC PROD.	0.01297	0.00958	0.02371	0.02061	0.03732	0.02165	0.01827	0.01450
18	LEATHER & LEATHER PROD.	0.00060	0.00088	0.00115	0.00068	0.00059	0.00227	0.00088	0.00094
19	STONE, CLAY, & GLASS PROD.	0.00579	0.00762	0.08495	0.02478	0.01082	0.00612	0.00686	0.01135
20	METAL & METAL PROD.	0.02457	0.04294	0.19014	0.06569	0.02228	0.03366	0.04492	0.05980
21	MACHINERY & EQUIPMENT	0.03630	0.06638	0.10814	0.03695	0.04012	0.03974	0.14718	0.18501
22	TRANSPORTATION EQUIPMENT	0.00944	0.01472	0.02041	0.01167	0.01027	0.01417	0.03326	0.02282
23	MISCELLANEOUS MFG.	0.00515	0.00842	0.01428	0.00706	0.00705	0.01787	0.01813	0.02028
24	TRANSPORTATION	0.05367	0.04398	0.08805	0.07578	0.06495	0.06160	0.04962	0.06528
25	COMMUNICATION	0.01315	0.01696	0.02292	0.01472	0.01453	0.01867	0.01734	0.01789
26	UTILITIES	0.04896	0.06396	0.07318	0.05812	0.05974	0.05877	0.05901	0.08416
27	WHOLESALE & RETAIL TRADE	0.13710	0.15095	0.26044	0.16762	0.14608	0.18443	0.24163	0.20600
28	FINANCE, INS., & REAL EST.	0.18684	0.29053	0.24286	0.16803	0.13756	0.18329	0.26792	0.21817
29	SERVICES	0.11849	0.17704	0.28478	0.17428	0.15711	0.19927	0.23894	0.24013
30	FEDERAL GOVT. ENTERPRISE	0.00490	0.00727	0.00891	0.00650	0.00613	0.00541	0.00754	0.00727
31	S. & L. GOVT. ENTERPRISE	0.00135	0.00245	0.00286	0.00179	0.00156	0.00205	0.00212	0.00224
32	HOUSEHOLDS	0.40803	0.70501	0.91141	0.50863	0.45662	0.66002	0.66907	0.73458
	TOTAL INPUT	3.02209	2.94063	3.82931	3.31225	2.64616	3.04474	3.59319	3.64499

TABLE IX (Continued)

	PRODUCING SECTOR	PURCHASING SECTOR							
		9	10	11	12	13	14	15	16
1	AGRICULTURE	0.11768	0.04933	0.05477	0.06728	0.04006	0.04926	0.03651	0.03297
2	MINING	0.05560	0.04368	0.05989	0.08339	0.05070	0.04825	0.09388	0.66204
3	CONSTRUCTION	0.02810	0.02160	0.02143	0.05381	0.03057	0.02423	0.01934	0.03890
4	FOOD & KINDRED PROD.	0.05922	0.05763	0.07465	0.05409	0.04489	0.06800	0.04813	0.04893
5	TEXTILES & FABRICS	0.00302	0.00326	0.02423	0.00253	0.00240	0.00413	0.00225	0.00265
6	APPAREL	0.01127	0.01290	0.01808	0.01015	0.00877	0.01365	0.00818	0.00987
7	LOGGING	0.19387	0.02265	0.01324	0.07591	0.02501	0.00988	0.00201	0.00141
8	SAWMILLS	0.14124	0.06557	0.02139	0.10147	0.03356	0.01339	0.00259	0.00203
9	OTHER LUMBER & WOOD PROD.	1.07931	0.02577	0.04729	0.00435	0.00276	0.00262	0.00212	0.00309
10	WOODEN FURNITURE & FIXT.	0.00134	1.00138	0.00174	0.00119	0.00103	0.00156	0.00093	0.00118
11	OTHER FURNITURE & FIXT.	0.00078	0.00058	1.00172	0.00050	0.00043	0.00065	0.00039	0.00049
12	PAPER & ALLIED PROD.	0.03658	0.02638	0.01435	1.03775	0.33654	0.12686	0.01091	0.00750
13	PAPER CONTAINERS & BOXES	0.00533	0.00350	0.01584	0.00278	1.00212	0.00427	0.00662	0.00347
14	PRINTING & PUBLISHING	0.00986	0.01028	0.01480	0.00967	0.00800	1.12835	0.01007	0.00887
15	CHEMICALS & ALLIED PROD.	0.02295	0.03665	0.02331	0.03656	0.02678	0.02055	1.09051	0.01805
16	PETROLEUM REFINING & PRCD.	0.07073	0.04375	0.05710	0.07556	0.05210	0.05188	0.05204	1.12724
17	RUBBER & PLASTIC PROD.	0.01160	0.06709	0.07515	0.01153	0.00893	0.01778	0.01724	0.00976
18	LEATHER & LEATHER PROD.	0.00086	0.00088	0.00111	0.00079	0.00067	0.00105	0.00064	0.00075
19	STONE, CLAY, & GLASS PROD.	0.00740	0.00714	0.01948	0.00854	0.00593	0.00751	0.01002	0.00924
20	METAL & METAL PROD.	0.06428	0.11008	0.24586	0.03808	0.04341	0.03293	0.06038	0.04390
21	MACHINERY & EQUIPMENT	0.05462	0.05603	0.06278	0.06875	0.05559	0.05021	0.04446	0.05150
22	TRANSPORTATION EQUIPMENT	0.02352	0.02002	0.01943	0.01579	0.01308	0.01790	0.01091	0.01292
23	MISCELLANEOUS MFG.	0.01788	0.01903	0.01240	0.04461	0.02631	0.01978	0.00708	0.00754
24	TRANSPORTATION	0.06861	0.05816	0.09153	0.11865	0.09237	0.09261	0.07627	0.07978
25	COMMUNICATION	0.01862	0.02003	0.02231	0.01651	0.01566	0.02661	0.01413	0.01534
26	UTILITIES	0.08035	0.06464	0.07539	0.20111	0.09611	0.08182	0.08787	0.07110
27	WHOLESALE & RETAIL TRADE	0.20365	0.18716	0.23301	0.19778	0.15925	0.19787	0.12587	0.13368
28	FINANCE, INS., & REAL EST.	0.20050	0.20794	0.24389	0.17370	0.15479	0.24505	0.15323	0.22675
29	SERVICES	0.19530	0.19741	0.25657	0.25854	0.19173	0.29026	0.18656	0.16780
30	FEDERAL GOVT. ENTERPRISE	0.00653	0.00664	0.00982	0.00683	0.00543	0.02401	0.00638	0.00671
31	S. & L. GOVT. ENTERPRISE	0.00209	0.00213	0.00274	0.00206	0.00171	0.00255	0.00259	0.00235
32	HOUSEHOLDS	0.67630	0.70022	0.88056	0.59336	0.51966	0.79276	0.46934	0.59215
	TOTAL INPUT	3.51298	3.20951	3.71583	3.37529	3.05677	3.46823	2.65944	3.39995

TABLE IX (Continued)

	PRODUCING SECTOR	PURCHASING SECTOR							
		17	18	19	20	21	22	23	24
1	AGRICULTURE	0.03110	0.03238	0.03832	0.04407	0.03994	0.04924	0.03399	0.04657
2	MINING	0.04412	0.03284	0.13300	0.09951	0.04953	0.05610	0.04421	0.08261
3	CONSTRUCTION	0.01618	0.01273	0.02393	0.02129	0.01744	0.01938	0.01614	0.04120
4	FOOD & KINDRED PROD.	0.04359	0.04551	0.05397	0.06420	0.05911	0.07134	0.04314	0.06991
5	TEXTILES & FABRICS	0.02024	0.03552	0.00395	0.00365	0.00362	0.00656	0.00915	0.00395
6	APPAREL	0.00913	0.01158	0.01113	0.01342	0.01205	0.01785	0.00951	0.01460
7	LOGGING	0.00241	0.00374	0.00432	0.00259	0.00198	0.00534	0.00782	0.00188
8	SAWMILLS	0.00297	0.00446	0.00591	0.00428	0.00359	0.00956	0.01412	0.00235
9	OTHER LUMBER & WOOD PRCD.	0.00583	0.01225	0.01245	0.00652	0.00389	0.01589	0.01710	0.00360
10	WOODEN FURNITURE & FIXT.	0.00100	0.00100	0.00128	0.00154	0.00139	0.00224	0.00098	0.00167
11	OTHER FURNITURE & FIXT.	0.00042	0.00042	0.00061	0.00064	0.00058	0.00175	0.00041	0.00070
12	PAPER & ALLIED PROD.	0.01538	0.01645	0.01959	0.00965	0.00908	0.00970	0.02971	0.00836
13	PAPER CONTAINERS & BOXES	0.01190	0.01282	0.01820	0.00663	0.00522	0.00433	0.01473	0.00293
14	PRINTING & PUBLISHING	0.00846	0.00838	0.01073	0.01193	0.01284	0.01400	0.00876	0.01419
15	CHEMICALS & ALLIED PROD.	0.06675	0.02066	0.02366	0.01920	0.01387	0.01680	0.02552	0.01210
16	PETROLEUM REFINING & PROD.	0.03862	0.03512	0.05544	0.05341	0.04799	0.05483	0.04253	0.11469
17	RUBBER & PLASTIC PROD.	1.05122	0.06402	0.03216	0.02069	0.02745	0.02945	0.04681	0.01775
18	LEATHER & LEATHER PROD.	0.00067	1.04666	0.00082	0.00059	0.00090	0.00110	0.00136	0.00105
19	STONE, CLAY, & GLASS PROD.	0.01275	0.00539	1.12012	0.01854	0.01453	0.01905	0.01428	0.00847
20	METAL & METAL PROD.	0.05328	0.05156	0.04434	1.39401	0.21191	0.22668	0.15167	0.03997
21	MACHINERY & EQUIPMENT	0.04348	0.03965	0.05232	0.06895	1.28869	0.17826	0.06911	0.05543
22	TRANSPORTATION EQUIPMENT	0.01189	0.01132	0.01463	0.01738	0.01735	1.08860	0.01146	0.02704
23	MISCELLANEOUS MFG.	0.00828	0.01548	0.01023	0.01150	0.01097	0.01502	1.03811	0.01039
24	TRANSPORTATION	0.07391	0.05548	0.11514	0.06604	0.06340	0.07515	0.06501	1.17214
25	COMMUNICATION	0.01493	0.01490	0.01762	0.02045	0.02076	0.02206	0.01652	0.02741
26	UTILITIES	0.06315	0.04774	0.09963	0.08095	0.06382	0.07208	0.05448	0.06883
27	WHOLESALE & RETAIL TRADE	0.13410	0.14664	0.16414	0.20107	0.18576	0.22157	0.14803	0.19740
28	FINANCE, INS., & REAL EST.	0.14558	0.14727	0.19135	0.21661	0.20042	0.22399	0.15422	0.24346
29	SERVICES	0.17741	0.17445	0.19991	0.22663	0.22991	0.26010	0.16112	0.23845
30	FEDERAL GOVT. ENTERPRISE	0.00611	0.01011	0.00751	0.00849	0.00868	0.00966	0.00765	0.00915
31	S. & L. GOVT. ENTERPRISE	0.00174	0.00161	0.00225	0.00271	0.00221	0.00264	0.00209	0.00414
32	HOUSEHOLDS	0.50696	0.50567	0.64788	0.78266	0.70450	0.86109	0.49475	0.84095
	TOTAL INPUT	2.64357	2.64379	3.13655	3.54062	3.33338	3.66140	2.75449	3.38304

TABLE IX (Continued)

	PRODUCING SECTOR	PURCHASING SECTOR							
		25	26	27	28	29	30	31	32
1	AGRICULTURE	0.04974	0.02722	0.04661	0.02377	0.07458	0.07032	0.03804	0.07556
2	MINING	0.04026	0.26626	0.04887	0.02050	0.04611	0.09978	0.10103	0.06118
3	CONSTRUCTION	0.03468	0.04057	0.01915	0.04043	0.02329	0.03265	0.14678	0.02178
4	FOOD & KINDRED PROD.	0.06879	0.03642	0.06915	0.02751	0.10636	0.10688	0.05209	0.11666
5	TEXTILES & FABRICS	0.00352	0.00195	0.00358	0.00145	0.00373	0.00576	0.00309	0.00602
6	APPAREL	0.01404	0.00749	0.01429	0.00547	0.01456	0.02296	0.01177	0.02441
7	LOGGING	0.00139	0.00107	0.00147	0.00059	0.00157	0.00191	0.00270	0.00170
8	SAWMILLS	0.00208	0.00158	0.00213	0.00146	0.00234	0.00284	0.00404	0.00255
9	OTHER LUMBER & WOOD PROD.	0.00298	0.00275	0.00235	0.00254	0.00287	0.00353	0.00848	0.00307
10	WOODEN FURNITURE & FIXT.	0.00166	0.00089	0.00168	0.00065	0.00147	0.00263	0.00129	0.00295
11	OTHER FURNITURE & FIXT.	0.00069	0.00038	0.00069	0.00028	0.00062	0.00109	0.00056	0.00122
12	PAPER & ALLIED PROD.	0.00775	0.00453	0.01131	0.00455	0.01056	0.01242	0.00750	0.01094
13	PAPER CONTAINERS & BOXES	0.00235	0.00141	0.00341	0.00102	0.00434	0.00376	0.00221	0.00364
14	PRINTING & PUBLISHING	0.01546	0.00804	0.01393	0.01073	0.01856	0.02419	0.01367	0.01909
15	CHEMICALS & ALLIED PROD.	0.01012	0.00765	0.01051	0.00458	0.01523	0.01752	0.01720	0.01635
16	PETROLEUM REFINING & PROD.	0.04449	0.07496	0.05712	0.02309	0.05109	0.08054	0.07651	0.07196
17	RUBBER & PLASTIC PROD.	0.01065	0.00709	0.01209	0.00561	0.01721	0.01799	0.01071	0.01590
18	LEATHER & LEATHER PROD.	0.00105	0.00056	0.00107	0.00041	0.00109	0.00170	0.00079	0.00185
19	STONE, CLAY, & GLASS PROD.	0.00704	0.00587	0.00604	0.00469	0.01006	0.00932	0.01585	0.00834
20	METAL & METAL PROD.	0.03063	0.02391	0.02469	0.01517	0.03635	0.04068	0.04580	0.03747
21	MACHINERY & EQUIPMENT	0.06754	0.03656	0.04335	0.01912	0.05620	0.06807	0.05211	0.06880
22	TRANSPORTATION EQUIPMENT	0.01782	0.00957	0.01789	0.00704	0.02701	0.02864	0.01589	0.02993
23	MISCELLANEOUS MFG.	0.01017	0.00567	0.01007	0.00429	0.01511	0.01560	0.00842	0.01599
24	TRANSPORTATION	0.04816	0.03787	0.05725	0.02168	0.05805	0.13998	0.05753	0.07065
25	COMMUNICATION	1.02941	0.01321	0.02783	0.01296	0.02429	0.02995	0.01924	0.02927
26	UTILITIES	0.06483	1.27951	0.07554	0.03110	0.07225	0.11507	0.18883	0.08993
27	WHOLESALE & RETAIL TRADE	0.17436	0.10236	1.18475	0.07228	0.18200	0.27440	0.14916	0.29861
28	FINANCE, INS., & REAL EST.	0.23204	0.15335	0.24809	1.18359	0.23899	0.34979	0.18302	0.34315
29	SERVICES	0.24847	0.12247	0.23481	0.10956	1.26997	0.34469	0.19867	0.32204
30	FEDERAL GOVT. ENTERPRISE	0.01165	0.00776	0.01229	0.01144	0.01283	1.01349	0.00766	0.01126
31	S. & L. GOVT. ENTERPRISE	0.00308	0.00164	0.00323	0.00134	0.00290	0.00449	1.00212	0.00412
32	HOUSEHOLDS	0.83806	0.44711	0.85074	0.32309	0.73968	1.33291	0.62602	1.49899
	TOTAL INPUT	3.09495	2.73767	3.11598	1.99318	3.14169	4.27554	3.06877	3.28597

TABLE X

TYPE I AND TYPE II OUTPUT MULTIPLIERS FOR OKLAHOMA, 1978

Producing Sector	Type I Output Multiplier	Type II Output Multiplier
1. Agriculture	2.12763	3.02209
2. Mining	1.39517	2.94063
3. Construction	1.83138	3.82931
4. Food & Kindred Prod.	2.19726	3.31225
5. Textiles & Fabrics	1.64520	2.64616
6. Apparel	1.59790	3.04474
7. Logging	2.12653	3.59319
8. Sawmills	2.03476	3.64499
9. Other Lumber & Wood Prod.	2.03047	3.51298
10. Wooden Furniture & Fixts.	1.67455	3.20951
11. Other Furniture & Fixts.	1.78555	3.71583
12. Paper & Allied Prod.	2.07455	3.37529
13. Paper Containers & Boxes	1.91768	3.05677
14. Printing & Publishing	1.73040	3.46823
15. Chemicals & Allied Prod.	1.63059	2.65944
16. Petroleum Refining & Prod.	2.10188	3.39995
17. Rubber & Plastic Prod.	1.53225	2.64357
18. Leather & Leather Prod.	1.53529	2.64379
19. Stone, Clay, & Glass Prod.	1.71633	3.13655
20. Metal & Metal Prod.	1.82470	3.54082
21. Machinery & Equipment	1.78902	3.33338
22. Transportation Equipment	1.77379	3.66140
23. Misc. Manufacturing	1.66993	2.75449
24. Transportation	1.53959	3.38304
25. Communication	1.25783	3.09495
26. Utilities	1.75755	2.73767
27. Wholesale & Retail Trade	1.25106	3.11598
28. Finance, Ins., & Real Est.	1.28493	1.99318
29. Services	1.52021	3.14169
30. Federal Govt. Enterprise	1.35363	4.27554
31. S. & L. Govt. Enterprise	1.69464	3.06877

its respective multiplier and summing. This gave total output of nearly $1.6 billion for Type I and $2.6 billion for Type II.

Income Multiplier

The income multiplier measures the total change in household income generated when payments to households in a given sector changes by one dollar. The total change in household income can be broken down into the direct, indirect, and the induced effect.

The direct effect measures the initial impact that a change in output will have on household income. It is therefore the household's row of the technical coefficients matrix and is presented in the first column of Table XI.

The direct and indirect income effects, presented in column two of Table XI, represent the total change in income resulting from a one dollar change in final demand in an endogenous sector. They are calculated by multiplying each column element of the interdependence coefficients matrix in Table VIII, by the corresponding household's row entry in the technical coefficients matrix. The column sum of this multiplication is the direct and indirect income effect for a sector. Type I income multipliers were then calculated by dividing the direct and indirect income effect by the direct effect and are presented in the third column of Table XI.

The Type I income multipliers ranged from a high of 6.95 in the petroleum refining and products sector, to a low of 1.13 for the federal government enterprise sector. The petroleum refining and products sector was followed by paper and allied products, agriculture, food and kindred products, utilities, paper containers and boxes, and other lumber and wood products.

TABLE XI

TYPE I AND TYPE II INCOME MULTIPLIERS FOR OKLAHOMA, 1978

Producing Sector	Direct Income Effect	Direct and Indirect Income Effect	Type I Income Mutliplier	Direct, Indirect, and Induced Income Effect	Type II Income Multiplier
1. Agriculture	0.09355	0.27220	2.90979	0.40803	4.36175
2. Mining	0.37014	0.47032	1.27066	0.70501	1.90471
3. Construction	0.37260	0.60802	1.63181	0.91141	2.44607
4. Food & Kindred Prod.	0.12516	0.33932	2.71105	0.50863	4.06384
5. Textiles & Fabrics	0.15378	0.30461	1.98090	0.45661	2.96935
6. Apparel	0.28466	0.44031	1.54681	0.66002	2.31865
7. Logging	0.21242	0.44634	2.10120	0.66907	3.14968
8. Sawmills	0.23674	0.49005	2.06995	0.73458	3.10284
9. Other Lumber & Wood Prod.	0.20625	0.45117	2.18746	0.67630	3.27898
10. Wood Furniture & Fixts.	0.29982	0.46713	1.55803	0.70022	2.33547
11. Other Furniture & Fixts.	0.37215	0.58743	1.57849	0.88056	2.36614
12. Paper & Allied Prod.	0.12174	0.39584	3.25143	0.59336	4.87386
13. Paper Containers & Boxes	0.14398	0.34667	2.40780	0.51966	3.60928
14. Printing & Publishing	0.32549	0.52886	1.62484	0.79276	2.43562
15. Chemicals & Allied Prod.	0.14830	0.31310	2.11135	0.46934	3.16489
16. Petroleum Refining & Prod.	0.05679	0.39503	6.95561	0.59215	10.42640
17. Rubber & Plastic Prod.	0.20140	0.33820	1.67928	0.50696	2.51723
18. Leather & Leather Prod.	0.19720	0.33734	1.71063	0.50567	2.56422
19. Stone, Clay, & Glass Prod.	0.23501	0.43221	1.83912	0.64788	2.75683
20. Metal & Metal Prod.	0.28302	0.52226	1.84532	0.78286	2.76611
21. Machinery & Equipment	0.24915	0.46999	1.88637	0.70450	2.82765

TABLE XI (Continued)

Producing Sector	Direct Income Effect	Direct and Indirect Income Effect	Type I Income Multiplier	Direct, Indirect, and Induced Income Effect	Type II Income Multiplier
22. Transportation Equipment	0.34886	0.57445	1.64661	0.86109	2.46826
23. Misc. Manufacturing	0.15295	0.33006	2.15792	0.49475	3.23470
24. Transportation	0.40206	0.56101	1.39533	0.84094	2.09159
25. Communication	0.48341	0.55908	1.15653	0.83806	1.73363
26. Utilities	0.11414	0.29827	2.61311	0.44711	3.91704
27. Wholesale & Retail Trade	0.49849	0.56754	1.13851	0.85074	1.70662
28. Finance, Ins., & Real Est.	0.14173	0.21554	1.52076	0.32309	2.27961
29. Services	0.35661	0.49345	1.38371	0.73968	2.07418
30. Federal Govt. Enterprise	0.78453	0.88921	1.13342	1.33291	1.69898
31. S. & L. Govt. Enterprise	0.23313	0.41763	1.79135	0.62602	2.68522

As was the case in Type II output multipliers, Type II income multipliers include the induced effects and are calculated using the interdependence matrix in which households were included as an endogenous sector (Table IX). The direct, indidrect, and induced effects are the household's row of this interdependence matrix, and are presented in column four of Table XI.

Type II income multipliers were calculated by dividing the direct, indirect, and induced income effect by the direct effect. They ranged from a high of 10.42 for the petroleum refining and products sector, to a low of 1.69 for the federal government enterprise sector (column five, Table XI).

The FPI sectors ranked relatively high in both Type I and Type II income multipliers. Paper and allied products had the second highest Type I and Type II income multipliers of 3.25 and 4.87, respectively. Paper containers and boxes had the sixth highest income multipliers of 2.41 and 3.61, followed by other lumber and wood products which had the seventh highest multipliers of 2.19 and 3.28.

These sectors directly paid over $146 million in income in Oklahoma in 1978. The total effect of this level of income on the total income of the state can be calculated by multiplying the income for each sector by its respective income multiplier and summing. This gave a total income of over $236 million for Type I, and over $503 million for Type II.

Type I and Type II income multipliers are based on two separate and distinct assumptions. Type I multipliers are based on the assumption that no change in household expenditures will occur when income paid to households change. This assumption is somewhat unrealistic,

as households would be expected to increase their expenditures with increased income. On the other hand, Type II income multipliers are based on the assumption that households do indeed increase their expenditures with increased income and do so in constant proportions. This of course implies a constant marginal propensity to consume, which is also somewhat unrealistic. For predictive purposes the actual income multipliers are likely to be somewhere between the two estimates.

Employment Multiplier

The employment multiplier is an estimate of the total employment change in the economy which results when employment in a sector changes by one job. As was the case for income, the total change in employment can be broken down into the direct, indirect, and induced effect.

The direct employment effect is the estimated direct response in employment in a sector which occurs from a change in final demand. It is calculated by dividing the number of people employed in a sector by that sector's output in thousands of dollars, and is therefore the average number of people employed per thousand dollars of output produced. The direct employment effects are presented in the first column of Table XII.

The direct and indirect employment effects, in the second column of Table XII, are a measure of the total employment change resulting from a $1,000 change in final demand. These effects are determined by multiplying each column of the interdependence coefficients matrix (Table VIII), by the column of direct employment effects and summing.

TABLE XII

TYPE I AND TYPE II EMPLOYMENT MULTIPLIERS FOR OKLAHOMA, 1978

Producing Sector	Direct Employment Effect	Direct and Indirect Employment Effect	Type I Employment Multiplier	Direct, Indirect, and Induced Employment Effect	Type II Employment Multiplier
1. Agriculture	0.01160	0.02739	2.36238	0.03850	3.31990
2. Mining	0.01549	0.02157	1.39267	0.04075	2.63157
3. Construction	0.02071	0.03723	1.79748	0.06203	2.99502
4. Food & Kindred Prod.	0.00927	0.02737	2.95423	0.04122	4.44797
5. Textiles & Fabrics	0.01590	0.02768	1.74026	0.04010	2.52154
6. Apparel	0.03757	0.05295	1.40944	0.07091	1.88750
7. Logging	0.00624	0.02717	4.35595	0.04537	7.27537
8. Sawmills	0.01207	0.02960	2.45201	0.04959	4.10773
9. Other Lumber & Wood Prod.	0.01255	0.02905	2.31511	0.04746	3.78170
10. Wood Furniture & Fixts.	0.03040	0.04323	1.42202	0.06228	2.04883
11. Other Furniture & Fixts.	0.03125	0.04604	1.47336	0.07000	2.24019
12. Paper & Allied Prod.	0.00420	0.02643	6.29454	0.04258	10.13992
13. Paper Containers & Boxes	0.01634	0.03107	1.90178	0.04521	2.76738
14. Printing & Publishing	0.02658	0.04116	1.54852	0.06273	2.36019
15. Chemicals & Allied Prod.	0.00827	0.01879	2.27307	0.03156	3.81812
16. Petroleum Refining & Prod.	0.00249	0.01888	7.59373	0.03499	14.07537
17. Rubber & Plastic Prod.	0.01206	0.02139	1.77332	0.03519	2.91709
18. Leather & Leather Prod.	0.02612	0.03779	1.44710	0.05115	1.97401
19. Stone, Clay, & Glass Prod.	0.01443	0.02667	1.84789	0.04430	3.06929
20. Metal & Metal Prod.	0.01734	0.03296	1.90042	0.05426	3.12878
21. Machinery & Equipment	0.01886	0.03461	1.83453	0.05378	2.85084

TABLE XII (Continued)

Producing Sector	Direct Employment Effect	Direct and Indirect Employment Effect	Type I Employment Multiplier	Direct, Indirect, and Induced Employment Effect	Type II Employment Multiplier
22. Transportation Equipment	0.01944	0.03537	1.81923	0.05880	3.02453
23. Misc. Manufacturing	0.14113	0.15726	1.11428	0.17072	1.20968
24. Transportation	0.01896	0.02859	1.50781	0.05147	2.71484
25. Communication	0.02376	0.02878	1.21136	0.05159	2.17125
26. Utilities	0.00578	0.01524	2.63837	0.02740	4.74520
27. Wholesale & Retail Trade	0.05325	0.05775	1.08457	0.08090	1.51934
28. Finance, Ins., & Real Est.	0.00925	0.01387	1.49906	0.02266	2.44925
29. Services	0.02469	0.03509	1.42123	0.05522	2.23653
30. Federal Govt. Enterprise	0.01782	0.02400	1.34642	0.06027	3.38150
31. S. & L. Govt. Enterprise	0.08618	0.09731	1.12911	0.11434	1.32679

Type I employment multipliers were calculated by dividing the direct and indirect effect by the direct effect. The multipliers ranged from a high of 7.59 for the petroleum refining and products sector, to a low of 1.08 for wholesale and retail trade. The FPI sectors again ranked high, with five of the top ten multipliers, including the second highest of 6.29 held by paper and allied products.

High employment multipliers, as seen for example in the paper and allied products sector, are caused by two basic factors. First, the paper and allied products sector is a highly capital intensive sector with a high output/employment ratio. Output increases substantially (assuming constant returns) when an additional employee is added in this sector. Second, the paper and allied products sector has strong linkages with other sectors in the economy, as indicated by its relatively large output multiplier. Therefore, an employment increase in paper and allied products would be accompanied by a substantial increase in output in this sector. Employment in other sectors is expanded in the process of producing the additional inputs required to produce this increased output.

Sectors with low employment multipliers are generally those sectors which are rather labor intensive, with low output/employment ratios, and weak linkages with the other sectors of the economy. Miscellaneous manufacturing, wholesale and retail trade, and state and local government enterprise are good examples of such sectors in Oklahoma.

The direct, indirect, and induced employment effects presented in column four of Table XII were calculated by multiplying each column of the interdependence coefficients matrix in Table IX, by the direct

employment effect and summing. Type II employment multipliers were calculated by dividing the direct, indirect, and induced income effects by the direct effects and are presented in column five of Table XII.

Type II employment multipliers ranged from a high of 14.07 for the petroleum refining and products sector, to a low of 1.20 for the miscellaneous manufacturing sector. The paper and allied products sector had the second highest employment multiplier of 10.13, followed by logging with a multiplier of 7.27. Other FPI sectors with relatively large multipliers were sawmills (sixth), and other lumber and wood products (eighth).

These sectors directly employed over 8,800 Oklahomans in 1978. The total effect of this level of employment can be calculated by multiplying sector employment by its respective employment multiplier and summing. This gave a total of over 23,000 jobs for Type I and over 36,700 jobs for Type II.

CHAPTER V

SUMMARY AND CONCLUSION

The objective of this study was to quantify the interrelationships that exist in the Oklahoma economy, and, within this framework, evaluate the role of the forest products industry in the economy.

An I-O model was formulated for the Oklahoma economy which consisted of 31 endogenous sectors (not including households) and four exogenous sectors. The FPI was delineated into six sectors: logging, sawmills, other lumber and wood products, wooden furniture and fixtures, paper and allied products, and paper containers and boxes. Data for the FPI sectors were collected by personal interviews, telephone interviews, and/or on-site plant inspections. The remaining sectors of the economy were estimated from regionally adjusted 1972 national I-O coefficients. This data was further adjusted to represent 1978 prices and production levels.

Six final demand sectors were included in the model: personal consumption expenditures, private capital formation, change in business inventories, federal government purchases, state and local government purchases, and exports. The final demand sectors were also estimated with secondary data. The only exception to this was exports, which, along with imports, were figured as residuals.

The direct relationships between the sectors were presented in the form of a transactions table and a technical coefficients matrix. The

transactions table presents, in dollar terms, the sales and purchases of each sector in the economy. The technical coefficients matrix identified the amount of purchases required from each sector (including households) to produce a dollar's worth of output in a given sector.

The direct and indirect linkages within the economy were estimated using an interdependence coefficients matrix with households excluded. This matrix estimated the total amount of output which must be generated by all sectors to deliver one dollar's worth of output from a particular sector to final demand. The induced effects caused by increased household expenditures were included by recalculating the interdependence matrix with households as an endogenous sector.

Type I and Type II output, income and employment multipliers, were calculated. These multipliers, in their own respective units, estimated the total change in the economy that would result from a one unit change in the output, income, or employment of a sector. As such, these multipliers can be used to estimate the total economic ramifications of any proposed policy of government and industry.

Forest Products' Role in the Oklahoma Economy

The FPI sectors in Oklahoma directly employed over 8,800 people, and generated over 782.3 million dollars' worth of output in 1978. Eighty-four percent of the inputs necessary to produce this output were locally produced. This implies strong linkages between the FPI sectors and the rest of the economy. The extent of these linkages is measured by the output, income, and employment multipliers.

Output multipliers estimate the total change in state output that results from a one dollar change in the output of a given sector, i.e., a measure of the economic impact of that sector. The FPI sectors were found to have substantial impacts. Logging, paper and allied products, sawmills, other lumber and wood products, and paper containers and boxes had the third, fifth, sixth, seventh, and eighth highest Type I output multipliers, respectively.

In terms of Type II output multipliers, the FPI sectors had the fifth, sixth, and eighth highest rankings. A simple average of the FPI multipliers revealed that as an aggregate the FPI sectors had the fourth highest Type I output multiplier of 1.98, and the seventh largest Type II multiplier of 3.40. The output multipliers revealed that the FPI sectors supported over $1.6 billion in output for Type I multipliers, and $2.6 billion for Type II.

Income multipliers estimate the total change in state income which results when income in a given sector increases by one dollar. The FPI sectors were found to have some of the largest income multipliers in the state. Paper and allied products had the second largest Type I and Type II income multipliers of 3.25 and 4.87, respectively. Paper containers and boxes had the sixth highest multipliers of 2.41 and 3.61, followed by other lumber and wood products with the seventh ranked multipliers of 2.19 and 3.28. Logging ranked tenth with Type I and Type II income multipliers of 2.10 and 3.15, respectively. Considered as an aggregate, the FPI sectors were found to have the fifth largest Type I and Type II income multipliers of 2.26 and 3.39. The income multiplier analysis revealed that these sectors supported over

$236 million in income for Type I multipliers, and over $503 million for Type II.

Employment multipliers estimate the total change in state employment per unit change in employment of a particular sector. They therefore provide a measure of the number of jobs which are both directly and indirectly dependent on a sector. Again, the FPI sectors were found to have some of the highest employment multipliers. Paper and allied products had the second highest Type I employment multiplier of 6.29, followed by logging with the third highest of 4.36. Sawmills, other lumber and wood products, and paper containers and boxes were also among the top ten, with the sixth, eighth, and tenth highest multipliers, respectively.

Paper and allied products and logging also had the second and third largest Type II employment multipliers of 10.14 and 7.28, respectively. Sawmills and other lumber and wood products were again in the top ten, with the sixth and eighth highest rankings. Considered again as an aggregate, the FPI sectors had the second highest Type I and Type II employment multipliers of 3.12 and 5.02, respectively. The employment multiplier analysis showed that the FPI sectors supported over 23,000 jobs for Type I multipliers, and over 36,200 jobs for Type II.

In conclusion, multiplier analysis has revealed that the FPI sectors in Oklahoma have a substantial impact on the output, income, and employment of the state. These impacts are directly related to the high degree of structural interdependence associated with these sectors. The FPI sectors therefore would provide an excellent vehicle for the objective of stimulating the economic development of the state.

The stronk linkages of these sectors with the rest of the economy indicates that the benefits of increased output, income, and employment, which would result from an expansion in the FPI sectors, would accrue to the local economy and not be exported to other regions.

Suggestions for Further Research

This study has provided a first step in the analysis of the role of the FPI sectors in the economy. More work needs to be done, however, in the area of developing procedures for collecting detailed data, so that companies do not find surveys cumbersome. More work also is needed in the area of estimating final demand to incorporate recently available data and projection techniques.

Finally, disaggregating forest land management out of the agriculture sector would provide valuable insights into the structure of the business of growing timber. With such a sector, various timber supply scenarios could be tested to analyze the impacts on the rest of the economy. With the growing demands on our timber resources, and the shrinking forestland base, the need for accurate impact analysis is self-evident.

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APPENDIXES

APPENDIX A

SECTOR CLASSIFICATIONS OF OKLAHOMA I-O MODEL

Oklahoma Model

(Endogenous)

Sector Classification	Industries Included
1. Agriculture (SIC pt. 01,02,07 (excl. 074), 08, 09)	a) crops b) livestock c) ag services d) forestry e) forestry services f) fishing, hunting, and trapping
2. Mining (SIC 10-14)	a) metal mining b) anthracite c) bituminous coal and lignite mining d) oil and gas extraction e) non-metallic minerals mining
3. Construction (SIC 15-17)	a) new construction b) maintenance construction
4. Food and Kindred Products (SIC 20,21)	a) meat products b) dairy products c) canned and preserved fruits and vegetables d) grain mill products and bakery products e) sugar and confectionary products f) fats and oils g) beverages and miscellaneous food and kindred products h) tobacco products
5. Textiles and Fabrics (SIC 22)	a) broad and narrow woven mills and fabrics b) knitting, yarn, and thread mills c) dyeing and finishing textile mills d) floor covering mills e) miscellaneous textile products
6. Apparel (SIC 23)	a) mens', womens', and youth garments b) hats, caps, and millinary c) fur products d) miscellaneous apparel and fabricated textile products
7. Logging (SIC 241)	a) logging camps and logging contractors

Sector Classification	Industries Included
8. Sawmills (SIC 242)	a) sawmills b) planing mills c) special product sawmills
9. Other Lumber and Wood Products (SIC 243-249)	a) millwork, veneer, plywood, and structural wood members b) wood containers c) wood buildings and mobile homes d) miscellaneous wood products
10. Wooden Furniture and Fixtures (SIC 2511,2517,2521,2541)	a) wood household furniture b) wooden cabinets c) wood office furniture d) wood partitions and fixtures
11. Other Furniture and Fixtures (SIC 25 except ones given in sector 10 above)	a) metal household furniture b) metal cabinets c) metal office furniture d) mattresses and bedsprings e) other metal furniture and fixtures
12. Paper and Allied Products (SIC 261-264, 266-269)	a) pulp mills b) paper mills c) paperboard mills d) converted and paperboard products, except boxes e) building paper and building board mills
13. Paperboard Containers and Boxes (SIC 265)	a) containers and boxes
14. Printing and Publishing (SIC 27)	a) newspapers b) periodicals c) books d) miscellaneous publishing e) commercial printing f) mainfold business forms g) greeting cards h) blankbooks and looseleaf binders i) printing trade services
15. Chemicals and Allied Products (SIC 28)	a) inorganic chemicals b) plastics, synthetic resins, rubber, and other man made fibers c) drugs d) soap, detergents, perfume, and cosmetics

Sector Classification	Industries Included
Chemicals and Allied Products (Cont.)	e) paints, varnishes, lacquers, and enamels f) organic chemicals g) agriculture chemicals h) miscellaneous chemicals
16. Petroleum Refining (SIC 29)	a) petroleum refining b) paving and roofing materials c) miscellaneous petroleum products
17. Rubber and Plastic Products (SIC 30)	a) tires and inner tubes b) rubber and plastic footwear c) reclaimed rubber d) rubber and plastic hose and belting e) fabricated rubber products f) miscellaneous rubber products
18. Leather and Leather Products (SIC 31)	a) leather tanning and finishing b) boot and shoe cutstock and bindings c) footwear d) leather gloves and mittens e) luggage f) handbags g) other leather goods
19. Stone Clay, Glass, and Concrete Products (SIC 32)	a) glass and glassware b) structural clay products and pottery c) concrete, gypsum, and plaster d) cut stone and stone products e) abrasives, abestos, and miscellaneous non-metallic products
20. Metal and Metal Products (SIC 33,34)	a) primary metal industries b) fabricated metal products, except machinery and transportation equipment
21. Machinery and Equipment (SIC 35,36)	a) machinery, except electrical b) electrical and electronic machinery, equipment and supplies
22. Transportation Equipment (SIC 37)	a) motor vehicles and cycles b) aircraft and missiles c) ships and boat building and repair d) railroad equipment e) miscellaneous transportation equipment

Sector Classification	Industries Included
23. Miscellaneous Manufacturing (SIC 38,39)	a) measuring, analyzing, and controlling instruments b) photographic, medical, and optical products c) watches and clocks d) miscellaneous manufacturing industries and products
24. Transportation (SIC 40-42,44-47)	a) railroad transportation b) local and suburban transit, and interurban highway transportation c) motor freight transportation and warehousing d) water transportation e) air transportation f) pipeline transportation g) transportation services
25. Communication (SIC 48)	a) telephone and telegraph b) radio and television c) communication services, nec.
26. Utilities (SIC 49)	a) electric services b) gas services c) water services d) sanitary services
27. Wholesale and Retail Trade (SIC 50-57,59,7396,8042)	a) wholesale and retail trade
28. Finance, Insurance, and Real Estate (SIC 60-67, pt. 1531)	a) banking b) credit agencies c) security and commodity brokers, dealers, exchanges, and services d) insurance e) insurance agents, brokers, and services f) real estate g) holding and other investment offices
29. Services (SIC 58,70,72,73,75,76, 78,79,80 (EXCL 8042), 81-84,86,89,074)	a) hotels and lodging, personal and repair services b) business services c) eating and drinking places d) automobile repair, services, and garages e) amusements f) health, educational, and social services, and non-profit organizations

Sector Classification	Industries Included
30. Federal Government Enterprise (SIC not applicable)	a) includes all enterprises which cover at least half of their operating costs from revenue earned
31. State and Local Government Enterprise (SIC not applicable)	a) gas and electric utilities b) water supply facilities c) transit facilities d) liquor stores e) water transportation f) air transportation g) highway toll facilities h) sewers and sewage disposal i) low-cost housing and urban renewal j) miscellaneous activities

APPENDIX B

QUESTIONNAIRES

SOUTHERN FOREST EXPERIMENT STATION
FOREST SERVICE, U.S. DEPARTMENT OF AGRICULTURE

OMB No. 40-R3606

LOGS AND OTHER ROUNDWOOD RECEIVED
Oklahoma, 1978

This form is for reporting the quantities and kinds of roundwood received by this plant in 1978 and the disposition of plant residues resulting from the manufacture or processing of wood products.

All replies will be held confidential and will be used only for statistical reports.

Plant name: _____

Mailing address: _____
(Street) (City) (State) (Zip code)

Plant location: _____
(City) (County) (State)

Type of roundwood received in 1978. Please check one.

- ☐ Sawlogs
- ☐ Veneer logs or bolts
- ☐ Posts
- ☐ Poles
- ☐ Piling
- ☐ Tight cooperage bolts
- ☐ Slack cooperage bolts
- ☐ Charcoal wood
- ☐ Furniture stock
- ☐ Handle stock
- ☐ Other (Specify) _____

Complete a separate form for each product. Do not include logs or bolts sold or transferred to another plant.

If no roundwood was received in 1978 please check the box below. No other information is needed.

☐ No roundwood was received in 1978.

☐ Check here if you wish to receive a copy of the report resulting from this study.

Person to be contacted if necessary regarding this report.

Name: _____ Title: _____

Telephone number _____ Date: _____

Area code: _____

Interviewer: _____

Section I.— Quantity of roundwood received.

1. Total quantity received _____

2. Unit of measure (check one).

- ☐ Thousand board feet.
- ☐ Standard cords.
- ☐ Cubic feet.
- ☐ Pieces.
- ☐ Linear feet.
- ☐ Other (specify) _____

3. Board foot log rule used (check one when applicable).

- ☐ International 1/4-inch.
- ☐ Doyle log rule.
- ☐ Scribner Decimal C.
- ☐ Lumber tally.
- ☐ Other (specify)_____

4. If other than standard cords (128 cubic feet) were used, please specify size:

_____ cubic feet.

5. If weight was used, please specify:

_____ pounds per MBF

_____ pounds per cord

6. Volume of product produced from roundwood received in 1978. (Lumber, square feet of plywood, etc.)

	Amount (Product)	Unit of Measure
Softwood	_____	_____
Hardwood	_____	_____

Plant name _____

County location _____

Product received _____

Section II.—Receipts of roundwood received by species group and origin, for product listed above.

1. Quantity received in 1978

County[1]	Yellow pine	Other softwoods	Oaks	Gums	Other hardwoods	Total All species
TOTAL						

[1]Enter county name. Enter name of State or foreign country if from outside the State.

Section III.--Disposal of plant residues in B78 by type and use.

Instructions: Please enter your best estimate of the percentage of each type of plant residue that was used for the various purposes indicated.

Use of residues	Bark		Coarse Residues (Suitable for chipping such as veneer cores, etc.)		Fine Residues (Veneer clippings, etc., not suitable for chipping)	
USED FOR:	Softwood (Percent)	Hardwood (Percent)	Softwood (Percent)	Hardwood (Percent)	Softwood (Percent)	Hardwood (Percent)
1. Manufacture of fiber products such as pulp, hardboard, or roofing felt						
2. Charcoal or chemical wood						
3. Industrial fuel at this or other plants						
4. Domestic household fuel--sold or given away						
5. Miscellaneous uses such as livestock bedding, mulch, small dimension, and specialty items						
6. NOT USED (including residues burned as waste)						
TOTAL	100%	100%	100%	100%	100%	100%

Section IV.--Residues produced.

Total quantity generated:

	Softwood	Hardwood	Unit of measure
Bark	_____	_____	_____
Coarse residues	_____	_____	_____
Fine residues	_____	_____	_____

REMARKS:

OKLAHOMA I/O STUDY

C O N F I D E N T I A L

For Authorized Personnel Only

Oklahoma State University
School of Forestry
Stillwater, Oklahoma 74074

Operation _____
Number _____
Location _____

1. Did your company operate in 1978? Yes _____ No _____

2. What period during 1978 did you operate?

   From _____ to _____

3. Is this your only business? Yes _____ No _____

4. If no please specify the other business(s).

   _____

   _____

5. Do you keep separate accounts for the different businesses?

   Yes _____ No _____

   (If no please estimate the answers to the following questions.)

6. A) What was your total output for 1978? (Please specify units output is measures in.)

   _____ _____ _____

   VALUE UNITS % CAPACITY

   Definition of full capacity _____ hrs./day _____ days/yr.

   B) Company income from other sources. _____

7. What was your total employment and payroll in 1978?

	Oklahoma Residents	Non Oklahoma Residents	Payroll In Dollars
Full-time			
Part-time			
TOTAL			

8. Please estimate the following expenses your company incurred during 1978. If possible please distinguish between "Inside" and "Outside" Oklahoma expenditures.

Item	Where Spent: Inside Oklahoma	Where Spent: Outside Oklahoma	Total Spent
A) Construction			
a. New			
b. Repair & maintenance			
B) New Depreciable Equipment			
a. Cars and trucks			
b. Machinery			
c. Office equipment			
d. Other			
C) New expensable Equipment			
a. Machinery & equipment			
b. Office equipment			
c. Other			
D) Maintenance of business vehicles or equipment			
E) Rental payments (equipment and real estate)			
F) Utilities			
a. Electricity			
b. Telephone			
c. Water			
d. Heat			
G) Finance			
a. Interest payments			
b. Payments on principal			

8. (continued)

Item	Where Spent: Inside Oklahoma	Where Spent: Outside Oklahoma		Total Spent
H) Insurance				
I) Professional Services (Doctors, Lawyer, etc.)				
J) Advertising				
K) General Supplies				
L) Skilled trades (repairmen not employed by your company)				
M) Transportation				
N) Miscellaneous				
O) Other				

9. What were your approximate outlays for Raw materials, contract work and component parts for 1978. (Primary manufactures use question 10 also)

General kind of input	volume*	% import	total cost	price per* unit

*For wood input only.

10. For Primary Producers Only:

What was the proportion of raw materials purchased from:

	%	App. Value
Federal Government	_____	_____
Industry	_____	_____
Non-Industrial Private	_____	_____

11. Allowance For Depreciation (1978)

a. Machines & Equipment _____

b. Buildings _____

c. Vehicles _____

12. Estimate your taxes for 1978.

a. Payments to Federal Government for all taxes, including employers share of social security. _____.

b. Payments to Federal Government for employees tax withheld. _____

_____.

c. Total payments to State and Local Government and its agencies for sales taxes, unemployment, ad valorem property tax, etc. _____

_____.

13. What are the markets for your production and the approximate value purchased by each? (If government identify as such.)

Business of Purchaser	Out of State Sales (%)	Approximate value (% or $)
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

14. Change in inventory. (dollars)

Depletion	Accumulation
_____	_____

15. Do you have any plans for expansion in the future?

Yes _____ No _____ % Increase in capacity _____
% Decrease in capacity _____

16. If yes, how would you allocate the costs of expansion?

A) Construction _____

B) Machinery & Equipment _____

C) Other (specify) _____

TIMBER OPERATOR SURVEY

CONFIDENTIAL

Department of Forestry

Oklahoma State University
Stillwater, Oklahoma 74074

Q-1. How many months did you operate in 1978? _____.

Q-2. Does your company both cut and haul timber?

1 YES
2 NO

Please describe the nature of your business _____
_____
_____

Q-3. How much timber did you cut on a contract basis in 1978? _____
_____ (Please specify units: cords, tons, M bd. ft. Doyle, other
_____)

Q-4. What was the average amount per unit you received for logs delivered on contract?_____

(If units were different than in Q-2, please specify _____)

Q-5. Did your company purchase any stumpage in 1978?

1 YES
2 NO

skip to Q-9

*** Q-6 thru Q-8 are concerned only with purchased stumpage operator cut in 1978. ***

Q-6. What is the volume of purchased stumpage your company cut in 1978?
_____ (Please specify units: cords, tons, M bd. ft. Doyle, other _____)

Q-7. What was the average price per unit you paid for this stumpage?
_____

Q-8. What was the average price per unit you received for delivering this wood to a buyer? _____

Q-9. Did your company cut any timber off your land?

1 YES
2 NO

skip to Q-12

*** Q-10 thru Q-11 are concerned only with timber cut on operator's own land ***

Q-10. What is the volume of timber your company cut off your land in 1978? _____(Please specify units: cords, tons, M bd. ft. Doyle, other _____)

Q-11. What was the average price per unit you received for delivering this wood to a buyer? _____

Q-12. How many workers did you employ on the average day in 1978? (include yourself and part time unsalaried members of your family) _____

Q-13. What was your total payroll in 1978? _____

Q-14. How much did you spend in Oklahoma in 1978 for the following items?

(A) New trucks _____
(B) New machinery (Loaders, Skidders, etc.) _____
(C) New equipment (Saws, etc.) _____
(D) General supplies _____
(E) Maintenance on vehicles and equipment _____
(F) Fuel and oil _____
(G) Tires and tubes _____
(H) Rental payments:
  Land _____
  Buildings _____
  Equipment _____
(I) Professional services:
  Accountants _____
  Lawyers _____
  Others (specify) _____
(J) Utilities:
  Electricity _____
  Gas _____
  Water _____
  Telephone _____
(K) Taxes:
  State _____
  Federal _____
(L) Insurance _____

(M) Depreciation:

Equipment _____

Trucks _____

Buildings _____

Other _____

(N) Payments on borrowed capital for trucks, equipment etc. (include principal and interest) _____

(O) Miscellaneous expenses not yet covered? Please specify

_____

Q-15. Of all the timber you harvested last year, what percent would you estimate came from each of the following ownership categories?

FEDERAL _____%

INDUSTRY _____%

PRIVATE _____%

OKLAHOMA TIMBER BUYER QUESTIONNAIRE

(In-State Manufacturer)

C O N F I D E N T I A L

For Authorized Personnel Only

Oklahoma State University
School of Forestry
Stillwater, Oklahoma 74074

Operation Number _____
Location _____

1. Did your company operate in 1978? Yes _____ No _____

2. What period during 1978 did you operate?

   From _____ to _____

3. Is this your only business? Yes _____ No _____

4. If no please specify the other business(s).

   _____

   _____

5. Do you keep separate accounts for the different businesses?

   Yes _____ No _____

   (If no please estimate the answers to the following questions.)

6. A) What was your total output for 1978? (Please specify units output is measures in.)

   _____ _____ _____

   VALUE UNITS % CAPACITY

   Definition of full capacity _____ hrs./day _____ days/yr.

   B) Company income from other sources. _____

7. What was your total employment and payroll in 1978?

	Oklahoma Residents	Non Oklahoma Residents	Payroll In Dollars
Full-time			
Part-time			
TOTAL			

8. What were your approximate outlays for Raw materials, contract work and component parts for 1978. (Primary manufactures use question 10 also)

General kind of input	volume*	% import	total cost	price per* unit

9. What was the proportion of raw materials purchased from:

	%	App. Value
Federal Government	_____	_____
Industry	_____	_____
Non-Industrial Private	_____	_____

10. What are the markets for your production and the approximate value purchased by each? (If government identify as such.)

Business of Purchaser	Out of State Sales (%)	Approximate value (% or $)

11. Do you have any plans for expansion in the future?

Yes _____ No _____ % Increase in capacity _____
% Decrease in capacity _____

12. If yes, how would you allocate the costs of expansion?

A) Construction _____

B) Machinery & Equipment _____

C) Other (specify) _____

NOTE: Need Bertleson's questionnaire done for timber, he used himself and timber exported.

OKLAHOMA TIMBER BUYERS QUESTIONNAIRE

(Broker)

C O N F I D E N T I A L

For Authorized Personnel Only

Oklahoma State University
School of Forestry
Stillwater. Oklahoma 74074

Operation Number _____
Location _____

1. Did you purchase oklahoma timber in 1978? Yes _____ No _____

2. What period during 1978 did you operate?

   From _____ to _____

3. Is this your only business Yes _____ No _____

4. What was your total employment and payroll for your timber purchasing operation in 1978?

	Oklahoma Residents	Non Oklahoma Residents	Payroll In Dollars
Full-time			
Part-time			
TOTAL			

5. Please estimate the following expenses your company incurred during 1978. If possible please distinguish between "Inside" and "Outside" Oklahoma expenditures.

   A) Professional Services
      a) CPA
      b) Lawyer

   B) Advertising

   C) General Supplies

   D) Telephone

   E) Transportation

   F) Miscellaneous
      (specify)

6. What were your approximate outlays for Raw materials, contract work and component parts for 1978.

General kind of input	volume	total cost	stumpage price per unit

7. What was your average selling price/unit?

8. What was the proportion of raw materials purchased from:

	%	App. Value
Federal Government		
Industry		
Non-industrial Private		

9. Estimate your taxes for 1978.

a. Payments to Federal Government for all taxes, including employers share of social security. _____.

b. Total payments to State and Local Government and its agencies for sales taxes, unemployment, ad valorem property tax, etc. _____
_____.

10. What are the market for your production?

Business of Purchaser	Out of State Sales (%)	Approximate value (% or $)

NOTE: Do Bertleson's questionnaire for exported logs only.

OKLAHOMA TIMBER BUYER QUESTIONNAIRE

(Out-of-State)

C O N F I D E N T I A L

1. Did your company purchase either standing timber or roundwood in Oklahoma during 1978? (circle one)

   1. Yes
   2. No

   (If no) Since our purpose is to gain information about the amount of timber harvested in Oklahoma in 1978, we do not need your answers to the remainder of the questions. Please return the questionnaire to us so we will know your company purchased not wood in our state that year. Thank you.

2. Was a portion of the Oklahoma wood your company purchased in the form of standing timber?

   1. Yes
   2. No

   → Please skip to Q-8.

Q-3. What volume of standing timber did your company purchase and cut in Oklahoma in 1978? _____
(Please specify units: (a) MBF Doyle, (b) cords, (c) tons, (d) other _____)

Q-4. If weight was used, please specify:

_____ pounds per MBF (Log scale _____)

_____ pounds per cord

Q-5. Please indicate primary use of timber (circle one).

1. Sawlogs
2. Veneer logs&bolts
3. Posts
4. Poles
5. Piling
6. Tight cooperage bolts
7. Slack cooperage bolts
8. Charcoal wood
9. Furniture stock
10. Handle stock
11. Pulpwood

Q-6. What was the average stumpage price paid for this Oklahoma timber in 1978? _____ (If volume units are different than in Q-3 please specify _____)

Q-7. What was the proportion of timber purchased from each ownership class:

_____% Federal

_____% Forest Industry

_____% Nonindustrial Private

Q-8. Was a portion of the Oklahoma wood your company purchased in the form of roundwood?

1. Yes
2. No

→ Please skip to Q 14

Q-9. What volume of roundwood (do not include standing timber) did your company purchase in Oklahoma in 1978? _____ (Please specify units: (a) thousand bd. ft. Doyle, (b) cords, (c) tons, (d) Other _____.

Q-10. If weight was used, please specify:

_____ pounds per MBF (Log scale _____)

_____ pounds per cord

Q-11. Please indicate the primary type of roundwood purchased (circle one).

1. Sawlogs
2. Vendeer logs or bolts
3. Posts
4. Poles
5. Piling
6. Tight cooperage bolts
7. Slack cooperage bolts
8. Charcoal wood
9. Furniture stock
10. Handle stock

Q-12. What was the average price paid for this Oklahoma roundwood in 1978? _____ (If volume units are different than in Q-7 please specify _____).

Q-13. What was the proportion of roundwood purchased from each seller class:

_____% Forest Industry

_____% Independent loggers

_____% Independent wood buyers

Q-14. Excluding the cost of wood itself, what was your total expense for procuring Oklahoma wood in 1978? _____

Q-15. Please estimate what percent of your total expenses were spend in each of the following categories

a. Wages for your employees _____
b. Contract labor _____
c. Transportation (freight) _____
d. Fuel & oil _____
e. New equipment (saws etc.) _____
f. New machinery (skidder, loader etc.) _____
g. New vehicles _____
h. Repair and maintenance _____
I. Other _____

Q-16. Please break-down the total volume of Oklahoma wood received in 1978 (both standing timber purchased and cut and roundwood) into the following species categories (if unknown, please estimate as a percent of total Oklahoma wood purchased).

_____(units _____) Yellow pine

_____(units _____) other softwoods

_____(units _____) Oaks

_____(units _____) Gums

_____(units _____) Other hardwoods

Q-17. On the table below please estimate the percent of volume in each species group coming from each Oklahoma county in which wood was purchased:

	Please Estimate % of Volume by Species Group				
County Name	Yellow Pine	Other Softwoods	Oaks	Gumm	Other Hardwoods
%	%	%	%	%	%
1.					
2.					
3.					
4.					
5.					

VITA

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Candidate for the Degree of

Master of Science

Thesis: THE IMPACTS OF THE FOREST PRODUCTS INDUSTRY ON THE ECONOMY OF OKLAHOMA

Major Field: Forest Resources

Biographical:

Personal Data: Born in Tulsa, Oklahoma, February 19, 1956, the son of Mr. and Mrs. K. R. Schooley.

Education: Graduated from Bishop Kelley High School, Tulsa, Oklahoma, in May, 1974; received Bachelor of Science in Agriculture (Forest Management) from Oklahoma State University in 1978; completed requirements for Master of Science degree in Forest Resources at Oklahoma State University in May, 1981.

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