THE IMPACT OF THE MCCLELLAN-KERR ARKANSAS RIVER NAVIGATION SYSTEM ON THE OKLAHOMA ECONOMY

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CHAPTER I

INTRODUCTION

Problems of economically depressed rural areas have long plagued economists, policy makers, and residents in those areas. In recent years, a wide range of programs has been implemented to assist rural communities in achieving economic development. However, some regions still lag far behind as compared to the growth of the nation as a whole.

Oklahoma is a typical low-income, rural area. Rapid regional growth has been anticipated since the 1970 completion of the McClellan-Kerr Arkansas River Navigation System, the largest civil works project ever undertaken by the Corps of Engineers. Major functions of the multipurpose project include navigation, flood control, water supply, hydro-electric power generation, and recreation. Economic growth, as foreseen by the public, is expected to be induced by expansion of the manufacturing sector, which in turn is generated by incoming firms and industries in response to the available low-cost waterway transportation.

Before regional planning at the state and local level or in the private sector can properly be made to meet the expected change in the economic structure, several questions must be answered. First of all, attraction of waterway transportation in the region, if it exists, does not necessarily imply that expansion of all industries will occur. Since factors affecting selection of firm location may vary from

industry to industry, it is important to know the role of transportation, especially by water, in various industries. If waterway user industries do engage in rapid expansion, the next question would be how other industries will react. Finally, given the impact of the waterway on the industry expansion, changes in other aspects of the regional economy and the magnitude of change are critical also. If the impact turns out to be insignificant, then other strategies of attracting industries in addition to water resource investment should be sought. Therefore, a study which leads to identifying the role of waterway transportation in the growth of regional economy is essential.

A Brief History of the Arkansas River

Navigation on the Arkansas River began in the 1700s. Congress began authorizing navigation improvements on the river in 1832 to facilitate the increasing traffic on the river. However, continuous floods impeded the progress and regularly low water retarded the travel. Railroad development in the late 1800s then replaced water as the primary mode of transportation in the region.

The feasibility of navigation on the river was determined in 1943 by the Arkansas River Survey Board, appointed by the Chief of the Corps of Engineers. In 1946, Congress authorized the development of the multi-purpose Arkansas River project in the Rivers and Harbors Act. Because of appropriation problems construction was not begun until 1957.

Navigation was opened from the Mississippi River to Little Rock, Arkansas, in December, 1968; to Fort Smith, Arkansas, in December, 1969; and finally to the Tulsa Port of Catoosa, Oklahoma, in December, 1970. The waterway was designated by Congress as the McClellan-Kerr Arkansas

River Navigation System. The official dedication of the waterway occurred in June, 1971.

The total cost of the project is approximately $1.2 billion; half of which was invested in each of the two states, Arkansas and Oklahoma. Seventeen locks and dams, twelve in Arkansas and five in Oklahoma, were constructed. In eastern Oklahoma, there are five upstream lakes not only serving to regulate the water level in the operation of the waterway but also providing excellent recreation areas.

Major commodity groups transported on the Arkansas waterway include sand, gravel and crushed rock, waterway improvement materials, petroleum and products, grains, ores and minerals, coal and lignite, steel and iron, fertilizers and chemicals, etc. Annual tonnages, by type of shipment and by commodity group, shipped on the Oklahoma portion of the Arkansas River from 1971 to 1976 are presented in Table I. It is forecast that shipments on the entire system (including the Arkansas portion) will exceed 13 million tons by 1980.

Study Area

Selecting an appropriate study area for impact analysis is a difficult task, since the extent of the effects of a change in exogenous force is not known before completion of the study. The intensity of impact varies with the type and force of the change. Sometimes a shock in a region brings about significant influences only on the regional economy; a boom in a small town resulting from the discovery of a new energy source in the vicinity is an example. However, it is <u>not</u> unusual that influences extend to distant areas, even when noticeable impacts are not realized in the region initiating the change. For

TABLE I

TONNAGES OF SHIPMENT ON THE ARKANSAS RIVER NAVIGATION SYSTEM, OKLAHOMA PORTION, 1971-1976

Year	1971	1972	1973	1974	1975	1976
Tonnage by Type of Shipment						
Total	215,928	1,115,871	851,875	902,610	881,094	1,772,771
Inbound [a/]	159,926	310,616	199,264	218,405	233,624	291,627
Outbound [a/]	51,964	521,348	282,839	416,075	520,518	1,255,553
Internal [a/]	4,038	283,907	369,772	268,130	126,952	225,591
Tonnage by Commodity Group						
Total	215,928	1,115,871	851,875	902,610	881,094	1,772,771
Grain	1,000	9,386	66,188	199,900	287,339	353,395
Coal	1,400	461,839	181,075	174,700	167,868	191,484
Sand and Gravel	-	111,400	206,900	120,420	123,534	124,525
Rock	-	162,016	142,231	118,384	-	103,891
Petroleum	25,634	16,490	4,119	12,832	19,106	666,970
Molasses	-	-	4,700	17,050	-	-
Paper	8,400	9,871	8,625	6,250	-	-
Chemicals	8,500	19,635	14,709	23,001	31,316	60,026
Fertilizers	-	92,577	48,389	45,750	81,850	63,252
Iron and Steel	150,831	192,500	147,853	157,557	123,973	123,066
Metal Products	-	-	-	-	11,750	47,332
Miscellaneous	9,063	40,157	27,086	26,766	34,358	38,830

[a/] Inbound means traffic terminating at points in Oklahoma; outbound means traffic originating at points in Oklahoma; internal means traffic originating and terminating at points in Oklahoma.

Source: U. S. Army Corps of Engineers, Tulsa District.

instance, a new highway connecting cities A and B in a state may generate greater benefits to neighboring states using the highway as a shortcut than those two cities. Furthermore, the determination of impacts will be extremely complicated when the interdependencies and feedbacks among sectors and regions are taken into considerations.

The study area is confined in the state of Oklahoma (Figure 1). An ideal study area would be obtained by specifying a zone of certain width, say, 150 miles, running parallel to the river on both sides. But this would make data collection difficult. Although the Arkansas River traverses through only part of the state, Tulsa (the second largest population center in the state) is located by the river; and Oklahoma City (the largest city in the state) is only 90 miles southwest of Tulsa (connected by Interstate 44). Hence, it was reasonable to select the state as the study region. Due to data and time limitations, it was decided not to include the Arkansas portion of the Navigation System in the study.

Seventy-seven counties are in the state of Oklahoma. The state contains about 70 thousand square miles of land area and a population of 2.56 million in 1970. More details in demographic and socio-economic characteristics will be presented in later chapters.

Objectives

The major objective of the study is to identify the role of the $1.2 billion navigation project in promoting economic growth in a predominantly rural state, and in generating regional income through transportation and recreation functions. Functions other than navigation and recreation will not be considered. Specific objectives are as follows:

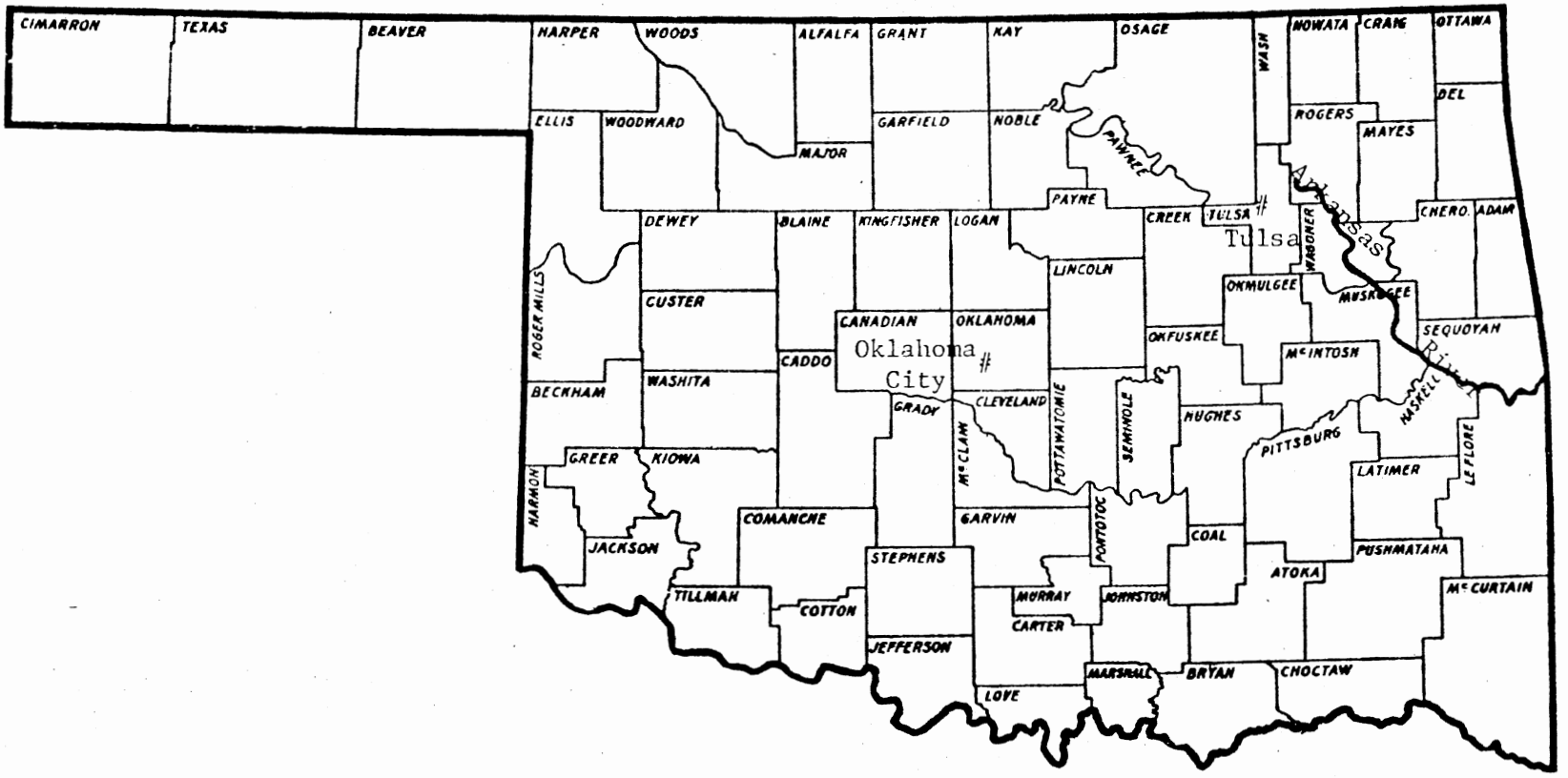

Figure 1. Location of the McClellan-Kerr Arkansas River Navigation System in the State of Oklahoma

1. to determine relative importance of selected factors, particularly transportation, affecting location of industries;

2. to estimate direct impact on major industries that might use water transportation intensively;

3. to estimate total impact of the waterway transportation on the entire state economy;

4. to measure the economic effects from recreational visitations and investments made on the Navigation System; and,

5. to forecast the change in population resulting from the waterway transportation and recreation.

Procedures

Procedures to accomplish each specific objective are briefly described below.

1. A set of factors affecting the selection of location will be chosen from several previous studies and will be used to evaluate how industries perceive the importance of those factors.

2. Data on interregional trade and transportation census will be employed to determine the direct effect of the water transport on selected industries.

3. An interregional input-output model will be constructed and the results used to trace interdependence among various industries. The total impact of the waterway transportation then will be estimated from the interdependence.

4. Data from recreation surveys will be applied to measure employment and income generated from participation in water-oriented recreational activities.

5. A regional model including a demographic sector will be constructed to estimate the future change in state population. Simulation techniques will be utilized.

Organization of the Study

Several studies on industry location and water resource investment are discussed in Chapter II to show the role of transportation in selecting location. The basic concept of the analytical tool used in the study is discussed in Chapter III. The model for estimating direct and total impacts of the water transportation on the state economy is developed in Chapter IV. The results of that model are presented in Chapter IV also. The estimation of recreation impacts of the Arkansas River Navigation System is presented in Chapter V. The demographic simulation model and the results of the simulation are discussed in Chapter VI. Finally, the study is summarized in Chapter VII.

CHAPTER II

FIRM LOCATION AND REGIONAL GROWTH

Location Theory of the Firm

Early location theory has indicated that a firm would select its location such that transport costs of raw materials, semi-finished products and final products are minimized; that is, other things being equal, the firm can maximize its profits by choosing such a location (3). The validity of the theory depends upon whether underlying assumptions are met. These assumptions include spatially constant prices of factors and products, the same processing costs among various locations under consideration, profit-maximization firms, no personal preference of a particular location over another, and ignorance of competitors.

In practice, these assumptions can not be met. For instance, there are variations in labor costs, taxes, energy costs, and land prices among different regions. A firm's profit is not likely to be determined solely by the transport costs incurred in shipping raw materials and products. In some cases, preferences of management may affect the location selected. Moreover, a firm may try to maximize its sales subject to certain level of profits instead of profits alone (5). Hence, the market potential may be more important than transport costs in the selection of location for a sales maximization firm. Under these circumstances where "other things are not equal," the applicability of the theory becomes quite limited. By relaxing some of the assumptions the

theory may still be useful in explaining how and why the location of a firm should be chosen. But the optimum location of one firm does not necessarily suggest optimum for another firm unless the location factors and their relative importance or weight are identical for both firms.

Based on the incentives of minimizing transportation costs of the firm, some industries may be classified as material-oriented and others market-oriented. Hoover (15, pp. 31-38) has pointed out, when loss of weight occurs during the production process, when procurement costs per ton-mile are greater than distribution costs, when materials are perishable, and when a large amount of fuel is required, location close to source of material is more economical. Industries such as beet sugar, cement, glass, and cottonseed-crushing, belong in this category. On the other hand, orientation to markets is important to industries involving weight gain during processing or higher distribution costs on products per ton-mile than procurement costs on materials; for example, beverage and baking industries.

However, intermediate location may be feasible for industries to which the attractions of markets and sources are about equal, and for which trans-shipment (transfer between different means of transport) is required. Flour milling is an example since the relative cheap and bulky raw product and the finished product have nearly the same transport costs per ton-mile (15). It follows that ports and railheads possess a potential of becoming manufacturing centers.

This classification does not give a satisfactory explanation of the location pattern of manufacturing industries. Automobiles, tires, aircraft, household appliances, and some other industries do not appear

to be market- or source-oriented. The types of orientation cited above are a result of sensitivity to transportation. That is, industries subject to relative high transport costs in terms of per dollar of product or per ton of shipment are more sensitive to transportation and tend to adhere to location where required transportation services are available at lower costs. Conversely, location of transportation insensitive industries may be determined by factors other than transportation.

There have been numerous empirical studies on location decisions in industries or firms (8) (13) (24). Data obtained from surveys of firms or interviews with executives were frequently used. Generally, the study area selected was confined to relatively small regions such as a state, a metropolitan area or an area consisting of several counties in a state. Before a few of these studies are discussed in the following section, it is important to know why new firms are established or existing firms are expanded and how the locations are selected.

The process of location decision has been studied by Dean (10) who interviewed 150 manufacturing firms in the East and the Midwest during the period from September 1966 to September 1969. It was found that the decision making in large firms is highly specialized and involves very few personal factors. In this study, a large firm is characterized by (1) having 500 employees or more, (2) serving national and regional markets, and (3) possessing one or more branch plants besides the main plant.

After the sales forecast is made for a certain length of time (say, five or ten years), then if a plant has insufficient capacity to produce

the projected output, a decision must be made as to whether or not other plant(s) already in operation will have excess capacity. When excess capacity is not available, the management must decide if the additional production can be contracted from another firm. If this approach is again found infeasible, then expansion of existing capacity will be considered. The decision on a new plant will finally be made when expansion of existing plant(s) appears to be impossible or undesirable.

During the search for a new plant location, a region is determined first. Selecting a region would primarily depend on market potential and market share, particularly if the plant is to serve a regional market. For a plant serving nationwide market, the market considerations are of less importance. Sometimes a subregion may be chosen before a specific community is determined. The last step is to select a site on which the new plant is established. The search for a site and the search for a community may be carried out at the same time; the "second best" community will be considered if the available site cannot be found in the most desirable community.

The decision process of small firms differs from that of large firms. First of all, the owners' preferences may enter the process. Since the market area of a small firm is usually local or regional, the selection of a region or a subregion may be bypassed. Dean also found that the owners are located in their market area in most cases, and that plant location is selected within the "activity space" or the "direct contact" space of the owners (10). Activity space is the area in which personal or business contacts, directly or indirectly, are possible. A portion of the activity space, where direct contacts can be made, is

called direct contact space. In general, very few alternatives of location decision exist due to limited time and funds of small firms.

A flow chart shown in Figure 2 will be helpful in presenting the stages of the decision process. It should be noted that decisions on location of a new plant for a large firm may be made several years before operations begin, which is not expressed in the chart.

Empirical Location Studies

Michigan Study

A study done by Mueller, Wilken and Wood (24) analyzed the attractiveness of Michigan as an industrial location. Satisfactions or dissatisfactions of manufacturers with selected factors were used as a measurement of attractiveness. In this study, location decisions in terms of new plant establishment, relocation and expansion also were investigated. Data were obtained by personal interviews with top executives of 239 manufacturing plants in Michigan and with 57 plant executives in three metropolitan areas in Ohio.

Each respondent was asked to select the five most important factors from a list of 21 locational factors which affected the selection of his present location. Labor costs, proximity to markets, availability of skilled labor, attitude of the state and community toward industry, taxes, and proximity to materials were identified most frequently as important factors. The degree of importance did not vary substantially among firms of different sizes and among six industry groups (transportation equipment, machinery, metal, petro-chemical, consumer goods, and primary materials). Thus, the results seemed to confirm the location theory which emphasizes market and cost factors (15).

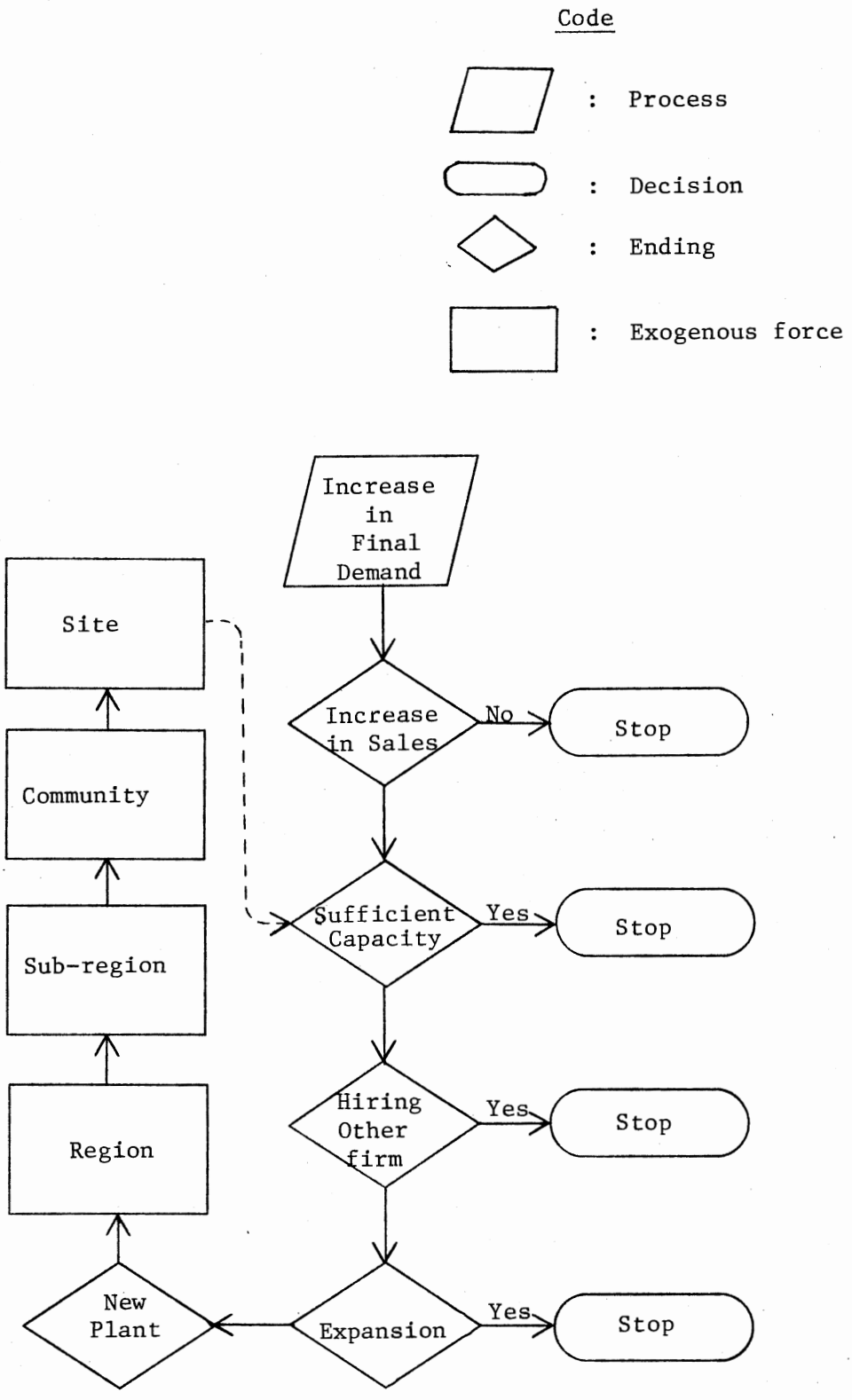

Figure 2. Process of Location Decision

Another finding of the study related to non-economic locational factors. Firms established after 1940, which accounted for 50 percent of total employment in the industries analyzed indicated that the main reason for locating the plants in Michigan was historical accident, preference of the founder, ties to community, or other personal considerations. Firms, regardless of date of establishment, representing 33 percent of employment, gave the same reason for selecting the plant sites. However, the results showed a declining significance of the personal factor in location decision as the firm size increases in terms of number of plants. As mentioned earlier, Dean (10) also found the location decision less personal in large firms.

The analysis also revealed the manufacturers' attitudes toward Michigan. Advantages perceived by Michigan firms were proximity to markets, favorable labor situations, proximity to materials, and favorable transportation facilities. Manufacturers in Ohio perceived the same advantages in Ohio but with a stronger feeling (expressed by a higher percentage of firms in terms of employment). However, the advantage of low taxes as indicated by one-third of Ohio firms was absent in Michigan. On the other hand, disadvantages found in Michigan, namely, high taxes, high labor costs, and existence of unions, were felt less intensively in Ohio. All this signified that the industrial position of Michigan has deteriorated and the state has become less attractive in comparison with the neighboring state of Ohio. The study reported that 21 percent of Michigan firms with 500 employees or more planned to expand outside the state; and another 21 percent of the firms planned expansion, either in-state and/or out-of-state. The "drain"

in manufacturing growth could be a serious obstacle to the economic development of the state.

Florida Study

The reliability of results of location study based on questionnaire data depends upon many factors. In a study on the location of Florida industries, Greenhut and Colberg (13) made a great deal of effort to explain how location factors should be defined so as to obtain meaningful data from surveys on plant or industry location. They pointed out that terms used in a questionnaire could have different meanings to different people. For instance, a firm may treat some economic advantages (such as community support and less pressure from labor unions) as appealing as personal preferences. In this case, it would be incorrect to interpret the personal reasons as a dominant factor in location decision. Sometimes cost advantages and market advantages could be interdependent and thus confusing. A firm which selected a location that offers lower processing cost may be able to sell a higher volume (due to the low cost and hence lower price). It would be difficult to distinguish whether the cost or the market is the real governing force. Therefore, even though the best sampling technique may be used and response rate high, results of the survey would still be questionable if the researcher failed to fully communicate with the respondents.

Three major groups of locational factors were classified in the study: (1) personal factors, with or without economic advantages; (2) cost factors in terms of labor, energy, raw materials, processing, taxes, etc.; and (3) demand factors, which includes access to markets

and anticipation of growth of markets. There were 26 individual factors, and each was well defined. For example, "access to markets" means access to the Florida market. Firms which served markets out of the state were regarded as being mainly attracted by the cost advantages of Florida location, while the market was only a secondary factor.

Greenhut and Colberg (13) also pointed out the complexity of the market (or demand) factor. Since each plant must have its market(s), the term "access to market" used by a new or relocation plant and a branch plant should be differentiated. If alternative market areas did not exist, this factor would imply "closeness to buyers" for a new plant but savings in transport costs for a branch plant. With the existence of alternative market areas, the Florida location selected by a plant, either new or expanded, would be the most advantageous in relation to alternative locations. This particular location could possess market or cost advantages. Therefore, in addition to locational factors, the questionnaire also required other information, such as on markets for products, sources of materials, alternative locations considered and their advantages and disadvantages.

A sample of 261 plants was selected from 1294 plants established, relocated, and expanded in 1956 and 1957. As Greenhut and Colberg (13, p. 50) stated, "in order to make the answers of respondents correspond as closely as possible to the 'universe,' namely, to all applicable plants which located in Florida in 1956 and 1957, a double 'blow up' of results was made." The adjustment resulted in a larger number of "observations" than the number of actually interviewed plants. Therefore,

the results of the study represented population rather than sample. Besides the questionnaire survey, telephone and on-site surveys were also employed to obtain more information. Follow-up letters were used extensively to insure the accuracy of answers. All non-agriculture industries were covered; the 26 industrial groups included primary, manufacturing, construction, and service industries. However, a majority of surveyed firms were in manufacturing.

The results showed access to markets, anticipation of market growth, and low freight cost on shipping final products, as leading locational factors for the Florida industries. Although these factors were important to most industries, there were exceptions. Climate (as it affects operations) was regarded influential by furniture, petroleum, leather, and stone and glass product industries. Low freight cost on input materials appeared to be an important factor in the lumber and wood products industry. The apparel industry placed the greatest weight on labor availability and low wages.

A more interesting finding of the study was preference of community by Florida industries. The extent to which an industry preferred developed counties to underdeveloped counties differed, but developed counties were considered more favorable by all industries combined. As far as individual industries are concerned, plants with 25 to 500 employees in food, lumber, and chemical industries showed a strong preference for location in underdeveloped counties. This suggested that these counties would have a reasonable chance to attract intermediate firms of the forementioned industries. Other industries

which serve non-local markets may also be attracted if skilled labor, raw materials, and service facilities are available in these counties. However, the deficiency of community facilities was indicated by plant officials as a disadvantage in Florida location. Rapid industrial growth is not likely to take place until certain fundamental problems are overcome.

Tennessee Study

Another large scale empirical study on plant locations was done by Carrier and Schriver (8) at Memphis State University. The main purpose of this study was to explain why firms chose to locate in Tennessee during the period 1955 to 1965. All manufacturing firms with 25 employees or more within one year after operations began were requested to participate in the study. Personal interviews with managers of 310 firms were taken in the summer of 1965 by eight interviewers. This number of firms represented a 90 percent participation rate. Every manufacturing industry under the two-digit Standard Industrial Classification (SIC) except tobacco (SIC 21), and petroleum and coal products (SIC 29) was covered in the study. The study report was based on the interview data of 308 firms; two firms were excluded to avoid disclosure.

Procedures similar to earlier studies were applied; each firm was asked to identify up to six most important factors in determining the plant location from a list of 37 locational factors. The difference

between this and other studies was that each firm was also asked to distribute 100 points among those selected factors. Therefore, the relative importance of locational factors was expressed in frequency (number of times a factor was identified) and mean point (total number of points of a factor divided by the number of firms assigning the points to that factor). Based on the first measure, the most essential factors (in order of decreasing importance) were (1) low cost and availability of labor, (2) low cost of electric power, (3) favorable labor-management relations, (4) community leaders cooperation, (5) low cost of building and land, and (6) low freight cost on finished product. However, by using the mean points as a criterion, the six highest ranking factors turned out to be (1) personal factors without economic advantages, (2) low cost and availability of labor, (3) available existing plant, (4) personal factor with economic advantages, (5) availability of low cost raw materials, and (6) greater demand in the area.

It seems difficult to interpret the results of these two series of data. For instance, personal factors without economic advantages was picked by 25 firms as an important location factor and ranked 16 of 37 factors, but evidently those firms assigned very high points (49.2 on average) to it and, hence, this factor ranked number one in mean point. Choosing a number of factors (with a maximum of six) only tells what the crucial factors are, but does not show the order of importance and by how much the importance of factor A exceeds factor B. Thus, the purpose of asking firms to "grade" the factors selected was to find out

their relative importance in determining location. Yet assigning 80, 15, and 5 points to factors A, B, and C, respectively, does not imply that the location decision consisted of 80 percent of A, 15 percent of B, and 5 percent of C. A reasonable interpretation, as suggested by Carrier and Schriver, is that factors A, B, and C appeared to be the most important ones among all factors considered; the importance of factor A far exceeded that of B and C, while B was just slightly more important than C (8, p. 36).

Therefore, the second set of data should not be used to determine the most significant locational factors. Rather it indicated how important a given factor compares with others. In other words, it indicated the importance of a factor perceived subjectively by a firm in relation to other locational factors when the firm identified these factors. Precise inter-firm comparison should not be made. For example, if factors A and B were assigned 80 and 20 points respectively by firm 1 and 70 and 30 by firm 2, one could conclude that the order of importance of factors A and B was the same for both firms and the relative importance was nearly equal. It would be erroneous to say that factor A was more essential to firm 1 than firm 2 while factor B was more critical to firm 2 than firm 1. Consequently, the highest mean point for personal factors without economic advantages only implied that those 25 firms identified this factor as far more important than others in location decision, but the remaining firms failed to notice the effect of the factor.

Carrier and Schriver also presented the data on distribution of firms by the number of points assigned, and the frequency and mean point

of each factor for each two-digit SIC industry. The important factors selected by industries with a frequency greater than 30 percent are summarized in Table II. There were only two firms included in the instruments and related products industry (SIC 38); hence, only factors identified by both firms are presented. The six most important factors for the entire manufacturing sector have been mentioned earlier in this section. As can be seen in Table II, those factors were not equally significant to individual industries. In general, low cost and availability of labor (factor 9) was the major consideration of location decision by industries in Tennessee except the printing and publishing industry (SIC 27). Low power cost (factor 11) ranked second in overall manufacturing, but did not seem to be a particularly important factor in lumber and wood (SIC 24), furniture and fixtures (SIC 25), printing and publishing (SIC 27), leather (SIC 31), and miscellaneous manufacturing (SIC 39) industries. Community and state tax structure (factor 22) was only considered as distinctly critical by the transportation equipment industry (SIC 37). This suggests that each industry has a different set of factors affecting its location choice, at least in Tennessee.

In view of the differences in sensitivity to various locational factors by various industries, Carrier and Schriver grouped 37 factors into six major categories and tested the significance of dissimilarities in industries' response to these locational categories. It was found that the miscellaneous manufacturing (SIC 39) and furniture and fixtures (SIC 25) industries were significantly more sensitive to personal factors (category 1) than other industries. As discussed earlier,

TABLE II

IMPORTANT LOCATION FACTORS IDENTIFIED BY TENNESSEE INDUSTRIES

SIC	Industry	No. of Firms	Locational Factors Identified as Important[a/]
20	Food and Kindred Products	10	24(6) 7(4) 9(4) 1(3) 5(3) 8(3) 11(3)
22	Textile Mill Products	10	9(4) 8(3) 11(3) 15(3) 24(3)
23	Apparel and Related Products	69	9(60) 29(29) 15(24) 11(32) 23(22)
24	Lumber and Wood Products	11	9(7) 15(6) 6(4) 8(4)
25	Furniture and Fixtures	35	9(17) 15(12)
26	Paper and Allied Products	17	3(6) 4(6) 9(6) 11(6)
27	Printing, Publishing, and Allied	5	15(3) 29(3)
28	Chemicals and Allied Products	12	11(7) 9(6) 3(4) 7(4) 35(4)
30	Rubber and Misc. Plastic Products	14	9(10) 11(9) 29(6) 15(5) 35(5)
31	Leather and Leather Products	11	9(9) 29(8) 35(7) 15(6)
32	Stone, Clay, and Glass Products	10	9(5) 4(4) 7(4) 10(4) 11(4)
33	Primary Metal Products	8	15(6) 9(5) 11(5) 4(3) 5(3)
34	Fabricated Metal Products	27	9(17) 21(10) 11(9) 15(9)
35	Machinery, excl. Electrical	12	9(6) 11(5) 15(5) 4(4)
36	Electrical Machinery	23	9(22) 29(12) 15(11) 11(9) 22(8)
37	Transportation Equipment	19	9(14) 22(10) 11(9) 29(8) 15(6) 23(6)
38	Instruments and Related Products	2	9(2) 15(2) 21(2)
39	Misc. Manufacturing	13	9(8) 24(5) 1(4)
All Manufacturing		308	9(202) 11(111) 15(110) 29(99)

[a/] Only factors that were identified as important by 30 percent or more of the firms are listed. To save space, locational factors are expressed by number. The corresponding factors are listed below. The number in parentheses following the factor number indicates the number of firms which identified that factor.

TABLE II (Continued)

1. Personal with economic advantages; 3. Greater demand in area; 4. Greater demand potential in area; 5. Low freight cost, finished product; 6. Better service from seller of raw materials or components; 7. Low cost on raw materials or components; 8. Availability of low cost raw materials; 9. Low cost and availability of labor; 10. Low cost of fuel; 11. Low cost of electric power; 15. Favorable labor-management relations; 21. Low cost of building and land; 22. Favorable community and state tax structure; 23. Community concessions; 24. Available existing plant; 29. Community leaders cooperation; 35. Low cost of financing plant through revenue or general obligation bonds.

[b] Factors identified by only one firm are excluded.

Source: Carrier and Schriver (8).

industries characterized by relatively high procurement cost, weight-loss production orocess, or using perishable materials tend to be oriented toward sources of materials (15). Results of this study showed that the food and kindred products (SIC 20), stone, clay and glass products (SIC 32), and lumber and wood products (SIC 24) industries, which are likely to be source-oriented, had very high sensitivity to the procurement cost factor (category 2). The index of sensitivity to processing cost (category 3), which is affected by the costs of labor, energy, land, capital, services, etc., was found particularly high in electrical machinery (SIC 36) and apparel and related products (SIC 23) industries while low in paper (SIC 26), food (SIC 20), and printing and publishing (SIC 27) industries. However, paper, food, and printing and publishing industries were highly sensitive to distribution cost (category 4), location demand (category 5), and certainty (category 6) factors, respectively. The magnitude of the sensitivity index for processing cost (category 3) was in general much greater than for other categories. This implies that factors related to processing cost were a major consideration in the location decision of Tennessee manufacturers.

An obvious merit of the study results is that it is fairly easy to distinguish important locational factors for a single industry on the one hand, and to trace the importance of a single factor (or a category of factors) to various industries on the other hand. The coverage of industries in manufacturing was sufficiently broad, but the number of observations (firms) for certain industries was quite small. Although the study was based on Tennessee firms, the authors believe that the findings would be applicable to other regions.

Estimating the Relationship Between Locational Advantages and Regional Growth

Empirical results of studies on firm or industry location have shown the important factors of location selection and differential in location factors for various industrial categories. It can be roughly concluded that firms or industries do respond to transportation advantage in terms of cost and time (distance), though with different sensitivities. If all firms were able to ship their products at zero cost to destinations (markets) within a very short period of time, access to markets or sources would not be a crucial factor of determining firm location. However, while location theory serves to explain the economic rationale of selecting firm or plant location, it fails to quantify the relationship between location advantages and industrial growth. Since one purpose of this study is to estimate the growth of economy in Oklahoma resulting from the availability of navigation on the Arkansas River Navigation System, an alternative approach should be adopted.

Although factors affecting the location decisions of firms may be obtained from interviews and the order of importance of those factors may be determined, it is extremely difficult to find unbiased results. It appears that the factors chosen by researchers to be listed in the questionnaires would influence the survey results. The studies discussed earlier may be used to show the differences. Greenhut and Colbert (13) mentioned that climate was critical for the furniture industry. However, the same industry in Tennessee did not perceive climate as an important factor (8). Further differences may occur if there is a discrepancy between what firm executives think as crucial factors and what actually are.

The survey method may not be appropriate for the present impact study. First, a large scale survey is costly and time consuming. Second, results of such a survey are highly dependent upon the respondents' knowledge, available time, and willingness of cooperation. Usually the survey is conducted by interviewing a top executive or manager of the firm. An executive may not be able to provide all the information precisely when the firm is very large. Third, an interviewer and a respondent may define a term in different ways; hence, the definition could be inconsistent throughout the study. For instance, if a firm which ships only 5 percent of its products (in terms of sales) via waterway identifies water transportation as an important location factor, how should one interpret the results? Fourth, if personal interviews were used in this study, the question related to investment or expansion plans of the surveyed firm should be asked to predict output growth. Nevertheless, when the respondent is not an influential decision-maker and when the firm does not have detailed plans, trustworthy answers would be difficult to obtain. Furthermore, even if investment can be estimated from the survey data, it is still difficult for both the interviewer and the respondent to isolate the contribution of waterway transportation from other factors (such as general trend and lower labor cost). Finally, there is no proper process for sampling or selecting firms for the interview since they are non-existent. More specifically, which firm will expand its capacity and locate in the study area is not the concern of this study. What matters is the region's share of overall economic growth which is reinformced by the new transportation system.

There is no shortage of studies in the area of water resources and regional growth. Howe (17) has shown the growth of employment from 1950 to 1960 for seven groups of the U. S. counties, which were classified by their characteristics in terms of water transportation. The finding is rather surprising; counties contiguous with navigable inland waterways and the Great Lakes had a lower growth rate of employment than non-contiguous counties and than the nation as a whole. Moreover, these counties which have access to waterways lost their share of employment in their major industries in the study period. In their recent study, Cicchetti, Smith, and Carson (9) applied regression techniques to investigate the response of variables indicating economic growth (such as income and value of farm output) to various types of water resource investment and other public expenditures. They found that effects of the investment on regional economy depend upon the nature of water resource and other investments and economic conditions of the region.

Again, these studies show what has happened to areas with or without advantages in water resources, rather than explaining the process of economic growth due to the locational superiority. It is important to know that the waterway per se does not generate a large amount of income or employment directly in a region. In a rural, low-income area, a waterway simply offers a locational advantage. Economic growth may be achieved through industrial development, which is a consequence of firms' decisions to locate their establishments in the area.

Empirical findings of previous studies have revealed that location factors of different industries vary substantially. It follows that the impact of the new transportation system on industries can be expected to

be different. Regression estimates of the linkage between overall regional employment (or income) and investment in the water resources may be biased results. Furthermore, the functional relationship as estimated by Cicchetti, Smith, and Carson would not be useful in predicting regional growth in the future. This is because their regression equation implicitly implies zero economic growth when public expenditures and investments are held constant, regardless the level of aggregate demand. Although Howe (17) has indicated that water way transportation does not automatically give rise to prosperity to regions possessing this advantage, it would be incorrect to use his results to draw the same conclusion for the state of Oklahoma. Experience in one area may not be applicable in another area, especially when two regions differ in resource endowment, economic structure, and other aspects. In short, models used for this type of impact study should cover the entire regional economy for which the structure is specified in detail, and should give some insight of the transmitting mechanism, whereby initial effects of waterway transportation can be conveyed to a locational advantage, and then to industry growth.

A possibility of using input-output analysis as a tool of estimating the impact of waterway transportation on the Oklahoma economy has been suggested by Lewis et al. (20). The economic rationale of their view is briefly discussed here. The availability of a waterway provides a low-cost means of transportation. Producers who use the new mode of transportation to ship their products could expand their market areas; and raw materials purchased (imported) from outside the region become less expensive if they are shipped by water. As a result, the pattern of interregional trade between the study area and outside area

will change or some of the interregional trade coefficients will change. This change will result in a change in technical (input-output) coefficients or regional economic structure. Once the new structure is obtained, further impact analysis can be carried on without neglecting the overall picture of the regional economy and without distorting the functional relationship.

The most obvious advantage of the input-output technique is its precision and flexibility. Precision means that input-output analysis has a broad coverage and a precise reflection of the state of economy and technology. For example, a national input-output model reveals GNP, shares of GNP by various industries, industry outputs, inter-industry commodity and service flows, imports, exports, etc. Flexibility implies that, according to his needs and purposes, a researcher can construct a detailed interregional model in which even small industry may be included, or a simple one-region model with only few sectors of the economy. Furthermore, input-output analysis has a wide range of applications in impact studies, economic projections, and government finance. Thus an input-output model can be used extensively in various stages of economic analysis. The major drawback of a static input-output model is the assumption of constant technologies; thus, it may not be suitable for long-run projections of the economy. Principles of input-output technique are explained in the next chapter; and how it can be applied in this study will also be discussed.

CHAPTER III

BASELINE INPUT-OUTPUT MODEL

Basic Concepts of Input-Output Analysis

Since the first input-output table was published by Professor Wassily Leontief (19) the input-output method has been accepted as a powerful tool of regional economic analysis. Literature reviews of input-output analysis, in theory and in practice, can be found in a number of textbooks, journal articles, and research reports (6) (18) (22) (23) (30). Hence, the details of the input-output method will not be discussed.

A hypothetical input-output transactions table is illustrated in Figure 3. The processing sector (surrounded by the hold line) which contains n endogenous industries in an economy can be expressed by matrix X (n by n). Thus, each entry in X, x_{ij}, indicates the amount of input purchased by the j-th industry from the i-th industry. The payments sector may have just a row showing the flow of goods and services. It can also be disaggregated into several components; for example, to present imports, inventory depletion, value added, payments to household, and payments to government. Similarly, the final demand sector may be separated into a number of columns such as government purchases, exports, investment, inventory change, and personal consumption. The row sums and column sums indicate the total outputs and total

outlays, respectively. Theoretically, an industry's output should be equal to its outlay.

Processing Sector	1 2 3 .. j .. n	Final Demand	Total Output
1 2 3 . i . n	x_{ij}	Y	X
Payments Sector			
Total Outlay			

Figure 3. Hypothetical Input-Output Table

Let X_j denote the output of the j-th industry. The technical or input-output coefficient, a_{ij}, can be obtained by dividing x_{ij} by X_j. That is,

$$a_{ij} = \frac{x_{ij}}{X_j} \tag{1}$$

Hence, the a_{ij} indicates the amount of input required from the i-th industry to produce a dollar's worth of output of the j-th industry. The technical coefficients can be expressed by matrix A where a_{ij} is the element of the i-th row and the j-th column.

Let the total final demand be denoted by a column vector Y, then the input-output model can be presented by the following form:

$$AX + Y = X \tag{2}$$

where X is a column vector representing the outputs. Equation 2 can be rewritten as

$$(I - A)X = Y \tag{3}$$

where I is an identity. Then,

$$X = (I - A)^{-1} Y \tag{4}$$

$$\text{Let } C = (I - A)^{-1} \tag{5}$$

where C is the interdependence matrix. Then c_{ij} is the element of i-th row and j-th column in C. The c_{ij} indicates the amount of goods or services required directly and indirectly from the i-th industry for each dollar delivery to the final demand sector by the j-th industry.

Input-output relationships such as expressed by equation 4 are useful in short-run forecasting. When final demand projections are available, output projections can be calculated from equation 4, i.e.,

$$X_0 = (I - A)^{-1} Y_0 \tag{6}$$

where X_0 and Y_0 stand for vectors containing projected values of output and final demand, respectively. Therefore, a change in the final demand of the j-th industry can cause changes in output of all the industries as long as the entries in the j-th column of matrix C are nonzero.

Although a single-region input-output model may provide information of regional exports and imports of each industry, it does not tell the destinations and sources of the shipments, nor does it show how an industry's imports are distributed and consumed by other industries. When regional interdependence is brought into the analysis, an interregional input-output model may be more desirable. The basic form of an

interregional commodity flow table is illustrated in Figure 4. For the purpose of simplicity, only two regions are included.

Region		1	2	1	2	Total
	Industry	1 2 . . . n	1 2 . . . n	Final Demand		Output
1	1 2 . . . n	X^{11}	X^{12}	Y^{11}	Y^{12}	
2	1 2 . . . n	X^{21}	X^{22}	Y^{21}	Y^{22}	
Payments Sector						
Total Outlay						

Figure 4. Hypothetical Two-Region Input-Output Table

Both the processing sector and the final demand sector contain four submatrices. In the processing sector, entries in X^{11}, denoted as x_{ij}^{11}, are flows of goods and services between industries located in Region 1. Submatrix X^{12} can be designated as the "interindustry export matrix to Region 2 for Region 1," or the "interindustry import matrix from Region 1 for Region 2." Any element in X^{12}, x_{ij}^{12}, indicates the amount of input purchased by the j-th industry in Region 2 from the i-th

industry in Region 1. Submatrix X^{21} shows the imports of Region 1 or the exports of Region 2. Submatrix X^{22} is simply the intraregional flow matrix for Region 2. The four submatrices in the final demand sector can be interpreted similarly; each indicates the goods and services sold to the final demand sector in the region denoted by the second (right) superscript by the processing sector in the region denoted by the first (left) superscript. For example, y_{ij}^{21} is the amount of imports of the j-th final demand component in Region 1 from the i-th industry in Region 2.

The multiregional input-output table as shown in Figure 4 can be converted to a single-regional table of either region. If submatrices X^{12}, Y^{11}, and Y^{12} are consolidated into a final demand vector, and X^{21} is compressed into a row vector representing imports (of the payments sector), then combined with X^{11}, an input-output table for Region 1 is obtained. On the other hand, with additional data recording relevant economic activities of Region 2 and interregional trade, the input-output table of Region 1 such as presented in Figure 3 also can be transformed to an interregional model covering these two areas. This is done by expanding the imports row (of the payments sector) and the exports column (of the final demand sector) of the flow table for Region 1 to form interregional trade matrices (X^{12} and X^{21}), then attaching the flow matrix for Region 2 (X^{22}) to the lower-right-hand quandrant of the two-region processing sector.

In algebraic form, an interregional model with k regions and n endogenous processing industries can be written as

$$X_i^u = \Sigma_{j=1}^{n} \Sigma_{v=1}^{k} x_{ij}^{uv} + \Sigma_{v=1}^{k} Y_i^{uv} \qquad (7)$$

where X_i^u is the output of the i-th industry in the Region u; x_{ij}^{uv} is the flow of goods or services of the i-th industry in the u-th region to j-th industry in the v-th region; and Y_{ij}^{uv} is the Region v's final demand for the goods or services produced by the i-th industry in Region u. Hence, an interregional technical coefficient can be compted as

$$a_{ij}^{uv} = \frac{x_{ij}^{uv}}{X_j^v} \tag{8}$$

Each a_{ij}^{uv} is interpreted in economic terms as the amount of input required from the i-th industry in Region u by the j-th industry in Region v to produce one-dollar output. The technical and interdependence coefficient matrices will have a kn by kn dimension.

The interregional input-output coefficient, a_{ij}^{uv}, can be separated into two parts:

$$a_{ij}^{uv} = \frac{x_{ij}^{uv}}{\sum_{u=1}^{k} x_{ij}^{uv}} \cdot \frac{\sum_{u=1}^{k} x_{ij}^{uv}}{X_j^v} \tag{9}$$

Let

$$t_{ij}^{uv} = \frac{x_{ij}^{uv}}{\sum_{u=1}^{k} x_{ij}^{uv}} \tag{10}$$

and

$$a_{ij}^{v} = \frac{\sum_{u=1}^{k} x_{ij}^{uv}}{X_j^v} \tag{11}$$

then

$$a_{ij}^{uv} = t_{ij}^{uv} \cdot a_{ij}^{v} \tag{12}$$

The first term on the right of the equality, t_{ij}^{uv}, can be designated as the "pure interregional trade coefficient;" and the second term as the "pure technical coefficient" (20).

In equation 10, t_{ij}^{uv} indicates the ratio of goods or services purchased by the j-th industry in Region v from the i-th industry in Region u, to the total purchases from the i-th industry (in all regions) made by the j-th industry in Region v. Therefore, for each interindustry shipment of goods or services from industry i to j, t_{ij}^{uv} is the domestically produced input by Region v per dollar of total input (purchased from the i-th industry in all regions by the j-th industry in Region v), if u = v; and t_{ij}^{uv} shows the proportion of imported input if $u \neq v$. The pure trade coefficient should have the following properties:

$$0 \leq t_{ij}^{uv} \leq 1,$$

$$\sum_{u=1}^{k} t_{ij}^{uv} = 1; \quad i,j = 1, 2, \ldots, n \quad \text{and} \quad u, v = 1, 2, \ldots, k.$$

The pure technical coefficient, a_{ij}^{v}, simply indicates the required input from the i-th industry for each dollar of output of the j-th industry in Region v, regardless the origins of the input. The technical coefficient matrix will have k^2 submatrices; each submatrix has n rows and n columns.

$$A = \begin{pmatrix} A^{11} & A^{12} & \cdots & A^{1v} & \cdots & A^{1k} \\ A^{21} & A^{22} & \cdots & A^{2v} & \cdots & A^{2k} \\ \vdots & \vdots & & \vdots & & \vdots \\ A^{u1} & A^{u2} & \cdots & A^{uv} & \cdots & A^{uk} \\ \vdots & \vdots & & \vdots & & \vdots \\ A^{k1} & A^{k2} & \cdots & A^{kv} & \cdots & A^{kk} \end{pmatrix} \tag{13}$$

$$\text{where } A^{uv} = \begin{pmatrix} a_{11}^{uv} & a_{12}^{uv} & \cdots & a_{1n}^{uv} \\ a_{21}^{uv} & a_{22}^{uv} & \cdots & a_{2n}^{uv} \\ \cdot & \cdot & & \cdot \\ \cdot & \cdot & & \cdot \\ \cdot & \cdot & & \cdot \\ a_{n1}^{uv} & a_{n2}^{uv} & \cdots & a_{nn}^{uv} \end{pmatrix} = \begin{pmatrix} t_{11}^{uv}a_{11}^{v} & t_{12}^{uv}a_{12}^{v} & \cdots & t_{1n}^{uv}a_{1n}^{v} \\ t_{21}^{uv}a_{21}^{v} & t_{22}^{uv}a_{22}^{v} & \cdots & t_{2n}^{uv}a_{2n}^{v} \\ \cdot & \cdot & & \cdot \\ \cdot & \cdot & & \cdot \\ \cdot & \cdot & & \cdot \\ t_{n1}^{uv}a_{n1}^{v} & t_{n2}^{uv}a_{n2}^{v} & \cdots & t_{nn}^{uv}a_{nn}^{v} \end{pmatrix} \tag{14}$$

The interregional interdependence coefficient matrix can be calculated by using equation 5. That is,

$$C = \begin{pmatrix} C^{11} & C^{12} & \cdots & C^{1v} & \cdots & C^{1k} \\ C^{21} & C^{22} & \cdots & C^{2v} & \cdots & C^{2k} \\ \cdot & \cdot & & \cdot & & \cdot \\ \cdot & \cdot & & \cdot & & \cdot \\ \cdot & \cdot & & \cdot & & \cdot \\ C^{u1} & C^{u2} & \cdots & C^{uv} & \cdots & C^{uk} \\ \cdot & \cdot & & \cdot & & \cdot \\ \cdot & \cdot & & \cdot & & \cdot \\ \cdot & \cdot & & \cdot & & \cdot \\ C^{k1} & C^{k2} & \cdots & C^{kv} & \cdots & C^{kk} \end{pmatrix} \tag{15}$$

$$\text{where } C^{uv} = \begin{pmatrix} c_{11}^{uv} & c_{12}^{uv} & \cdots & c_{1n}^{uv} \\ c_{21}^{uv} & c_{22}^{uv} & \cdots & c_{2n}^{uv} \\ \cdot & \cdot & & \cdot \\ \cdot & \cdot & & \cdot \\ \cdot & \cdot & & \cdot \\ c_{n1}^{uv} & c_{n2}^{uv} & \cdots & c_{nn}^{uv} \end{pmatrix} \tag{16}$$

The interpretation of c_{ij}^{uv} is the same as that of c_{ij} coefficient for the single-region model, except that the former has an interregional dimension. The c_{ij}^{uv} indicates the quantity of output of the i-th industry in Region u required to satisfy (directly and indirectly) one dollar's

worth of Region v's final demand for goods or services of the j-th industry. Hence, a change in the final demand for j in a region may result in a significant change in the output of i in another region.

Application of Input-Output Analysis in the Study

The theoretical framework discussed thus far suggests that, given the technology (constant A matrix), levels of industrial output are determined by the magnitude of final demand. On the other hand, given the final demand, output will be determined by the state of technology, i.e., $(I - A)^{-1}$. This holds true for both single region and interregional models. However, in an interregional model, changes in the trade patterns can also affect the output levels. This is because any variation in the trade pattern of an industry will change some of the trade coefficients, which in turn yield different technical coefficients, and thus different interdependence coefficients.

The interregional trade between the study area and the rest of the world can be expected to change after the completion of the Arkansas waterway. It follows that, while holding technology constant, the industrial output in the study area should change. The case can be illustrated more clearly by using a two-region input-output model, where the study area is designated as Region 1 and the rest of the world as Region 2. As indicated by Lewis et al. (20), industries that can ship their products via water should obtain a larger share of the market since the costs of water transportation are lower. As a result,

$$\hat{t}_{ij}^{12} \geq t_{ij}^{12} \qquad (17)$$

where t_{ij} is the trade coefficient before the waterway was completed, and $\hat{t}_{ij}$ is the new coefficient which reflects the new trade patterns after the water transportation became available. Moreover, imports of the study area may be expected to rise. That is,

$$\hat{t}^{21}_{ij} \geq t^{21}_{ij} \tag{18}$$

The changes in the trade coefficients of the study area will certainly change some technical coefficients of the interregional model; a new matrix, $\hat{A}$, can be obtained. Let T be the trade coefficient matrix under the assumption of "no waterway," and $\hat{T}$ be the matrix of new trade coefficients. Given the final demand projections, Y_0, two sets of output projections may be calculated:

$$X_0 = (I - A)^{-1}TY_0 \tag{19}$$

which expresses the projected output levels based on the assumption of no waterway facility; and

$$\hat{X}_0 = (I - \hat{A})^{-1}\hat{T}Y_0 \tag{20}$$

which shows the levels of output that may be reached under the new patterns of interregional trade. In the study, it is assumed that the availability of the waterway will not change the technology, i.e., the pure technical coefficients. Therefore, the effect of the Arkansas waterway on the regional output can be estimated as

$$\Delta X = \hat{X}_0 - X_0 \tag{21}$$

After the changes in industrial output of the study area are obtained, the impact on regional employment and income can be measured. Let G be a diagonal matrix (n by n), of which the i-th element in the principal diagonal is the base period employment-output ratio for the i-th industry. By multiplying the matrix G by the ΔX column vector

which expresses the output changes, changes in employment by industry can be estimated. However, diagonal elements in G should be adjusted to account for the change in labor productivity. Hence,

$$\Delta L = \hat{G} \cdot \Delta X \tag{22}$$

where L denotes the employment vector and $\hat{G}$ is the adjusted or projected employment-output ratio matrix. Similarly, income changes can be measured by applying the income-output ratio matrix to the ΔX vector. Assuming constant income-output ratios,

$$\Delta M = H \cdot \Delta X \tag{23}$$

where M is a column vector of n elements showing industrial incomes, and H is a diagonal matrix of which the i-th element in diagonal indicates the income-output ratio for the i-th industry.

There is a wide range of applications of input-output analysis. Multipliers, value added, etc., also can be estimated from an input-output model. However, no attempt is made in this study to exhaust all the possible applications of this technique in regional analysis.

Constructing the Baseline Input-Output Model

As described earlier, the impact of waterway transportation on the economy of the study area can be estimated from an input-output model containing two regions: the study area and the rest of the world. Procedures of establishing the interregional model will be discussed in this section. Due to the difficulty of collecting data, the empirical model used here will include the study area and the rest of the nation.

Two models for two periods of time are required in the study. The first model, referred to as the "baseline model," depicts the economic

structure before the completion of the Arkansas waterway. Since the waterway in Oklahoma was completed in 1970, the baseline model is estimated for 1967. The second model, called the "impact model," is designed to show the effects of the waterway on interregional trade; i.e. trade coefficients. Relevant data of 1972 will be selected to estimate the new trade coefficients. The impact model is discussed in the next chapter.

Study Area

One of the shortcomings of input-output analysis is that it is expensive and time consuming to build a detailed model. Moreover, required data for input-output model at the regional level are always incomplete. Therefore, the technical coefficient matrix for the state of Oklahoma estimated by Schreiner et al. (36) is used for the study area. Their model, consisting of 79 endogenous industries, gives a relatively fine breakdown of the processing sector. Because the industry classification does not match the Standard Industrial Classification (SIC), the first input-output industry will be referred to as IO-1, the second IO-2, and so on.

The technical coefficients presented by Schreiner et al. were calculated from 1963 data, which may not be appropriate for the economic structure of 1967. Therefore, annual rates of change in interindustry trade from 1963 to 1975, estimated by Almon (2), were applied to adjust the 1963 commodity and services flows to a 1967 base. This was done by compounding the annual growth rate coefficient for each of the sectors for the four year period 1963-67. The technical coefficients for 1967 were then calculated from the 1967 interindustry trade projections.

To save space, only the resultant 1967 pure technical coefficient matrix, which is referred to as A^1, is presented in the study (see Table XXII of Appendix). A detailed description of processing industries can be found in several studies (28) (32) (57).

The Rest of the Nation

Since the study area constitutes only a small portion of the U. S. economy, the national technical coefficients for 1967 (58) were directly used in the study. Nevertheless, this model contains three more processing industries, namely, gross imports of goods and services (IO-80), business travel, entertainment and gifts (IO-81), and office supplies (IO-82), than the state model. In the present study, these relatively insignificant industries are treated as exogenous because state data are not available. The 1967 U. S. input-output model has been discussed in a great detail in the Survey of Current Business (58); thus, it is not shown in the study. The pure technical coefficient matrix for the rest of the nation is designated as A^2.

Trade Coefficient Matrix

The interregional and interindustry transactions data (such as x_{ij}^{uv} in equation 10) are not available; hence trade coefficients cannot be estimated. Alternative coefficients estimated from interstate and intraindustry commodity trade for 1963 (33) are employed in the study. However, two assumptions must be made. The first is that trade patterns in 1967 and in 1963 are the same. The second assumption can be expressed as:

$$t_{i1}^{uv} = t_{i2}^{uv} = \ldots = t_{in}^{uv} = t_{i}^{uv} \qquad u,v = 1, 2 \text{ and } i = 1, 2, \ldots n \quad (24)$$

The interstate commodity trade of 1963 has been estimated by Rodgers (33) for 61 input-output industries which produce goods. Each trade coefficient, t_i^{uv}, is computed by dividing the commodity flow from Region u to Region v by total consumption of commodity i in Region v. Service industries for which interstate trade is not available are assumed as nontraded, i. e., each region consumes domestically produced services. Thus, for each service industry,

$$t_i^{uv} = 1 \qquad \text{if } u = v \tag{25}$$

and

$$t_i^{uv} = 0 \qquad \text{if } u \neq v \tag{26}$$

Due to the characteristic of the trade coefficients as shown in equation 24, the interregional coefficient matrix which was written as

$$A^{uv} = [a_{ij}^{uv}] = [t_{ij}^{uv} \cdot a_{ij}^{v}] \tag{14}$$

now can be expressed as

$$A^{uv} = [a_{ij}^{uv}] = T^{uv}A^{v} \tag{27}$$

where

$$T^{uv} = \text{diag}\,[t_1^{uv}\ t_2^{uv}\ \ldots\ t_n^{uv}] \qquad u,v = 1,2 \tag{28}$$

and

$$A^{v} = [a_{ij}^{v}] \quad v = 1,2 \text{ and } i,j = 1,2, \ldots, n \tag{29}$$

Thus, the entire technical coefficient matrix, A (as equation 13), can be written as

$$A = T \cdot \bar{A} \tag{30}$$

where

$$T = \begin{bmatrix} T^{11} & \vdots & T^{12} \\ \cdots & \vdots & \cdots \\ T^{21} & \vdots & T^{22} \end{bmatrix} \tag{31}$$

and

$$\bar{A} = \begin{bmatrix} A^{1} & \vdots & 0 \\ \cdots & \vdots & \cdots \\ 0 & \vdots & A^{2} \end{bmatrix} \tag{32}$$

The diagonal elements of T^{11}, T^{12}, T^{21}, and T^{22} are presented in Table III.

Baseline Output Projections

Under the assumption that the pattern of interregional trade for the final demand sector is the same as that for the processing sector, the model as expressed by Figure 4 and equation 7 can be written in matrix form as

$$X = T\bar{A}X + TY \tag{33}$$

The TY term yields the exporting and importing components, as well as the domestically produced and domestically consumed component of the final demand sector. Equation 33 can also be written as

$$X = (1 - T\bar{A})^{-1}TY \tag{34}$$

The output projections were estimated by using the above equation.

The final demand projections for 1980 used in the study were obtained from Harvard interregional input-output study (34). However, these estimates are expressed in 1958 dollars. Deflators for the period from 1958 to 1963 developed by Scheppach (34) were coverted to an annual rate of change; then these rates were compounded to get the deflators for 1958-67 period. The 1980 final demand projections in 1967 dollars were calculated by applying the 1958-67 deflators to the 1980 projections in 1958 dollars. The output projections (X_0) for 1980 are shown in Table IV. The $(I-T\bar{A})^{-1}$ matrix will be provided upon request.

TABLE III

DIAGONAL ELEMENTS OF THE TRADE COEFFICIENT MATRIX FOR THE 1963 BASELINE MODEL

INDUSTRY	T^{11}	T^{12}	T^{21}	T^{22}
1 LIVESTOCK, PRDTS.	0.379846	0.014546	0.620154	0.985454
2 OTHER AGRIC. PRDTS.	0.702612	0.009174	0.297188	0.990826
3 FORESTRY, FISHERIES	1.000000	0.0	0.0	1.000000
4 AGRI. FORES. FISH. SV.	1.000000	0.0	0.0	1.000000
5 IRON, FERRO. ORES MIN.	0.030664	0.0	0.969336	1.000000
6 NONFERROUS ORES MINING	0.080929	0.000258	0.919071	0.999742
7 COAL MINING	0.038958	0.001783	0.961042	0.998217
8 CRUDE PETRO., NATL GAS	0.858880	0.033108	0.141120	0.966892
9 STONE, CLAY MINING	0.799222	0.000261	0.200778	0.999739
10 CHEM FERT MIN MINING	0.005401	0.0	0.994599	1.000000
11 NEW CONSTRUCTION	1.000000	0.0	0.0	1.000000
12 MAINT., REPAIR CONSTR.	1.000000	0.0	0.0	1.000000
13 ORDNANCE, ACCESSORIES	0.468652	0.006388	0.531348	0.993612
14 FOOD, KINDRED PRDTS.	0.343184	0.004543	0.656816	0.995457
15 TOBACCO MANUFACTURES	0.0	0.0	1.000000	1.000000
16 FABRICS	0.029877	0.000067	0.970123	0.999933
17 TEXTILE PRDTS.	0.005554	0.000144	0.994446	0.999856
18 APPAREL	0.032366	0.002343	0.967634	0.997657
19 MISC. TEXTILE PRDTS.	0.017457	0.001244	0.982543	0.998756
20 LUMBER, WOOD PRDTS.	0.062308	0.002446	0.937692	0.997554
21 WOODEN CONTAINERS	0.000471	0.000249	0.999529	0.999751
22 HOUSEHOLD FURNITURE	0.028720	0.002708	0.971280	0.997292
23 OTHER FURNITURE	0.046183	0.002493	0.953817	0.997507
24 PAPER, ALLIED PRDTS.	0.015350	0.000981	0.984650	0.999019
25 PAPERBOARD CONTAINERS	0.034347	0.003306	0.965653	0.996694
26 PRINTING, PUBLISHING	0.693209	0.000271	0.306791	0.999729
27 CHEM, SELECT. PRDTS.	0.145289	0.002795	0.854711	0.997205
28 PLASTICS, SYNTHETICS	0.009244	0.000957	0.990756	0.999043
29 DRUGS, COSMETICS	0.010105	0.000579	0.989895	0.999421
30 PAINT, ALLIED PRDTS.	0.019596	0.002415	0.980404	0.997585
31 PETRO, RELATED INDS.	0.900661	0.020857	0.099339	0.979143
32 RUBBER, MISC. PLASTICS	0.229185	0.008826	0.770815	0.991174
33 LEATHER TANNING PRDTS.	0.087442	0.0	0.912558	1.000000
34 FOOTWEAR, LEAT. PRDTS.	0.010544	0.001191	0.989456	0.998809
35 GLASS, GLASS PRDTS.	0.462338	0.019374	0.537662	0.980626
36 STONE, CLAY PRDTS.	0.649602	0.001215	0.350398	0.998785
37 PRIMARY IRON STEEL MFR	0.078617	0.000677	0.921383	0.999323
38 PRIMARY NONFERROUS MFR	0.184960	0.004782	0.815040	0.995218
39 METAL CONTAINERS	0.018998	0.001288	0.981002	0.998712
40 FABRICATED METAL PRDTS	0.643929	0.009375	0.356071	0.990625

TABLE III (Continued)

INDUSTRY	T^{11}	T^{12}	T^{21}	T^{22}
41 SCREW MACH PRDTS, ETC.	0.040844	0.001405	0.959156	0.998595
42 OTHER FAB. METAL PRDTS	0.457068	0.003213	0.542932	0.996787
43 ENGINES, TURBINES	0.040567	0.001768	0.959433	0.998232
44 FARM MACH., EQUIP.	0.045901	0.002061	0.954099	0.997939
45 CONSTRUC. MACH. EQUIP.	0.324156	0.025833	0.675844	0.974167
46 MATERIAL HANDLING MACH	0.051780	0.002877	0.948220	0.997123
47 METALWORKING MACHINERY	0.004823	0.000981	0.995177	0.999019
48 SPECIAL MACH. EQUIP.	0.068079	0.002740	0.931921	0.997260
49 GENERAL MACH. EQUIP.	0.171073	0.008679	0.828927	0.991321
50 MACHINE SHOP PRDTS.	0.068353	0.005485	0.931647	0.994515
51 OFFICE, COMPUT. MACHS.	0.067226	0.000402	0.932774	0.999598
52 SERVICE IND. MACHINES	0.154854	0.004838	0.845146	0.995162
53 ELECT. TRANSMISS. EQP.	0.066999	0.002773	0.933001	0.997227
54 HOUSEHOLD APPLIANCES	0.012349	0.000959	0.987651	0.999041
55 ELECT. LIGHTING EQUIP.	0.012474	0.000454	0.987526	0.999546
56 RADIO TV, ETC.,EQUIP.	0.206670	0.011856	0.793330	0.988144
57 ELECTRONIC COMPONENTS	0.017745	0.002062	0.982255	0.997938
58 MISC. ELECTRICAL MACH.	0.065711	0.002746	0.934289	0.997254
59 MOTOR VEHICLES, EQUIP.	0.029452	0.001424	0.970548	0.998576
60 AIRCRAFT, PARTS	0.728817	0.020253	0.271183	0.979747
61 OTHER TRANSPORT. EQUIP	0.067132	0.002757	0.932868	0.997243
62 PROF. SCIEN. INSTRU.	0.194705	0.002108	0.805295	0.997892
63 MEDICAL, PHOTO. EQUIP.	0.000908	0.000363	0.999092	0.999637
64 MISC. MANUFACTURING	0.150225	0.001345	0.849775	0.998655
65 TRANSP., WAREHOUSING	1.000000	0.0	0.0	1.000000
66 COMMUNICA. EX BRDCAST.	1.000000	0.0	0.0	1.000000
67 RADIO, TV BROADCASTING	1.000000	0.0	0.0	1.000000
68 ELEC.GAS,WATER SAN.SV.	1.000000	0.0	0.0	1.000000
69 WHOLESALE RETAIL TRADE	1.000000	0.0	0.0	1.000000
70 FINANCE, INSURANCE	1.000000	0.0	0.0	1.000000
71 REAL ESTATE, RENTAL	1.000000	0.0	0.0	1.000000
72 HOTELS, PERSONAL SERV.	1.000000	0.0	0.0	1.000000
73 BUSINESS SERVICES	1.000000	0.0	0.0	1.000000
74 RESEARCH, DEVELOPMENT	1.000000	0.0	0.0	1.000000
75 AUTO. REPAIR, SERVICES	1.000000	0.0	0.0	1.000000
76 AMUSEMENTS	1.000000	0.0	0.0	1.000000
77 MED., EDUC. SERVICES	1.000000	0.0	0.0	1.000000
78 FEDERAL GOVT. ENTERPR.	1.000000	0.0	0.0	1.000000
79 STATE LOCAL GOVT. ENT.	1.000000	0.0	0.0	1.000000

TABLE IV

BASELINE MODEL OUTPUT PROJECTIONS FOR 1980
($1,000 in 1967 Price Dollars)

INDUSTRY	Oklahoma	Rest of U.S.	U.S.	INDUSTRY	Oklahoma	Rest of U.S.	U.S.
1 LIVESTOCK, PRDTS.	831045	41018400	41849445	41 SCREW MACH PRDTS, ETC.	22690	14521962	14544652
2 OTHER AGRIC. PRDTS.	703462	41347520	42050982	42 OTHER FAB. METAL PRDTS	119456	17590112	17709568
3 FORESTRY, FISHERIES	11406	2453413	2464819	43 ENGINES, TURBINES	11851	6008801	6020652
4 AGRI. FORES. FISH. SV.	64188	3227136	3291324	44 FARM MACH., EQUIP.	16849	6620554	6637403
5 IRON, FERRO. CRES MIN.	67	2514252	2514319	45 CONSTRUC. MACH. EQUIP.	276600	8626868	8903468
6 NONFERROUS ORES MINING	3481	2545271	2548752	46 MATERIAL HANDLING MACH	10519	3264607	3275126
7 COAL MINING	10101	4996429	5006530	47 METALWORKING MACHINERY	11553	11500500	11512053
8 CRUDE PETRO., NATL GAS	1456333	21021296	22477629	48 SPECIAL MACH. EQUIP.	25670	8574673	8600343
9 STONE, CLAY MINING	38409	2624525	2662934	49 GENERAL MACH. EQUIP.	107964	10786561	10894525
10 CHEM FERT MIN MINING	14	1424040	1424054	50 MACHINE SHOP PRDTS.	33169	5444282	5477451
11 NEW CONSTRUCTION	1589497	48732048	50321545	51 OFFICE, COMPUT. MACHS.	16231	20553168	20569399
12 MAINT., REPAIR CONSTR.	622786	42007072	42629858	52 SERVICE IND. MACHINES	44709	7491188	7535897
13 ORDNANCE, ACCESSORIES	65646	8641399	8707045	53 ELECT. TRANSMISS. EQP.	43426	13313104	13356530
14 FOOD, KINDRED PRDTS.	981843	119985456	120967299	54 HOUSEHOLD APPLIANCES	10844	10061540	10072384
15 TOBACCO MANUFACTURES	0	11115246	11115246	55 ELECT. LIGHTING EQUIP.	3309	5856868	5860177
16 FABRICS	3718	27223680	27227398	56 RADIO TV, ETC.,EQUIP.	405674	26810160	27215834
17 TEXTILE PRDTS.	1421	7591649	7593070	57 ELECTRONIC COMPONENTS	30353	13946783	13977136
18 APPAREL	102339	39015584	39117923	58 MISC. ELECTRICAL MACH	16219	5034283	5050502
19 MISC. TEXTILE PRDTS.	9108	6610934	6620042	59 MOTOR VEHICLES, EQUIP	134345	82158224	82292569
20 LUMBER, WOOD PRDTS.	42078	14223308	14270386	60 AIRCRAFT, PARTS	725898	23305968	24031866
21 WOODEN CONTAINERS	192	766010	766202	61 OTHER TRANSPORT. EQUI	35643	10914324	10949967
22 HOUSEHOLD FURNITURE	29888	9911184	9941072	62 PROF. SCIEN. INSTRU.	37841	10913520	10951361
23 OTHER FURNITURE	14091	4847434	4861525	63 MEDICAL, PHOTO. EQUIP	3782	10300883	10304665
24 PAPER, ALLIED PRDTS.	26443	24611520	24637963	64 MISC. MANUFACTURING	50075	18015600	18065675
25 PAPERBOARD CONTAINERS	31089	8851530	8882619	65 TRANSP., WAREHOUSING	783238	77278608	78061846
26 PRINTING, PUBLISHING	211169	32423280	32634449	66 COMMUNICA. EX BRDCAST	413423	35003600	35417023
27 CHEM, SELECT. PRDTS.	125899	34901184	35027083	67 RADIO, TV BROADCASTIN	56106	4755301	4811407
28 PLASTICS, SYNTHETICS	13474	13707317	13720791	68 ELEC.GAS,WATER SAN.SV	778387	62325312	63103699
29 DRUGS, COSMETICS	15160	22400032	22415192	69 WHOLESALE RETAIL TRAD	2716405	234913024	237629429
30 PAINT, ALLIED PRDTS.	10963	4215922	4226885	70 FINANCE, INSURANCE	919163	78824320	79743483
31 PETRO, RELATED INDS.	1479820	38255088	39734908	71 REAL ESTATE, RENTAL	2589312	213222768	215812080
32 RUBBER, MISC. PLASTICS	222118	20816016	21038134	72 HOTELS, PERSONAL SERV	375195	35158912	35534107
33 LEATHER TANNING PRDTS.	169	1438067	1438236	73 BUSINESS SERVICES	784970	81722928	82507898
34 FOOTWEAR, LEAT. PRDTS.	6784	5253151	5259935	74 RESEARCH, DEVELOPMENT	0	931000	931000
35 GLASS, GLASS PRDTS.	121832	5339177	5461009	75 AUTO. REPAIR, SERVICE	245264	21258880	21504144
36 STONE, CLAY PRDTS.	140584	10721770	10862354	76 AMUSEMENTS	126665	14833549	14960214
37 PRIMARY IRON STEEL MFR	54517	43925776	43980293	77 MED., EDUC. SERVICES	1133838	93316704	94450542
38 PRIMARY NONFERROUS MFR	165150	27667552	27832702	78 FEDERAL GOVT. ENTERPR	161485	13345097	13506582
39 METAL CONTAINERS	6655	4790797	4797452	79 STATE LOCAL GOVT. ENT	163285	15625884	15789169
40 FABRICATED METAL PRDTS	239389	11796666	12036055	TOTAL	22893734	2109093551	2131987285

CHAPTER IV

THE IMPACT MODEL

Selecting Major Industries Using Water Transport

Theoretically all commodities can be transported by water. However, water transport is characterized by long-haul economies since it has relatively high terminal and pickup costs and low line-haul costs (15). Furthermore, water transportation has the following disadvantages: slowness, interruption of service due to drought or flood, and requirement of transfer of freight (21, p. 721). Since the transfer of commodities between truck or train and barge increases terminal costs and the possibility of higher freight damage, transfer of freight may make low-cost water transportation unattractive to many firms and industries.

Commodities adapted to water transportation generally are those bulk commodities for which fast movement and fast turnover are not a critical factor in the marketing system (35, p. 12). According to the data for commodity shipment on the Arkansas River provided by the Tulsa District of the Corps of Engineers, major commodity groups consist of chemicals, iron and steel, and metal products for inbound shipment; and coal, petroleum and related products, and grains for outbound shipment. Rock, sand, and gravel are primarily shipped within the channel. Although wheat is a major commodity shipped on the Arkansas waterway,

less than 3 percent of the wheat produced in Oklahoma was transported by water in 1976.[1]

Consequently, to avoid over-emphasizing the direct impact of water transportation, only a few industries in the manufacturing sector were selected as major users of the Arkansas waterway. These industries include Chemicals (IO-27)[2], Plastics and Synthetics (IO-28), Petroleum (IO-31), Primary Iron and Steel (IO-37), and Fabricated Metal (IO-40). The results of the Census of Transportation in 1967 (45), which only covered the manufacturing sector, indicated that industries other than those indicated above had very small tonnages of shipment by water (less than 2 percent of the total tonnage). However, the indirect impact of the Arkansas waterway can be expected to affect the entire state economy in the future, even though few industries are directly benefited by the low-cost water transportation. For example, sales of oil field machinery may increase as a result of expansion of the petroleum industry. It has been found in a previous study that available water transportation does not guarantee regional growth (17). Nevertheless, the effect of water resources on a state's economy may be significant when indirect impacts are taken into consideration.

Estimating Trade Coefficients for 1980

Since trade coefficients are calculated from flows of interregional

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[1]The percentage was a high estimate made by Jim Shouse and Marc Johnson, Department of Agricultural Economics, Oklahoma State University, based on 1976 Oklahoma projections.

[2]To save space and to facilitate identification, IO-27 is used to denote the Chemical industry which is the 27th industry of the input-output classification (see Table IV).

trade, absolute levels of commodity flow for each of the selected industries must be estimated first. Trade coefficients for other industries are assumed to be the same as 1963 coefficients used in the baseline model, either because water transport plays an insignificant role, or insufficient data prevent the estimation of newer coefficients for these industries.

The trade model for an individual commodity can be very complicated. The magnitude of trade, for instance, depends upon the quantity supplied by exporters, geographical distance, transport costs, availability of transportation facilities, and demand of importers. The demand, in turn, is a function of the price of the traded good, prices of substitutes, income, population, and tastes and preferences. Some of these variables may be highly interrelated. Since the study deals with the industry rather than individual commodities, and each industry includes many commodities, the situation will be more complicated. For example, both non-electric heating equipment and metal sanitary ware belong to Fabricated Metal Products industry (IO-40). However, these products are quite different, for instance, in value per unit of weight, unit price, transport cost, demand, manufacturing process, and location of production. Therefore, it is possible that a region imports some of the commodities and exports others classified under the same industry. Thus the commodity trade model may not be appropriate for the present study.

Because data on interregional trade by industry in this area are scarce, a simple model of interstate trade between Oklahoma and each of the remaining states (excluding Alaska and Hawaii) were estimated for each selected industry. Using the state as boundary of region may

not be the best way of delineating regions, since a state is a relatively large geographical area, and some economic activities may not be evenly distributed in the entire state. However, since data required for this study were most frequently recorded by state, it was more convenient to employ states as observations of the model. More specifically, for each industry, imports by Oklahoma from another state were treated as an observation, as were exports from Oklahoma to another state. Different models were estimated for Oklahoma imports and exports.

The trade between Oklahoma and other states for an industry may be assumed as a function of geographical distance, transport cost, value of shipment per unit of weight, demand, proportion of total tonnage shipped by water, etc. However, trade cannot be estimated by these functions due to data difficulty. For instance, value of shipment per unit of weight can only be computed on the national basis from census data (43) (44). The value will be the same for each observation, if the assumption is made that value of shipment per ton between Oklahoma and another state is the same as that between Oklahoma and any other state. Since it was impossible to obtain a least square regression equation showing relationship between volume of trade and value of shipment per ton, an alternative method was used.

Although the volume of trade (either import or export) can be expected to have an inverse relationship with geographical distance between Oklahoma and other states, some industries ship their products farther than others because of different degrees of production concentration in terms of location and product characteristics. Therefore, the geographical distance should be adjusted for an industry's "average shipping distance" of products. The average shipping distance for an

industry was calculated from transportation census data (44) by dividing ton-miles of shipment by tonnage of shipment of the industry. Given the locations of production and consumption, the average shipping distance may affect the trade volume since it reflects transportability. However, the average distance of shipping depends on characteristics of products (such as durable or nondurable), capability of bearing transport cost, mode of transportation, and transport costs required for an industry. Hence, the first step in estimating trade was to establish the relationship between shipping distance and the relevant variables. Each of the input-output industries in the manufacturing sector, except Ordnance (IO-13) and Printing and Publishing (IO-26) for which data were not available, was used as an observation. The results obtained were:

$$D = 640.4148 + 5.0878\ W + 0.0042\ V - 77.7587\ T \qquad (35)$$

(16.0254) (2.7682) (2.6502) (-4.5406) t statistics

$R^2 = 0.43$ $F = 11.4010$ at 46 and 3 degrees of freedom

where

D = average shipping distance in miles;

W = percentage of tonnage shipped by water in 1963 (44);

V = value of shipment per ton in dollars in 1963 (43) (44); and

T = inputs required from Transportation and Warehousing (IO-65) per dollar of output in cents, which is a proxy variable for the transport cost of an industry (57).

The least square equation seems to be satisfactory in explaining the transportability of products in the manufacturing sector. Each independent variable is statistically significant at 1 percent level. Since water transportation is only suitable for long hauls (15, p. 20), a higher percentage of products shipped by water would indicate a longer

shipping distance. The equation shows that products would be shipped 5 miles farther for a 1 percent increase in tonnage of water transportation. The value of shipment per ton is another determinant of transportability (15, p. 25). Products of high value can usually "afford" or bear higher transport cost and thus can be shipped farther. Therefore, for every $1,000 increase in per ton value of shipment, goods can be expected to be transported 4 miles farther. The transport cost per dollar of output may be the most important factor of shipping distance. For every 1¢ change in the transport cost per dollar of output, distance shipped would change inversely by 78 miles.

The model expressed by equation 35 is rather simple. However, adding more independent variables did not significantly improve the results. For example, a dummy variable indicating durable and nondurable industries and a variable representing concentration of industries[3] were insignificant when they were included in the model.

The second step of the estimating procedure was to develop models of Oklahoma imports and exports for each of the selected industries. Again, these models are simple as compared to economic theories underlying supply and demand, and interregional trade, due to a lack of appropriate data. The least square regression equations were estimated in the form of

$$x_i^{lv} = a_o \left(\frac{M^{lv}}{D_i}\right)^{a_1} (y_i^v)^{a_2} \qquad (36)$$

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[3]Concentration ratio measures how closely the locational distribution of value added of an industry matches the locational distribution of population. These figures were obtained from (16, p. 214).

for Oklahoma exports; and

$$x_i^{ul} = b_o \left(\frac{M^{lv}}{D_i}\right)^{b_1} \left(y_i^u\right)^{b_2} \tag{37}$$

for Oklahoma imports; where

x_i^{lv} = Oklahoma exports to state v for the i-th industry in 1963, measured in \$1,000 (33);

M^{lv} = geographical distance measured in highway miles between Oklahoma City and capital of state v;

D_i = average shipping distance in miles for industry i;

y_i^v = final demand gross product of state v for the i-th industry in 1963, measured in \$1,000 (28); and

x_i^{ul} = Oklahoma imports from state u for the i-th industry in 1963, measured in \$1,000 (33).

Since the coefficients in a Cobb-Douglas function represent elasticities of the dependent variable with respect to the corresponding independent variables (7, p. 411), coefficients (exponents) a_1 (or b_1) and a_2 (or b_2) can be regarded as Oklahoma export (or import) elasticities with respect to transportation and demand, respectively. The estimated elasticities are presented in Table V.

Only two independent variables are included in the model. Other variables, such as production, population, and per capita income, also are determinants of the trade volume. However, these variables are highly correlated with final demand. The results were not noticeably improved when more variables were added. Moreover, inclusion of such variables in the model sometimes resulted in inconsistent signs of $\frac{M}{D}$ and y for different regression equations. A dummy variable expressing whether or not a state was connected to the Arkansas River Navigation System also was found statistically insignificant and unstable in its signs. Another reason why only two independent variables were used in

TABLE V

TRANSPORTATION AND DEMAND ELASTICITIES FOR OKLAHOMA IMPORTS AND EXPORTS FOR SELECTED INDUSTRIES[a/]

Industry	Elasticities		R^2	F
	Transportation	Demand		
	Oklahoma Imports			
IO-27 Chemical	-2.6867 (-5.6804)	0.7726 (4.7482)	.63	26.1840
IO-28 Plastics and Synthetics	-1.5855 (-3.0545)	0.7817 (5.9032)	.46	19.4184
IO-31 Petroleum	-3.3227 (-5.9201)	0.9103 (2.8639)	.51	24.2326
IO-37 Iron and Steel	-2.8911 (-4.3368)	0.9891 (5.3433)	.47	20.2556
IO-40 Fabricated Metal	-3.0741 (-7.5227)	1.3790 (6.4476)	.69	50.5614
	Oklahoma Exports			
IO-27 Chemical	-1.0780 (-4.9063)	0.5329 (7.9063)	.61	35.3231
IO-28 Plastics and Synthetics	-1.2041 (-3.2958)	0.7121 (7.6397)	.57	31.0179
IO-31 Petroleum	-5.2799 (-7.1398)	0.8757 (2.0908)	.57	30.1175
IO-37 Iron and Steel	-1.4364 (-5.6139)	0.6745 (9.4921)	.70	53.1341
IO-40 Fabricated Metal	-3.1267 (-4.1392)	0.7279 (1.8410)	.31	10.4960

[a/] Figures in parentheses under estimated elasticities indicate t-statistics for the corresponding elasticities. All t-values are significant at the 1 percent level except those for demand elasticity for Oklahoma exports of Petroleum (IO-31) and Fabricated Metal (IO-40); those are significant at the 5 and 10 percent level, respectively. All F-values are significant at the 1 percent level.

the model is that since 1980 final demand estimates (34) are already available, projections of trade can be made without having to conduct other large scale studies on projections of state economic activities.

Since the section of the Arkansas River Navigation System was not opened until 1970, the imported and exported goods of Oklahoma in 1963 would have been shipped by means other than water. In other words, the percentage of tonnage of water transportation was zero for all industries in the 1963 base period. The proportion of output of Oklahoma industries transported by water has not been estimated. Hence, the national percent distribution of water transport in 1972 (46) is assumed to prevail in Oklahoma in 1980.

It should be noted that the tonnage of manufacturing goods shipped by water declined from 26.3 percent in 1967 (45) to 18.4 percent in 1972 (46) for the nation. This indicates that the relative importance of waterway transportation has decreased somewhat and that the distribution of commodity shipments by different modes of transportation varies from month to month and from year to year. Furthermore, the percentage of water transportation tonnage would drop to 4.1 and 4.6 percent for 1967 and 1972, respectively, when petroleum shipments are excluded from commodity shipments by all modes of transport. Thus petroleum production would affect the usage of the waterway to a great extent.

The projected trade volume in 1980 for the industries selected in the study was made by first substituting the 1972 percent figures of total tonnage shipped by water into equation 35 to obtain the increase in the average shipping distances for those industries. Then by using the increases in shipping distances and final demand projections for

1980, as well as elasticities (listed in Table V) the percent increase in trade from 1963 to 1980 was computed. The projected trade coefficients for 1980 for the selected industries were calculated from the trade projections. These coefficients are presented in Table VI. The projected coefficients under $\hat{T}^{12}$ and $\hat{T}^{21}$ are greater than the corresponding 1963 coefficients (Table III). This implies increases in the interregional trade for 1980 Oklahoma output.

TABLE VI

TRADE COEFFICIENTS FOR THE IMPACT MODEL, 1980

Industry	$\hat{T}^{11}$	$\hat{T}^{12}$	$\hat{T}^{21}$	$\hat{T}^{22}$
IO-27 Chemical	.124620	.003239	.875380	.996861
IO-28 Plastics and Synthetics	.004990	.001364	.995010	.998636
IO-31 Petroleum	.893830	.040342	.106170	.959658
IO-37 Iron and Steel	.045966	.001352	.954034	.998648
IO-40 Fabricated Metal	.469043	.029215	.530957	.970785

Output Projections of the Impact Model

Once the new trade coefficients which reflect the effects of water transportation were obtained, the interregional technical coefficient matrix for the impact model was computed using equations 30 through 32. To save space, the interdependence coefficient matrix, or $(I-\hat{T}\bar{A})^{-1}$,

which contains 158 rows and columns is not presented in this study. It will be provided by the author upon request.

The procedures for estimating the baseline output, as discussed in the previous chapter, were used to calculate the 1980 output projections for industries in the impact model. The output projections for Oklahoma of both models and the changes in output over the baseline model are presented in Table VII. Schreiner et al. (36) estimated the 1970 output in 1963 dollars. The consumer price index (51, p. 344) was used to convert those estimates to 1967 prices. These figures are included in Table VII for purposes of comparison.

The Arkansas River Navigation System will lead to a 7.8 percent, or $1.8 billion, increase in 1980 output of goods and services in Oklahoma (Table VII). This increase of output primarily comes from the Petroleum (IO-31), Crude Petroleum and Natural Gas (IO-8), Fabricated Metal (IO-40), and Real Estate (IO-71) industries, which account for $824, $347, $202, and $102 million, respectively. However, the five major waterway user industries (see Table V), as well as Iron Ore Mining (IO-5) and the Crude Petroleum and Natural Gas (IO-8) industries have the highest percent changes.

The output projections for the impact model for individual industries are greater than or equal to those for the baseline model. This indicates that the expansion of the trade area for Oklahoma, which is a result of the availability of low-cost water transportation, does have positive effects on the state economy. The Arkansas River Navigation System not only has an impact on the industries which utilize water as means of transportation, but virtually on all industries. Conceivably, if port facilities and barge transport techniques are improved so

TABLE VII

OKLAHOMA OUTPUT PROJECTIONS BY INPUT-OUTPUT INDUSTRY FOR 1970 AND 1980
($1,000 in 1967 Price Levels)

INDUSTRY	1970 Output	1980 Output		Change from Baseline Estimates	Percent Change
		Baseline Model	Impact Model		
1 LIVESTOCK, PRDTS.	805206	831045	832251	1206	0.15
2 OTHER AGRIC. PRDTS.	551648	703462	705767	2305	0.33
3 FORESTRY, FISHERIES	6219	11406	11450	44	0.39
4 AGRI. FORES. FISH. SV.	41773	64188	64459	271	0.42
5 IRON, FERRO. ORES MIN.	11	67	85	18	26.87
6 NONFERROUS ORES MINING	2008	3481	3541	60	1.72
7 COAL MINING	7983	10101	10154	53	0.52
8 CRUDE PETRO., NATL GAS	1145861	1456333	1803758	347425	23.86
9 STONE, CLAY MINING	24093	38409	39913	1504	3.92
10 CHEM FERT MIN MINING	4	14	15	1	7.14
11 NEW CONSTRUCTION	883203	1589497	1589497	0	0.0
12 MAINT., REPAIR CONSTR.	402149	622786	661431	38645	6.21
13 ORDNANCE, ACCESSORIES	67881	65646	65648	2	0.0
14 FOOD, KINDRED PRDTS.	789913	981843	983354	1511	0.15
15 TOBACCO MANUFACTURES	0	0	0	0	0.0
16 FABRICS	2806	3718	3719	1	0.03
17 TEXTILE PRDTS.	1104	1421	1422	1	0.07
18 APPAREL	70765	102339	102353	14	0.01
19 MISC. TEXTILE PRDTS.	7031	9108	9109	1	0.01
20 LUMBER, WOOD PRDTS.	38741	42078	42208	130	0.31
21 WOODEN CONTAINERS	36	192	192	0	0.0
22 HOUSEHOLD FURNITURE	17411	29888	29888	0	0.0
23 OTHER FURNITURE	10870	14091	14092	1	0.01
24 PAPER, ALLIED PRDTS.	21246	26443	26493	50	0.19
25 PAPERBOARD CONTAINERS	24250	31089	31182	93	0.30
26 PRINTING, PUBLISHING	126208	211169	215691	4522	2.14
27 CHEM, SELECT. PRDTS.	89235	125899	141072	15173	12.05
28 PLASTICS, SYNTHETICS	9630	13474	18865	5391	40.01
29 DRUGS, COSMETICS	9363	15160	15183	23	0.15
30 PAINT, ALLIED PRDTS.	8965	10963	11037	74	0.67
31 PETRO, RELATED INDS.	1180786	1479820	2303634	823814	55.67
32 RUBBER, MISC. PLASTICS	159681	222118	222737	619	0.28
33 LEATHER TANNING PRDTS.	24	169	178	9	5.33
34 FOOTWEAR, LEAT. PRDTS.	5566	6784	6784	0	0.0
35 GLASS, GLASS PRDTS.	91175	121832	122945	1113	0.91
36 STONE, CLAY PRDTS.	92764	140584	142927	2343	1.67
37 PRIMARY IRON STEEL MFR	42726	54517	76257	21740	39.88
38 PRIMARY NONFERROUS MFR	125755	165150	168838	3688	2.23
39 METAL CONTAINERS	4853	6655	6750	95	1.43
40 FABRICATED METAL PRDTS	195022	239389	441774	202385	84.54

TABLE VII (Continued)

INDUSTRY	1970 Output	1980 Output		Change from Baseline Estimates	Percent Change
		Baseline Model	Impact Model		
41 SCREW MACH PRDTS, ETC.	12946	22690	22768	78	0.34
42 OTHER FAB. METAL PRDTS	85704	119456	123743	4287	3.59
43 ENGINES, TURBINES	11737	11851	11884	33	0.28
44 FARM MACH., EQUIP.	12925	16849	16858	9	0.05
45 CONSTRUC. MACH. EQUIP.	198694	276600	277677	1077	0.39
46 MATERIAL HANDLING MACH	10028	10519	10539	20	0.19
47 METALWORKING MACHINERY	8251	11553	11555	2	0.02
48 SPECIAL MACH. EQUIP.	17316	25670	25681	11	0.04
49 GENERAL MACH. EQUIP.	88251	107964	108394	430	0.40
50 MACHINE SHOP PRDTS.	22986	33169	33189	20	0.06
51 OFFICE, COMPUT. MACHS.	13022	16231	16237	6	0.04
52 SERVICE IND. MACHINES	38563	44709	44891	182	0.41
53 ELECT. TRANSMISS. EQP.	35612	43426	43748	322	0.74
54 HOUSEHOLD APPLIANCES	7926	10844	10846	2	0.02
55 ELECT. LIGHTING EQUIP.	2404	3309	3314	5	0.15
56 RADIO TV, ETC.,EQUIP.	257978	405674	405804	130	0.03
57 ELECTRONIC COMPONENTS	15882	30353	30365	12	0.04
58 MISC. ELECTRICAL MACH.	11667	16219	16239	20	0.12
59 MOTOR VEHICLES, EQUIP.	117740	134345	134364	19	0.01
60 AIRCRAFT, PARTS	651643	725898	727600	1702	0.23
61 OTHER TRANSPORT. EQUIP	31690	35643	35666	23	0.06
62 PROF. SCIEN. INSTRU.	29388	37841	37970	129	0.34
63 MEDICAL, PHOTO. EQUIP.	2459	3782	3782	0	0.0
64 MISC. MANUFACTURING	30842	50075	50199	124	0.25
65 TRANSP., WAREHOUSING	700573	783238	831002	47764	6.10
66 COMMUNICA. EX BROCAST.	277440	413423	419462	6039	1.46
67 RADIO, TV BROADCASTING	29604	56106	58561	2455	4.38
68 ELEC.GAS,WATER SAN.SV.	546089	778387	809474	31087	3.99
69 WHOLESALE RETAIL TRADE	1797648	2716405	2749374	32969	1.21
70 FINANCE, INSURANCE	513019	919163	940476	21313	2.32
71 REAL ESTATE, RENTAL	1404381	2589312	2691000	101688	3.93
72 HOTELS, PERSONAL SERV.	190673	375195	378073	2878	0.77
73 BUSINESS SERVICES	408985	784970	821125	36155	4.61
74 RESEARCH, DEVELOPMENT	0	0	0	0	0.0
75 AUTO. REPAIR, SERVICES	170690	245264	248857	3593	1.46
76 AMUSEMENTS	43980	126665	127929	1264	1.00
77 MED., EDUC. SERVICES	413543	1133838	1134832	994	0.09
78 FEDERAL GOVT. ENTERPR.	107043	161485	165148	3663	2.27
79 STATE LOCAL GOVT. ENT.	104805	163285	168651	5366	3.29
TOTAL	15488171	22893728	24673936	1780196	7.78

that more commodities are adapted to water transportation, the economic impact will be greater and will spread to even more industries.

Employment and Income Projections for 1980

The main concern of the study is not just industrial output changes but the impact on employment and income of the state. Estimates on additional jobs created and additional income generated from the navigation project may be more meaningful and useful than output projections. This section will use these two variables as a measure of economic impact.

Employment

Employment in 1970 of the state, expressed by work force data, or number of jobs, has been estimated for each input-output industry by Schreiner et al. (36). Most of the employment data was obtained from the Oklahoma Employment Security Commission (OESC) (26). Separate estimates of wages and salaries, self-employed workers and unpaid family workers were available only by relatively broad industry categories. The 1963 employment data in the Harvard Economic Research Project (HERP) study (32) were used to allocate the OESC wage and salary industry employment figures to the related input-output industries. The distribution of proprietors among industries, computed from the Internal Revenue Service report (61), was used to disaggregate self-employed and unpaid family workers. Employment in Government Enterprise industries (IO-78 and IO-79) was obtained from other sources (37) (47). Since output for the Research and Development industry (IO-74) was not estimated in 1967, employment in this industry was included in the Business

Service industry (IO-73). Other industries with zero output were not given employment estimates. The 1970 employment data for various industries are presented in Table VIII. The employment-output ratios were obtained by dividing the 1970 employment by the output level (shown in Table VII) of the corresponding industries.

Schreiner et al. (36) also considered the effect of changes in labor productivity on employment. Changes in the employment-output ratios were computed to reflect expected changes in labor productivity by 1980. Labor productivity for a given industry is defined generally as output per unit of employed labor, which can be viewed as the output-employment ratio, or the reciprocal of the employment-output ratio. Hence, changes in labor productivity can significantly affect industry employment. National labor productivity annual growth rates estimated by Almon et al. (3) were used to compute the employment ratios for 1980.

The industry categories used in Almon's study are not exactly the same as input-output classifications in this study. It was necessary to make adjustments to obtain a set of growth rates compatible with the input-output industries. For each industry of this study that included more than one industry defined by Almon, tha annual labor productivity growth rate was computed by taking the average of growth rates for related industries, weighted by the 1967 value added figures given in the Census of Manufacturing (43). On the other hand, the same growth rate was applied to each of the industries if an industry in Almon's study included several input-output industries. Moreover, the growth rate for Finance and Services in the Almon study was applied to Input-Output Industries 70 through 79, since estimates were not available for

TABLE VIII

OKLAHOMA EMPLOYMENT ESTIMATES FOR 1970 AND PROJECTIONS FOR 1980, BY INPUT-OUTPUT INDUSTRY

INDUSTRY	1970 Employment	1980 Employment		Change from Baseline Estimates
		Baseline Model	Impact Model	
1 LIVESTOCK, PRDTS.	57573	34166	34216	50
2 OTHER AGRIC. PRDTS.	53257	39050	39178	128
3 FORESTRY, FISHERIES	562	593	595	2
4 AGRI. FORES. FISH. SV.	6108	8797	8834	37
5 IRON, FERRO. CRES MIN.	0	0	0	0
6 NONFERROUS ORES MINING	249	347	353	6
7 COAL MINING	522	531	534	3
8 CRUDE PETRO., NATL GAS	38525	31589	39125	7536
9 STONE, CLAY MINING	1437	1843	1915	72
10 CHEM FERT MIN MINING	0	0	0	0
11 NEW CONSTRUCTION	44779	70823	70823	0
12 MAINT., REPAIR CONSTR.	7842	10673	11335	662
13 ORDNANCE, ACCESSORIES	386	302	302	0
14 FOOD, KINDRED PRDTS.	16512	16397	16423	25
15 TOBACCO MANUFACTURES	0	0	0	0
16 FABRICS	98	101	101	0
17 TEXTILE PRDTS.	21	18	18	0
18 APPAREL	9025	11049	11050	2
19 MISC. TEXTILE PRDTS.	864	888	888	0
20 LUMBER, WOOD PRDTS.	2509	2240	2247	7
21 WOODEN CONTAINERS	0	0	0	0
22 HOUSEHOLD FURNITURE	1561	2277	2277	0
23 OTHER FURNITURE	696	767	767	0
24 PAPER, ALLIED PRDTS.	1233	1294	1296	2
25 PAPERBOARD CONTAINERS	1502	1625	1630	5
26 PRINTING, PUBLISHING	9290	11994	12251	257
27 CHEM, SELECT. PRDTS.	1674	1442	1615	174
28 PLASTICS, SYNTHETICS	557	577	808	231
29 DRUGS, COSMETICS	248	298	299	0
30 PAINT, ALLIED PRDTS.	349	382	384	3
31 PETRO, RELATED INDS.	8097	5714	8896	3181
32 RUBBER, MISC. PLASTICS	4408	4711	4724	13
33 LEATHER TANNING PRDTS.	0	0	0	0
34 FOOTWEAR, LEAT. PRDTS.	754	746	746	0
35 GLASS, GLASS PRDTS.	4936	4753	4797	43
36 STONE, CLAY PRDTS.	3983	4894	4976	82
37 PRIMARY IRON STEEL MFR	2347	2760	3860	1101
38 PRIMARY NONFERROUS MFR	1898	2176	2224	49
39 METAL CONTAINERS	100	113	114	2
40 FABRICATED METAL PRDTS	10956	11373	20989	9615

TABLE VIII (Continued)

INDUSTRY	1970 Employment	1980 Employment		Change from Baseline Estimates
		Baseline Model	Impact Model	
41 SCREW MACH PRDTS, ETC.	776	1281	1286	4
42 OTHER FAB. METAL PRDTS	4060	4954	5131	178
43 ENGINES, TURBINES	204	144	144	0
44 FARM MACH., EQUIP.	698	737	737	0
45 CONSTRUC. MACH. EQUIP.	7625	9237	9273	36
46 MATERIAL HANDLING MACH	99	90	91	0
47 METALWORKING MACHINERY	253	329	329	0
48 SPECIAL MACH. EQUIP.	798	897	897	0
49 GENERAL MACH. EQUIP.	3894	3881	3897	15
50 MACHINE SHOP PRDTS.	2206	2194	2196	1
51 OFFICE, COMPUT. MACHS.	459	305	305	0
52 SERVICE IND. MACHINES	2796	2220	2229	9
53 ELECT. TRANSMISS. EQP.	853	806	812	6
54 HOUSEHOLD APPLIANCES	177	178	178	0
55 ELECT. LIGHTING EQUIP.	25	31	31	0
56 RADIO TV, ETC., EQUIP.	11468	14422	14427	5
57 ELECTRONIC COMPONENTS	721	792	793	0
58 MISC. ELECTRICAL MACH.	208	278	278	0
59 MOTOR VEHICLES. EQUIP.	2411	2483	2483	0
60 AIRCRAFT, PARTS	10101	8637	8657	20
61 OTHER TRANSPORT. EQUIP	944	819	820	1
62 PROF. SCIEN. INSTRU.	508	533	535	2
63 MEDICAL, PHOTG. EQUIP.	19	18	18	0
64 MISC. MANUFACTURING	2479	2735	2742	7
65 TRANSP., WAREHOUSING	33726	31576	33501	1926
66 COMMUNICA. EX BRDCAST.	10742	11819	11991	173
67 RADIO, TV BROADCASTING	1765	3135	3272	137
68 ELEC.GAS.WATER SAN.SV.	10401	10946	11383	437
69 WHOLESALE RETAIL TRADE	208859	269547	272818	3271
70 FINANCE, INSURANCE	34657	58199	59548	1349
71 REAL ESTATE, RENTAL	8068	13943	14490	548
72 HOTELS, PERSONAL SERV.	31064	57291	57731	439
73 BUSINESS SERVICES	39012	70179	73412	3232
74 RESEARCH, DEVELOPMENT	0	0	0	0
75 AUTO. REPAIR, SERVICES	6407	8629	8755	126
76 AMUSEMENTS	8262	22302	22525	223
77 MED., EDUC. SERVICES	71598	183989	184151	161
78 FEDERAL GOVT. ENTERPR.	8576	12126	12401	275
79 STATE LOCAL GOVT. ENT.	4874	7117	7351	234
TOTAL	826651	1106104	1142210	36106

individual industries corresponding to those industries. The adjusted annual growth rates by industry are presented in Table IX.

The projected 1980 employment were estimated from the employment-output ratios adjusted for labor productivity and output projections of both baseline and impact models. An additional 36,000 jobs, or 3.3 percent of the employment level of baseline model, are created (Table VIII). Since the employment projections are derived from output projections and constant employment-output ratios for each industry, the percent changes in employment over the baseline estimates for individual industries will be the same as those for output (column 5 of Table VII). Absolute gains in employment will primarily be found in the Fabricated Metal (IO-40), Crude Petroleum and Natural Gas (IO-8), Petroleum (IO-31), and Iron and Steel (IO-37) industries of the manufacturing sector. Industries in the services sector (IO-65 through IO-79) gain an additional 12,531 jobs, accounting for one-third of the total increase. The Transportation and Warehousing (IO-65), Wholesale and Retail (IO-69), Finance and Insurance (IO-70), and Business Services (IO-73) industries have much greater gain than other service industries.

Income

Personal income also is used as a measure of economic impact. The 1970 personal income by input-output industry was estimated by Schreiner et al. (36). Because their estimates were expressed in 1963 prices, the consumer price index (51, p. 344) was applied to convert these estimates to 1967 prices so that comparisons can be made. As discussed in the previous chapter, changes in income can be estimated from output changes and income-output ratios (equation 23). These ratios were calculated by

TABLE IX

FORECAST OF ANNUAL GROWTH RATE IN LABOR PRODUCTIVITY
BY INDUSTRY FOR THE UNITED STATES, 1970 TO 1980

	INDUSTRY	Growth Rate		INDUSTRY	Growth Rate
1	LIVESTOCK, PRDTS.	5.69	41	SCREW MACH PRDTS, ETC.	0.60
2	OTHER AGRIC. PRDTS.	5.69	42	OTHER FAB. METAL PRDTS	1.34
3	FORESTRY, FISHERIES	5.69	43	ENGINES, TURBINES	3.64
4	AGRI. FORES. FISH. SV.	0.65	44	FARM MACH., EQUIP.	2.13
5	IRON, FERRO. CRES MIN.	2.20	45	CONSTRUC. MACH. EQUIP.	1.40
6	NONFERROUS ORES MINING	2.20	46	MATERIAL HANDLING MACH	1.40
7	COAL MINING	2.20	47	METALWORKING MACHINERY	0.75
8	CRUDE PETRO., NATL GAS	4.48	48	SPECIAL MACH. EQUIP.	2.81
9	STONE, CLAY MINING	2.20	49	GENERAL MACH. EQUIP.	2.07
10	CHEM FERT MIN MINING	2.20	50	MACHINE SHOP PRDTS.	3.79
11	NEW CONSTRUCTION	1.30	51	OFFICE, COMPUT. MACHS.	6.48
12	MAINT., REPAIR CONSTR.	1.30	52	SERVICE IND. MACHINES	3.86
13	ORDNANCE, ACCESSORIES	2.15	53	ELECT. TRANSMISS. EQP.	2.58
14	FOOD, KINDRED PRDTS.	2.27	54	HOUSEHOLD APPLIANCES	3.13
15	TOBACCO MANUFACTURES	2.18	55	ELECT. LIGHTING EQUIP.	0.99
16	FABRICS	2.52	56	RADIO TV, ETC..EQUIP.	2.23
17	TEXTILE PRDTS.	4.37	57	ELECTRONIC COMPONENTS	5.69
18	APPAREL	1.68	58	MISC. ELECTRICAL MACH.	0.40
19	MISC. TEXTILE PRDTS.	2.34	59	MOTOR VEHICLES, EQUIP.	1.03
20	LUMBER, WOOD PRDTS.	1.98	60	AIRCRAFT, PARTS	2.68
21	WOODEN CONTAINERS	2.93	61	OTHER TRANSPORT. EQUIP	2.63
22	HOUSEHOLD FURNITURE	1.64	62	PROF. SCIEN. INSTRU.	2.06
23	OTHER FURNITURE	1.64	63	MEDICAL, PHOTO. EQUIP.	4.83
24	PAPER, ALLIED PRDTS.	1.72	64	MISC. MANUFACTURING	3.94
25	PAPERBOARD CONTAINERS	1.71	65	TRANSP., WAREHOUSING	1.79
26	PRINTING, PUBLISHING	2.62	66	COMMUNICA. EX BRDCAST.	3.08
27	CHEM. SELECT. PRDTS.	5.06	67	RADIO, TV BROADCASTING	0.65
28	PLASTICS, SYNTHETICS	3.05	68	ELEC.GAS,WATER SAN.SV.	3.08
29	DRUGS, COSMETICS	3.02	69	WHOLESALE RETAIL TRADE	1.59
30	PAINT, ALLIED PRDTS.	1.12	70	FINANCE, INSURANCE	0.65
31	PETRO, RELATED INDS.	5.91	71	REAL ESTATE, RENTAL	0.65
32	RUBBER, MISC. PLASTICS	2.67	72	HOTELS, PERSONAL SERV.	0.65
33	LEATHER TANNING PRDTS.	1.47	73	BUSINESS SERVICES	0.65
34	FOOTWEAR, LEAT. PRDTS.	2.11	74	RESEARCH, DEVELOPMENT	0.65
35	GLASS, GLASS PRDTS.	3.33	75	AUTO. REPAIR, SERVICES	0.65
36	STONE, CLAY PRDTS.	2.12	76	AMUSEMENTS	0.65
37	PRIMARY IRON STEEL MFR	0.82	77	MED., EDUC. SERVICES	0.65
38	PRIMARY NONFERROUS MFR	1.37	78	FEDERAL GOVT. ENTERPR.	0.65
39	METAL CONTAINERS	1.98	79	STATE LOCAL GOVT. ENT.	0.65
40	FABRICATED METAL PRDTS	1.69			

dividing the 1970 income by output for each industry. It is assumed that the 1970 income-output ratios will prevail in 1980. Incomes of 1970 and 1980 projections under two different assumptions (models) are presented in Table X.

Total personal income in 1980 will increase by $301 million (1967 prices), or 4.5 percent due to the existence of the Arkansas River Navigation System (last row in Table X). The greatest absolute increases will come from Crude Petroleum and Natural Gas (IO-8), Fabricated Metal (IO-40), and Petroleum (IO-31) industries in the manufacturing sector. The service industries (IO-65 through IO-79) will gain an additional $77 million in personal income over the base-line projection, and will account for 25 percent of the total increase. Major sources of this increase in the service industries will be in Transportation and Warehousing (IO-65), Wholesale and Retail (IO-69), Finance and Insurance (IO-70), and Business Services (IO-73) industries. Although not all industries will realize the income gains, none will experience declines. Several industries are simply too small in terms of the share of the state economy to reflect the benefits resulting from waterway transportation. In spite of being expected to be direct users of the waterway, for instance, the Chemical (IO-27) and Plastics and Synthetics (IO-28) industries have relatively small absolute gains in employment and income. However, the percent increase in the impact variables is impressive.

The importance of the service industries may be underestimated as emphasis is focused on economic growth by means of expansion of manufacturing. The technical coefficient matrix (see Appendix Table XXII) indicates that each manufacturing industry requires certain service

TABLE X

OKLAHOMA INCOME FOR 1970 PROJECTIONS FOR 1980, BY INPUT-OUTPUT INDUSTRY
($1,000 in 1967 Price Levels)

INDUSTRY	1970 Income	1980 Income		Change from Baseline Estimates
		Baseline Model	Impact Model	
1 LIVESTOCK, PRDTS.	150378	155203	155429	225
2 OTHER AGRIC. PRDTS.	139099	177379	177961	581
3 FORESTRY, FISHERIES	1632	2992	3004	12
4 AGRI. FORES. FISH. SV.	18225	28005	28123	118
5 IRON, FERRO. ORES MIN.	0	0	0	0
6 NONFERROUS ORES MINING	1531	2655	2701	46
7 COAL MINING	5157	6525	6559	34
8 CRUDE PETRO., NATL GAS	302185	384063	475685	91623
9 STONE, CLAY MINING	8771	13983	14530	548
10 CHEM FERT MIN MINING	0	0	0	0
11 NEW CONSTRUCTION	264563	476134	476134	0
12 MAINT., REPAIR CONSTR.	57963	89753	95333	5570
13 ORDNANCE, ACCESSORIES	101	98	98	0
14 FOOD, KINDRED PRDTS.	115504	143569	143790	221
15 TOBACCO MANUFACTURES	0	0	0	0
16 FABRICS	438	581	581	0
17 TEXTILE PRDTS.	90	116	117	0
18 APPAREL	23771	34377	34382	5
19 MISC. TEXTILE PRDTS.	1659	2149	2149	0
20 LUMBER, WOOD PRDTS.	14292	15523	15571	48
21 WOODEN CONTAINERS	0	0	0	0
22 HOUSEHOLD FURNITURE	5793	9945	9945	0
23 OTHER FURNITURE	2556	3313	3314	0
24 PAPER, ALLIED PRDTS.	3647	4539	4548	9
25 PAPERBOARD CONTAINERS	4657	5971	5989	18
26 PRINTING, PUBLISHING	53040	88689	90588	1899
27 CHEM, SELECT. PRDTS.	10575	14920	16718	1798
28 PLASTICS, SYNTHETICS	114	160	224	64
29 DRUGS, COSMETICS	1122	1816	1819	3
30 PAINT, ALLIED PRDTS.	1822	2229	2244	15
31 PETRO, RELATED INDS.	64125	80365	125103	44739
32 RUBBER, MISC. PLASTICS	24136	33574	33668	94
33 LEATHER TANNING PRDTS.	0	0	0	0
34 FOOTWEAR, LEAT. PRDTS.	2125	2590	2590	0
35 GLASS, GLASS PRDTS.	41321	55215	55719	504
36 STONE, CLAY PRDTS.	28627	43384	44107	723
37 PRIMARY IRON STEEL MFR	15335	19567	27370	7803
38 PRIMARY NONFERROUS MFR	25100	32963	33699	736
39 METAL CONTAINERS	647	888	901	13
40 FABRICATED METAL PRDTS	61897	75979	140213	64234

TABLE X (Continued)

INDUSTRY	1970 Income	1980 Income		Change from Baseline Estimates
		Baseline Model.	Impact Model	
41 SCREW MACH PRDTS, ETC.	2374	4161	4175	14
42 OTHER FAB. METAL PRDTS	14085	19631	20336	705
43 ENGINES, TURBINES	112	113	114	0
44 FARM MACH., EQUIP.	3431	4473	4475	2
45 CONSTRUC. MACH. EQUIP.	59054	82208	82528	320
46 MATERIAL HANDLING MACH	1446	1517	1520	3
47 METALWORKING MACHINERY	1331	1863	1864	0
48 SPECIAL MACH. EQUIP.	4718	6995	6998	3
49 GENERAL MACH. EQUIP.	23388	28612	28726	114
50 MACHINE SHOP PRDTS.	10169	14674	14683	9
51 OFFICE, COMPUT. MACHS.	1744	2174	2175	1
52 SERVICE IND. MACHINES	7208	8357	8391	34
53 ELECT. TRANSMISS. EQP.	11165	13614	13715	101
54 HOUSEHOLD APPLIANCES	1184	1619	1620	0
55 ELECT. LIGHTING EQUIP.	192	264	264	0
56 RADIO TV. ETC.,EQUIP.	91849	144433	144480	46
57 ELECTRONIC COMPONENTS	2037	3893	3895	2
58 MISC. ELECTRICAL MACH.	1374	1911	1913	2
59 MOTOR VEHICLES. EQUIP.	16812	19183	19185	3
60 AIRCRAFT, PARTS	70084	78070	78253	183
61 OTHER TRANSPORT. EQUIP	4374	4920	4923	3
62 PROF. SCIEN. INSTRU.	5283	6803	6826	23
63 MEDICAL, PHOTO. EQUIP.	148	228	228	0
64 MISC. MANUFACTURING	8618	13993	14028	35
65 TRANSP., WAREHOUSING	249464	278900	295908	17008
66 COMMUNICA. EX BRDCAST.	58356	86958	88228	1270
67 RADIO, TV BROADCASTING	9152	17346	18105	759
68 ELEC.GAS,WATER SAN.SV.	83220	118622	123359	4737
69 WHOLESALE RETAIL TRADE	894003	1350917	1367313	16396
70 FINANCE, INSURANCE	211092	378207	386977	8770
71 REAL ESTATE, RENTAL	45489	83870	87164	3294
72 HOTELS, PERSONAL SERV.	139415	274332	276437	2104
73 BUSINESS SERVICES	197301	378683	396125	17442
74 RESEARCH, DEVELOPMENT	0	0	0	0
75 AUTO. REPAIR, SERVICES	37025	53202	53981	779
76 AMUSEMENTS	20488	59007	59596	589
77 MED., EDUC. SERVICES	387260	1061778	1062709	931
78 FEDERAL GOVT. ENTERPR.	68470	103294	105637	2343
79 STATE LOCAL GOVT. ENT.	16873	26288	27151	864
TOTAL	4211791	6744335	7044908	300572

inputs. Hence, insufficient facilities and manpower in the service sector can impede the growth of other sectors and thus the whole economy. A family may not want to live in a community without a supermarket; by the same token, a firm may not build a factory in an area without direct access to maintenance and repair services. However, service industries would not appear in an area where other industries needing the services do not exist. It has been found that suppliers of certain goods and services will not be available in communities where the number of consumers does not exceed the "threshold" level (12). Business cannot continue if sales do not reach the minimum receipts sufficient to cover costs. Therefore, while the state attempts to attract new manufacturing firms, expansion of the service sector also should be accomplished.

It should be noted that changes in reserves of crude oil and natural gas were not taken into consideration in this study. The additional output, employment, and income generated from the industry (IO-8) are substantial. This suggests a strong linkage between the state economy and nonrenewable resources. Therefore, rapid depletion of oil and gas in the state will adversely affect the economic growth.

CHAPTER V

ECONOMIC IMPACT OF RECREATION

In addition to water transportation, the McClellan-Kerr Arkansas River Navigation System also provides water-oriented recreation areas. Major on-site recreational activities of upstream lakes (Keystone, Fort Gibson, Eufaula, Tenkiller, and Oologah) and the main channel in Oklahoma include camping, fishing, picknicking, boating, sightseeing, water skiing, and swimming. The wide variety of activities draws tremendous participants from the state and outside Oklahoma. A recreation study on the system, conducted by Badger, Schreiner and Presley (4) has shown that over 20 million visitor days were recorded in 1975 for the Oklahoma portion of the Arkansas River Navigation System. This chapter will discuss the impact of water-based recreation on the state economy. Data used for estimating the impact are primarily obtained from the results of the aforementioned study (4). However, since the area in that study contains only 23 counties in eastern Oklahoma and 40 counties in Arkansas, the results cannot be used directly in the present study. It is necessary to make various adjustments and estimates before the recreation impact on Oklahoma economy is measured. The adjusting procedures are discussed in the following sections.

Recreation Expenditures

Recreation expenditures of both on-site recreationists and

recreation home owners (seasonal and permanent) include two major categories: trip expenditures and annual expenditures. Trip expenditures refer to expenses on food, transportation, lodging and other recreation related activities during visits to the recreation areas in the Navigation System. While annual expenditures consist of outlay for boating, fishing, camping, and skiing for the entire season, they exclude the initial investment on recreation equipment. The expenditures incurred in the Oklahoma portion of the waterway for on-site recreationists and recreation home owners were estimated separately.

On-Site Recreationists

Estimated expenditures per visitor day[1] by recreation activity and by lake (area) have been made by Badger et al. (4, p. 70). The product of per visitor day expenditure and annual visitor days of a lake yields the aggregate expenditure for that lake. The total expenditure in Oklahoma was obtained by summing aggregate expenditures for individual lakes in Oklahoma. It was assumed that off-season (October to April) expenditure per visitor day was 60 percent of in-season expenditures. The aggregate expenditures for 1975 are presented in Table XI.

More than 75 percent of the total visitor days for the entire Arkansas River Navigation System occurred in Oklahoma. The total expenditures for recreation in Oklahoma were approximately $179 million in 1975, which amounted to 80 percent of the total expenditures for the entire navigation system. The per visitor day expenditures did not vary

[1]A visitor day is defined as a visit by one individual to a public area for recreation purposes for any portion of a 24-hour period measured from midnight (4, p. 58).

TABLE XI

AGGREGATE EXPENDITURES FOR ON-SITE RECREATIONISTS, MCCLELLAN-KERR ARKANSAS RIVER NAVIGATION SYSTEM, OKLAHOMA, 1975

Lake	Expenditure Per Visitor Day (Dollars)	Recreation Season		Off-Season		Total	
		Visitor Days (1,000)	Aggregate Expenditures ($1,000)	Visitor Days (1,000)	Aggregate Expenditures ($1,000)	Visitor Days (1,000)	Aggregate Expenditures (1,000)
Keystone	10.0007	2,175.4	21,756	864.3	5,078	3,021.7	26,834
Fort Gibson	9.0529	2,930.7	26,531	1,179.5	6,407	4,110.2	32,938
Eufaula	10.4157	3,221.7	33,554	1,473.0	9,205	4,694.5	42,759
Tenkiller	10.7950	3,790.8	40,922	1,435.5	9,298	5,226.3	50,220
Oologah	9.1159	959.5	8,747	461.6	2,525	1,421.1	11,272
Main Channel	8.2657	1,308.7	10,817	819.5	4,064	2,128.2	14,881
Total	-	14,386.6	142,327	6,215.4	36,577	20,602.0	178,904

Source: Badger, Schreiner and Presley (4, pp. 70-72).

substantially among different lakes, but there were great distinctions in the aggregate expenditures. The expenditures at Tenkiller and Eufaula Lakes exceeded 50 percent of the Oklahoma total.

Seasonal and Permanent Recreation Home Owners

In the 1974-75 period an estimated 5,496 out of 5,788 residences around the lakes in the Arkansas River Navigation System were located in Oklahoma. A survey sample of 270 homes indicated that 21 percent of the homes were used only seasonally (4, p. 73). Hence, this proportion of recreation homes was classified as seasonal homes. Because permanent residents have expenses on food, transportation, and utilities throughout the year even if they do not participate in recreation activities, the trip expenditures were not estimated for permanent home owners. Since there were variations in expenses on individual activities, such as boating and fishing, from 1974 to 1975, the average of the two-year period was used to calculate aggregate home owner expenditures. The estimated average trip expenditures, made by Badger et al. (4, p. 77), for seasonal residents were $1,210.58 per household, and annual expenditures (on boating, fishing, camping, etc.) for both seasonal and permanent home owners were $253.66 per household. Aggregate expenditures were computed by multiplying per household expenditures by the number of residences. The results are shown in Table XII.

Primate Capital Investments

Recreation investments consist of two major categories, namely,

recreation equipment and recreation homes. The former includes purchases of boats, motors, canoes, campers, tents, motor homes, bicycles, and skiing equipment by on-site recreationists and recreation home owners. The latter refers to investments in mobile homes, constructed homes and lots of seasonal and permanent home owners. Each type of investment will be discussed.

TABLE XII

AGGREGATE EXPENDITURES FOR SEASONAL AND PERMANENT HOME OWNERS, MCCLELLAN-KERR ARKANSAS RIVER NAVIGATION SYSTEM, OKLAHOMA, 1974-75

Lake	Number of Residences			Aggregate Expenditures ($1000)		
	Seasonal	Permanent	Total	Trip	Annual	Total
Keystone	127	477	604	153	153	306
Fort Gibson	307	1,158	1,465	372	372	744
Eufaula	511	1,921	2,432	617	617	1,234
Tenkiller	207	786	995	252	252	504
Total	1,154	4,342	5,496	1,394	1,394	2,788

Source: Badger, Schreiner and Presley (4, pp. 77-78).

Investment on Recreation Equipment by On-Site Recreationists

Badger et al. (4, p. 79) have estimated the value of recreation equipment per visitor day, from the survey data, by dividing the total

value from the survey sample by the total annual visitor days of the recreationists interviewed. Hence, the aggregate investment on equipment by on-site recreationists at each lake can be calculated from the value per visitor day and the total number of visitor days. These estimates are presented in Table XIII.

TABLE XIII

AGGREGATE VALUE OF EQUIPMENT INVESTMENT OF ON-SITE RECREATIONISTS, MCCLELLAN-KERR ARKANSAS RIVER NAVIGATION SYSTEM, OKLAHOMA, 1975

Lake	Equipment Value per Visitor Day	Visitor Days (1,000)	Aggregate Value ($1,000)
Keystone	$16.53	3,021.7	49,949
Fort Gibson	14.18	4,110.2	58,283
Eufaula	17.67	4,694.5	82,952
Tenkiller	23.32	5,226.3	121,877
Oologah	22.90	1,421.1	32,543
Main Channel	11.04	2,128.2	23,495
Total	--	20,602.0	369,098

Source: Badger, Schreiner and Presley (4, p. 81).

As mentioned in the study of Badger et al. (4, p. 80), the equipment per visitor day is affected by the intensity of equipment utilization, i.e. the per visitor day value is inversely related to

the frequency of use. The equipment value per visitor day varied significantly among lakes in 1975. The equipment value at Lake Tenkiller was about twice as much as the value on the Oklahoma Main Channel. Total value of investment amounted to $369 million in 1975; the aggregate value at Lake Tenkiller accounted for almost one-third of the total.

Investment on Recreation Equipment by Recreation Home Owners

Average investment value of recreation equipment per household was estimated by Badger et al. (4, p. 83) at $2,988 and $1,720 for seasonal and permanent residents, respectively, in 1975. These values and number of residences were used to measure the aggregate value of home owner investment on recreation equipment. The estimates are given in Table XIV. The total investment was about $11 million in 1975, of which the permanent home owner investment accounted for about two-thirds.

TABLE XIV

AGGREGATE VALUE OF EQUIPMENT INVESTMENT OF RECREATION HOME OWNERS, MCCLELLAN-KERR ARKANSAS RIVER NAVIGATION SYSTEM, OKLAHOMA, 1975

	Season Home	Permanent Home	Total
Number of Residences	1,154	4,342	5,496
Average Value per Household	$2,988.10	$1,720.42	--
Aggregate Investment ($1,000)	3,488.3	7,470.1	10,918.4

Source: Badger, Schreiner and Presley (4, p. 83).

Investment on Recreation Homes

Both seasonal and permanent homes were categorized into mobile homes and constructed homes. About 68 percent of the seasonal homes and 20 percent of the permanent homes were mobile homes. Data on average value of mobile homes, constructed homes, lots for seasonal and permanent residents, as well as the proportion of mobile home owners who rented lots, were obtained from the study of Badger et al. (4, p. 84), to estimate the investment value of recreation homes along the Arkansas River in Oklahoma. The results are presented in Table XV.

The investment of recreation homes amounted to $138.7 million, with $16 million for seasonal and $122 million for permanent homes. Approximately $17 million of the total value represented mobile homes and $122 million represented constructed. The average value of recreation homes (both mobile and constructed) including lots was about $25,000.

Recreation Expenditures and Investments Classified by Input-Output Industry

Expenditures and investments, resulting from participation of recreation activities and purchases of recreation equipments and homes, constitute increases in the final demand. Hence, increases in the output of goods and services of the state can be expected. To estimate the recreation impact of the Arkansas waterway on the state economy and individual industries, however, the aggregate expenditures and investments as presented earlier must be distributed among related input-output industries. The procedures of allocating the aggregate figures to

TABLE XV

AGGREGATE VALUE OF RECREATION HOME INVESTMENT, MCCLELLAN-KERR ARKANSAS RIVER NAVIGATION SYSTEM, OKLAHOMA, 1974-75

Type of Home	Seasonal	Permanent	Total
Mobile Homes			
Estimated Number	785	868	1,653
Value of Homes ($1,000)	6,383.3	7,203.2	13,586.5
Value of Lots ($1,000)	1,044.6	2,150.6	3,195.2
Total Value ($1,000)	7,427.9	9,353.8	16,781.7
Constructed Homes			
Estimated Number	369	3,474	3,843
Value of Homes ($1,000)	7,218.0	94,717.6	101,935.6
Value of Lots ($1,000)	1,735.3	18,296.6	20,031.9
Total Value ($1,000)	8,953.3	113,014.2	121,967.5
Total			
Estimated Number	1,154	4,342	5,496
Value of Homes ($1,000)	13,601.3	101,920.8	115,522.1
Value of Lots ($1,000)	2,779.9	20,447.2	23,227.1
Total Value ($1,000)	16,381.2	122,368.0	138,749.2

Source: Badger, Schreiner and Presley (4, p. 84).

various input-output industries as well as to the study region and also outside the region have been discussed in detail (4, pp. 82-95). For example, they estimated that about 74 percent of 1975 total expenditures for on-site recreationists (on-season and off-season) occurred in the study area. Since their study area does not cover the entire state of Oklahoma, the percent distribution within and outside the region should be adjusted.

In 1975, approximately 91 percent of on-site recreationists of the Arkansas River came from either Oklahoma or Arkansas (4, p. 24). Although the proportion of participants of lakes in Oklahoma from each of these two states is not available, it would be reasonable to assume that the majority are from Oklahoma. First of all, the two largest metropolitan areas of Oklahoma, Oklahoma City and Tulsa, are included in the 200-mile radius circle around the lake area, while no populous cities in the neighboring states (Arkansas, Kansas, and Missouri) are in the circle. Second, survey data show that more than 85 percent of recreationists traveled 150 miles or less to the recreation areas along the Arkansas River (4, p. 23). Third, since water-based recreation facilities are available in all neighboring states of Oklahoma, people in those states do not have to participate recreational activities only in Oklahoma. Furthermore, as the largest population center in the vicinity of the lake area, Oklahoma City (which was treated as outside the region in the study of Badger et al.), is included in the study area, the proportion of expenditures and investments occurring in the region would increase substantially. In view of these factors, it is assumed that 90 percent of the total recreation expenditures and investments estimated in the previous section occurred in Oklahoma. Aggregate

expenditures and investments outside the state were obtained by subtracting the in-state estimates from the totals presented in the study of Badger et al. (4, pp. 85-95).

The percent distribution of aggregate expenditures and investments by intput-output industries and procedures of allocation applied in the aforementioned report (4) were adopted in the present study. However, since projections of recreation expenditures and investments for the Arkansas waterway are not available, a conservative assumption that the 1980 level will be the same as 1975 level was made. This is because energy shortage, inflation, and recession could reduce the demand for recreation considerably, and adequate projections cannot be made without using sufficient effort and other resources. Since the estimated expenditures and investments on recreation are expressed in current (1975) dollars, the consumer price index (56, p. 439) was employed to convert these estimates to 1967 prices. The results are presented in Table XVI.

Recreation provided by the Arkansas River Navigation System will increase the final demand of 36 input-output industries in Oklahoma. Wholesale and Retail (IO-69) gets the largest share. Food (IO-14), Transportation Equipment (IO-59 to IO-61), and Petroleum (IO-31) industries also experience substantial increase. The overall increase in the final demand is about $118 million for Oklahoma input-output industries and $54 million for the rest of the U. S.

Estimating Economic Impact of Recreation

The total increase in final demand by industry for the state and outside the state can be expressed by vectors ΔY^1 and ΔY^2, respectively.

TABLE XVI

1980 INCREASES IN OKLAHOMA FINAL DEMAND INDUCED BY RECREATION, BY INPUT-OUTPUT INDUSTRY
($1,000 in 1967 Price Levels)

INDUSTRY	Current Expenditures		Capital Formation		Total	
	Within State	Outside State	Within State	Outside State	Within State	Outside State
1 LIVESTOCK, PRDTS.	776	265	0	0	776	265
2 OTHER AGRIC. PRDTS.	893	299	0	0	893	299
3 FORESTRY, FISHERIES	117	34	0	0	117	34
13 ORDNANCE, ACCESSORIES	14	3	0	0	14	3
14 FOOD, KINDRED PRDTS.	19999	6476	0	0	19999	6476
17 TEXTILE PRDTS.	105	111	0	0	105	111
19 MISC. TEXTILE PRDTS.	0	0	131	65	131	65
20 LUMBER, WOOD PRDTS.	1	0	3	0	4	0
22 HOUSEHOLD FURNITURE	798	534	0	0	798	534
27 CHEM. SELECT. PRDTS.	291	78	0	0	291	78
28 PLASTICS, SYNTHETICS	0	0	3	0	3	0
29 DRUGS, COSMETICS	605	250	0	0	605	250
31 PETRO, RELATED INDS.	12776	4019	0	0	12776	4019
32 RUBBER, MISC. PLASTICS	1105	655	16	5	1122	660
38 PRIMARY NONFERROUS MFR	210	142	0	0	210	142
40 FABRICATED METAL PRDTS	413	279	0	0	413	279
42 OTHER FAB. METAL PRDTS	307	114	0	0	307	114
43 ENGINES, TURBINES	0	0	2754	1240	2754	1240
54 HOUSEHOLD APPLIANCES	356	242	0	0	356	242
55 ELECT. LIGHTING EQUIP.	404	261	0	0	404	261
58 MISC. ELECTRICAL MACH.	0	14	0	0	0	14
59 MOTOR VEHICLES, EQUIP.	0	14	6293	3402	6293	3416
61 OTHER TRANSPORT. EQUIP	1862	852	10409	6129	12271	6981
64 MISC. MANUFACTURING	3468	3340	75	58	3543	3397
65 TRANSP., WAREHOUSING	4488	1216	386	210	4874	1426
66 COMMUNICA. EX BRDCAST.	16	0	0	0	16	0
68 ELEC.GAS.WATER SAN.SV.	120	0	0	0	120	0
69 WHOLESALE RETAIL TRADE	31881	12480	7213	4014	39094	16494
70 FINANCE, INSURANCE	7628	5562	0	0	7628	5562
71 REAL ESTATE, RENTAL	31	0	0	0	31	0
72 HOTELS, PERSONAL SERV.	643	740	0	0	643	740
73 BUSINESS SERVICES	903	659	0	0	903	659
75 AUTO. REPAIR, SERVICES	225	269	0	0	225	269
76 AMUSEMENTS	527	75	0	0	527	75
77 MED., EDUC. SERVICES	0	14	0	0	0	14
79 STATE LOCAL GOVT. ENT.	206	70	0	0	206	70
TOTAL	91169	39068	27283	15122	118452	54190

Let

$$Y = \begin{bmatrix} \Delta Y^1 \\ \cdots \\ \Delta Y^2 \end{bmatrix} \tag{38}$$

Then, by using equation 34, the change in output (ΔX) can be calculated as

$$\Delta X = (I - \hat{T}\bar{A})^{-1} \hat{T}\Delta Y \tag{39}$$

where $\hat{T}$ is the trade coefficient matrix of the impact model.

The increases of output of Oklahoma industries, resulting from higher recreation demand, are presented in Table XVII. Procedures of estimating changes in employment and income applied in this section were similar to those in the previous chapter. The results are also shown in Table XVII.

The Arkansas waterway will generate an additional output of $115 million in 1980 for Oklahoma. Almost all industries experience the output increases. Approximately 36 and 12 percent of the total increase come from the Wholesale and Retail (IO-69) and Petroleum (IO-31) industries, respectively. The recreation provided by the Arkansas River will create increases of more than 7,400 jobs and $38 million income for all input-output industries in Oklahoma. The majority of the additional jobs and income are in Wholesale and Retail (IO-69) industry.

Although both transportation and recreation made available by the waterway project have positive effects on the Oklahoma economy, the impacts are different in nature. The previous chapter showed that waterway transportation has a greater economic impact on the manufacturing sector than on the service sector. However, data in Table XVII indicate that water-oriented recreation has a significant impact on

TABLE XVII

1980 INCREASES IN OUTPUT, EMPLOYMENT, AND INCOME DUE TO GREATER RECREATION DEMAND, OKLAHOMA
(1967 Prices)

INDUSTRY	Output ($1000)	Employment	Income ($1000)
1 LIVESTOCK, PRDTS.	1503	67	281
2 OTHER AGRIC. PRDTS.	1609	97	406
3 FORESTRY, FISHERIES	138	8	36
4 AGRI. FORES. FISH. SV.	201	30	88
5 IRON, FERRO. ORES MIN.	0	0	0
6 NONFERROUS ORES MINING	2	0	2
7 COAL MINING	4	0	3
8 CRUDE PETRO., NATL GAS	6311	149	1664
9 STONE, CLAY MINING	45	2	16
10 CHEM FERT MIN MINING	0	0	0
11 NEW CONSTRUCTION	0	0	0
12 MAINT., REPAIR CONSTR.	1639	31	236
13 ORDNANCE, ACCESSORIES	8	0	0
14 FOOD, KINDRED PRDTS.	7593	138	1110
15 TOBACCO MANUFACTURES	0	0	0
16 FABRICS	1	0	0
17 TEXTILE PRDTS.	1	0	0
18 APPAREL	2	0	1
19 MISC. TEXTILE PRDTS.	3	0	1
20 LUMBER, WOOD PRDTS.	18	1	7
21 WOODEN CONTAINERS	0	0	0
22 HOUSEHOLD FURNITURE	26	2	9
23 OTHER FURNITURE	0	0	0
24 PAPER, ALLIED PRDTS.	14	1	2
25 PAPERBOARD CONTAINERS	18	1	3
26 PRINTING, PUBLISHING	818	51	344
27 CHEM, SELECT. PRDTS.	131	2	16
28 PLASTICS, SYNTHETICS	3	0	0
29 DRUGS, COSMETICS	8	0	1
30 PAINT, ALLIED PRDTS.	3	0	1
31 PETRO, RELATED INDS.	13733	58	746
32 RUBBER, MISC. PLASTICS	363	8	55
33 LEATHER TANNING PRDTS.	0	0	0
34 FOOTWEAR, LEAT. PRDTS.	0	0	0
35 GLASS, GLASS PRDTS.	62	3	28
36 STONE, CLAY PRDTS.	115	4	35
37 PRIMARY IRON STEEL MFR	25	1	9
38 PRIMARY NONFERROUS MFR	101	1	20
39 METAL CONTAINERS	5	0	1
40 FABRICATED METAL PRDTS	339	18	108

TABLE XVII (Continued)

INDUSTRY	Output ($1000)	Employment	Income ($1000)
41 SCREW MACH PRDTS, ETC.	5	0	1
42 OTHER FAB. METAL PRDTS	237	11	39
43 ENGINES, TURBINES	118	2	1
44 FARM MACH., EQUIP.	3	0	1
45 CONSTRUC. MACH. EQUIP.	50	2	15
46 MATERIAL HANDLING MACH	1	0	0
47 METALWORKING MACHINERY	1	0	0
48 SPECIAL MACH. EQUIP.	2	0	1
49 GENERAL MACH. EQUIP.	27	1	7
50 MACHINE SHOP PRDTS.	7	1	3
51 OFFICE, COMPUT. MACHS.	1	0	0
52 SERVICE IND. MACHINES	7	0	1
53 ELECT. TRANSMISS. EQP.	9	0	3
54 HOUSEHOLD APPLIANCES	6	0	1
55 ELECT. LIGHTING EQUIP.	6	0	0
56 RADIO TV, ETC.,EQUIP.	21	1	7
57 ELECTRONIC COMPONENTS	1	0	0
58 MISC. ELECTRICAL MACH.	6	0	1
59 MOTOR VEHICLES, EQUIP.	203	4	29
60 AIRCRAFT, PARTS	314	4	34
61 OTHER TRANSPORT. EQUIP	850	21	117
62 PROF. SCIEN. INSTRU.	7	0	1
63 MEDICAL, PHOTO. EQUIP.	0	0	0
64 MISC. MANUFACTURING	566	34	158
65 TRANSP., WAREHOUSING	7149	314	2546
66 COMMUNICA. EX BROCAST.	1087	34	229
67 RADIO, TV BROADCASTING	351	21	109
68 ELEC.GAS,WATER SAN.SV.	2221	34	338
69 WHOLESALE RETAIL TRADE	41416	4479	20597
70 FINANCE, INSURANCE	10769	743	4431
71 REAL ESTATE, RENTAL	5416	32	175
72 HOTELS, PERSONAL SERV.	969	161	709
73 BUSINESS SERVICES	5176	504	2497
74 RESEARCH, DEVELOPMENT	0	0	0
75 AUTO. REPAIR, SERVICES	807	31	175
76 AMUSEMENTS	852	164	397
77 MED., EDUC. SERVICES	198	35	185
78 FEDERAL GOVT. ENTERPR.	910	74	582
79 STATE LOCAL GOVT. ENT.	820	39	132
TOTAL	115431	7423	38750

service industries. The increase in output, employment, and income of the service sector, resulting from greater recreation demand, account for 68, 90, and 85 percent, respectively, of the total.

CHAPTER VI

DEMOGRAPHIC IMPACT

The previous chapters have shown that the economic impact of the Arkansas River is significant. It follows that changes in population can be expected because the regional economy and population are interrelated. For instance, outmigration may occur when regional unemployment is high. A major purpose of regional development is to provide jobs for people. Since one of the most useful sets of information for planning is population, it was felt that the impact of the Arkansas River Navigation System on the state's population should be discussed in the study.

Population projections can be made by different approaches. Simple techniques include extrapolation and less sophisticated mathematical models such as regression of population on time, income, or employment. More complicated techniques include an estimation of a large econometric model consisting of a large number of demographic and socio-economic variables. In the regional model developed by Hamilton et al. (14), not only birth, death, growth, migration, labor force, and skill level of various age groups were related to population but also linkages among demography, employment, and water resrouces were also taken into consideration. While this type of sophisticated model yields useful results, development of the model is costly in terms of time, personnel, and funds. Ekholm et al. (11, p. 89) estimated population changes for the

Oklahoma and Texas high plains by using total regional employment of the current year and the ratio of population to total employment of the preceding year.

Complicated and sophisticated techniques for projecting population do not necessarily produce better and more accurate projections than do the simple ones. However, procedures such as used in the study of Ekholm et al. (11, p. 89) may not give results sufficiently useful in planning because no information on the basic population structure was provided. For example, an estimated 10 percent population increase can hardly be meaningful to state policy makers if changes in different age groups are not known. The effects of a projected 10 percent increase in teenagers and a 10 percent increase in oldsters would be different. Therefore, this chapter covers not only projections on total state population but also population structure. A simulation model is constructed to estimate the 1980 population; 1970 is used as the base year. Various equations are specified in the following sections.

Population

Population in the study area is assumed to be determined by the existing population, births, deaths, and migration. The entire population is divided into several age groups with different birth and death rates. The total state population is computed from the following equation:

$$POPN_t = CHLD_t + TNGR_t + YADL_t + PMAG_t + MDAG_t + OLDR_t \quad (40)$$

where

$POPN_t$ = total population in the year t;

$CHLD_t$ = number of children in the year t (ages 0 to 13);

$TNGR_t$ = number of teenagers in the year t (ages 14 to 19);

$YADL_t$ = number of young adults in the year t (ages 20 to 24);

$PMAG_t$ = number of prime aged in the year t (ages 25 to 44);

$MDAG_t$ = number of middle aged in the year t (ages 45 to 64); and

$OLDR_t$ = number of oldsters in the year t (over 65 years of age).

Again, population of each age group is determined by births, deaths, migration, and changing ages due to passage of time. Hence,

$$CHLD_t = CHLD_{t-1} + BCHD_{t-1} + MCHD_{t-1} - GCHD_{t-1} - DCHD_{t-1} \quad (41)$$

where

$BCHD_{t-1}$ = births of children in the year t-1;

$MCHD_{t-1}$ = net migrating children in the year t-1;

$GCHD_{t-1}$ = growing children in the year t-1; and

$DCHD_{t-1}$ = deaths of children in the year t-1.

$$TNGR_t = TNGR_{t-1} + GCHD_{t-1} + MTNR_{t-1} - GTNR_{t-1} - DTNR_{t-1} \quad (42)$$

where

$MTNR_{t-1}$ = net migrating teenagers in the year t-1;

$GTNR_{t-1}$ = growing teenagers in the year t-1; and

$DTNR_{t-1}$ = deaths of teenagers in the year t-1.

$$YADL_t = YADL_{t-1} + GTNR_{t-1} + MYAD_{t-1} - GYAD_{t-1} - DYAD_{t-1} \quad (43)$$

where

$MYAD_{t-1}$ = net migrating young adults in the year t-1;

$GYAD_{t-1}$ = growing young adults in the year t-1; and

$DYAD_{t-1}$ = deaths of young adults in the year t-1.

$$PMAG_t = PMAG_{t-1} + GYAD_{t-1} + MPAG_{t-1} - GPAG_{t-1} - DPAG_{t-1} \quad (44)$$

where

$MPAG_{t-1}$ = net migrating prime aged in the year t-1;

$GPAG_{t-1}$ = growing prime aged in the year t-1; and

$DPAG_{t-1}$ = deaths of prime aged in the year t-1.

$$MDAG_t = MDAG_{t-1} + GPAC_{t-1} + MMAG_{t-1} - GMAG_{t-1} - DMAG_{t-1} \quad (45)$$

where

$MMAG_{t-1}$ = net migrating middle aged in the year t-1;

$GMAG_{t-1}$ = growing middle aged in the year t-1; and

$DMAG_{t-1}$ = deaths of middle aged in the year t-1.

$$OLDR_t = OLDR_{t-1} + GMAG_{t-1} + MOLD_{t-1} - DOLD_{t-1} \quad (46)$$

where

$MOLD_{t-1}$ = net migrating oldsters in the year t-1; and

$DOLD_{t-1}$ = deaths of oldsters in the year t-1.

Birth

The live birth rate was attributed to each of the four fertile age groups. Since birth rates appear to have a downward trend in recent years, an annual 3 percent rate of decline in the birth rates, which was estimated from 1965 to 1974 birth rates of the nation (56, p. 55), was applied to project the birth rates. The births of children can be expressed by the following equation.

$$BCHD_t = (TNGR_t)(BRTN_t) + (YADL_t)(BRYA_t) + (PMAG_t)(BRPA_t) + (MDAG_t)(BRMA_t) \quad (47)$$

where

$BRTN_t$ = birth rate of teenagers in the year t;

$BRYA_t$ = birth rate of young adults in the year t;

$BRPA_t$ = birth rate of prime aged in the year t; and

$BRMA_t$ = birth rate of middle aged in the year t.

Then,

$$BRTN_t = (BRTN_{t-1})(TRBR) \quad (48)$$

where

TRBR = trend factor of birth rate, which was estimated as .97.

Similarly,

$$BRYA_t = (BRYA_{t-1})(TRBR) \quad (49)$$

$$BRPA_t = (BRPA_{t-1})(TRBR) \quad (50)$$

$$BRMA_t = (BRMA_{t-1})(TRBR) \quad (51)$$

Growth

The number of persons growing out of any original age class is computed by dividing the number of persons in the class by the number of years spent in that class. Hence,

$$GCHD_t = CHLD_t/14 \quad (52)$$

$$GTNR_t = TNGR_t/6 \quad (53)$$

$$GYAD_t = YADL_t/5 \quad (54)$$

$$GPAG_t = PMAG_t/20 \quad (55)$$

$$GMAG_t = MDAG_t/20 \quad (56)$$

The initial (1970) values for these variables and their sources are presented in Table XVIII.

Death

Different death rates were applied to different age groups. The death rates for the total U. S. population from 1970 to 1974 (56, p. 63) indicated a one percent decrease each year. It was assumed that this trend would continue in the study period, 1970-1980. The death of each

TABLE XVIII

INITIAL (1970) VALUE OF VARIABLES IN THE DEMOGRAPHIC MODEL FOR OKLAHOMA

Variable	Description	Value	Source
$CHLD_0$	Number of children	637,859	(38, p. 415)
$TNGR_0$	Number of teenagers	294,343	(38, p. 415)
$YADL_0$	Number of young adults	204,557	(38, p. 415)
$PMAG_0$	Number of prime aged	585,337	(38, p. 415)
$MDAG_0$	Number of middle aged	536,850	(38, p. 415)
$OLDR_0$	Number of oldsters	300,229	(38, p. 415)
$BRTN_0$	Birth rate of teenagers	.033852	(59, p. 68)
$BRYA_0$	Birth rate of young adults	.091134	(59, p. 68)
$BRPA_0$	Birth rate of prime aged	.027837	(59, p. 68)
$BRMA_0$	Birth rate of middle aged	.000056	(59, p. 68)
$DRCD_0$	Death rate of children	.002003	(60, p. 105)
$DRTN_0$	Death rate of teenagers	.001105	(60, p. 105)
$DRYA_0$	Death rate of young adults	.001486	(60, p. 105)
$DRPA_0$	Death rate of prime aged	.002323	(60, p. 105)
$DRMA_0$	Death rate of middle aged	.010964	(60, p. 105)
$DROD_0$	Death rate of oldsters	.058652	(60, p. 105)
$MTNR_0$	Migrating teenagers	2,612	(42, p. 98)
$MYAD_0$	Migrating young adults	1,249	(42, p. 98)
$MPAG_0$	Migrating prime aged	2,445	(42, p. 98)
$MMAG_0$	Migrating middle aged	2,957	(42, p. 98)
$MOLD_0$	Migrating oldsters	1,372	(42, p. 98)
$CHPM_0$	Number of children per migrant	.415989	(40, p. 269)
$LPRT_0$	Labor force part. rate/teenagers	.298842	(39, p. 159)

group is computed as below.

$$DCHD_t = (CHLD_t)(DRCD_{t-1})(TRDR) \quad (57)$$

where

$DRCD_{t-1}$ = death rate of children in the year t-1; and

TRDR = trend factor of death rate (assumed to be .99).

$$DTNR_t = (TNGR_t)(DRTN_{t-1})(TRDR) \quad (58)$$

where

$DRTN_{t-1}$ = death rate of teenagers in the year t-1.

$$DYAD_t = (YADL_t)(DRYA_{t-1})(TRDR) \quad (59)$$

where

$DRYA_{t-1}$ = death rate of young adults in the year t-1.

$$DPAG_t = (PMAG_t)(DRPA_{t-1})(TRDR) \quad (60)$$

where

$DRPA_{t-1}$ = death rate of prime aged in the year t-1.

$$DMAG_t = (MDAG_t)(DRMA_{t-1})(TRDR) \quad (61)$$

where

$DRMA_{t-1}$ = death rate of middle aged in the year t-1.

$$DOLD_t = (OLDR_t)(DROD_{t-1})(TRDR) \quad (62)$$

where

$DROD_{t-1}$ = death rate of oldsters in the year t-1.

Migration

From an economic point of view, people normally respond to better economic opportunities through in-migration. In other words, people

would move to where jobs are available and incomes are higher. However, human action may not be explained solely by economics. It has been found that although unemployed family heads were more willing to move than family heads with stable jobs; however, most unemployed did not actually move (1, p. 17). Mobility of people is affected not only by economic motives but family and community ties, home ownership, pension plans, personal factors, etc. (1, p. 18). During the period from 1965 to 1970, states along the West Coast (California, Oregon and Washington) attracted more than 1.2 million migrants, while unemployment rates of these states were considerably higher than the national level. The out-migration for the same period amounted to 104,000 in Pennsylvania although the state had a very low unemployment rate (42). Therefore, people do not necessarily follow jobs.

The inconsistency between net changes in migration and economic opportunities, as well as the scarcity of migration data make the task of projecting state of regional migration more complex and difficult. Many important factors determining mobility of people are not quantifiable; and data on quantifiable factors may not be available. A migration model based only upon economic theory would not be satisfactory. Constructing a sophisticated model to explain migration pattern is beyond the scope of the study. Since Hamilton et al. (14, pp. 147-152) found a specified relationship between net migration and local unemployment rate for the Susquehanna River Basin, the migration rate is assumed as a function of the ratio of state to national unemployment rates in the study.

Migration data recorded by state and age group, obtained from Current Population Reports (42), were used to estimate the equation of

rate for each age group. More specifically, for each age class except children, a regression equation for which state net migration of the age class was used as the dependent variable and the ratio of state to national unemployment rates independent variable was estimated. However, the states of Alaska, California, Hawaii, New York, Oregon, Pennsylvania, and Washington, which showed unusual migration patterns in terms of job opportunities, were excluded to prevent distorting the migration projections. As mentioned earlier, migration is not compltely determined by economic incentives. Large discrepancies between the estimated state migration computed from the regression equations and actual migration data were found. Therefore, an adjusting factor was applied to these equations to reduce the deviation. Furthermore, since children usually move with parents, the migration equation for children is expressed in a different form. The equations used in the simulation model are as follows:

$$MCHD_t = (MTNR_t + MYAD_t + MPAG_t + MMAG_t)(CHPM_t) \tag{63}$$

where

$CHPM_t$ = number of children per migrant in the year t.

The trend factor applied to estimate the changes in the birth rate was used to project the number of children per migrant. Thus,

$$CHPM_t = (CHPM_{t-1})(TRBR) \tag{64}$$

Then,

$$MTNR_t = (POPN_{t-1})[a_2 + b_2(SUEM_{t-1}/NUEM_{t-1})](AJFM) \tag{65}$$

where

$SUEM_{t-1}$ = state unemployment rate in the year t-1;

$NUEM_{t-1}$ = national unemployment rate in the year t-1, which is determined exogenously;

AJFM = adjusting factor for state migration; and

a_2 and b_2 are constant.

Similarly,

$$MYAD_t = (POPN_{t-1})[a_3 + b_3(SUEM_{t-1}/NUEM_{t-1})](AJFM) \quad (66)$$

$$MPAG_t = (POPN_{t-1})[a_4 + b_4(SUEM_{t-1}/NUEM_{t-1})](AJFM) \quad (67)$$

$$MMAG_t = (POPN_{t-1})[a_5 + b_5(SUEM_{t-1}/NUEM_{t-1})](AJFM) \quad (68)$$

$$MOLD_t = (POPN_{t-1})[a_6 + b_6(SUEM_{t-1}/NUEM_{t-1})](AJFM) \quad (69)$$

The constants are presented in Table XIX.

Labor Force

The total labor force is provided by each age group except children, and each age group has its own labor force participation rate. Hence,

$$TLBF_t = (TNGR_t)(LPRT_t) + (YADL_t)(LPRY_t) + (PMAG_t)(LPRP_t) + (MDAG_t)(LPRM_t) + (OLDR_t)(LPRO_t) \quad (70)$$

where

$TLBF_t$ = total labor force in the year t;

$LPRT_t$ = labor force participation rate of teenagers in the year t;

$LPRY_t$ = labor force participation rate of young adults in the year t;

$LPRP_t$ = labor force participation rate of prime aged in the year t;

$LPRM_t$ = labor force participation rate of middle aged in the year t; and

$LPRO_t$ = labor force participation rate of oldsters in the year t.

The trend of labor force participation rate of total population has been upward due to higher education level and increasing female

TABLE XIX

CONSTANTS AND COEFFICIENTS IN THE DEMOGRAPHIC MODEL FOR OKLAHOMA, 1970

Constant or Coefficient	Description	Value	Source(s)
TRBR	Factor of change in birth rate per year	.97	(56, p. 55)
TRDR	Factor of change in death rate per year	.99	(56, p. 63)
AJFM	Adjusting factor for state migration	1.8	(42, p. 98)
MLTY	Number of military workers	35,000	(39, p. 159)
RCEM	Annual rate of change in total employment	.0274	(26, p. 4) (39, p. 159)
a_2	Intercept of migration rate for teenagers	.007700	--
a_3	Intercept of migration rate for young adults (eq. 66)	.011137	--
a_4	Intercept of migration rate for prime aged (eq. 67)	.018043	--
a_5	Intercept of migration rate for middle aged	.007404	--
a_6	Intercept of migration rate for oldsters (eq. 69)	.004222	--
b_2	Regresion coefficient for unemployment of migration rate for teenagers (eq. 65)	-.006893	--
b_3	Regression coefficient for unemployment of migration rate for young adults (eq. 66)	-.010841	--
b_4	Regression coefficient for unemployment of migration rate for prime aged (eq. 67)	-.014325	--
b_5	Regression coefficient for unemployment of migration rate for middle aged (eq. 68)	-.005710	--
b_6	Regression coefficient for unemployment of migration rate for oldsters (eq. 69)	-.003364	--

TABLE XIX (Continued)

Constant or Coefficient	Description	Value	Source(s)
c_2	Intercept of labor force participation rate for teenagers (eq. 71)	.295637	--
c_3	Intercept of labor force participation rate for young adults (eq. 72)	.721019	--
c_4	Intercept of labor force participation rate for prime aged (eq. 73)	.697685	--
c_5	Intercept of labor force participation rate for middle aged (eq. 74)	.697954	--
c_6	Intercept of labor force participation rate for oldsters (eq. 75)	.191975	--
d_2	Regression coefficient for unemployment in LPRT (eq. 71)	-.163766	--
d_3	Regression coefficient for unemployment in LPRY (eq. 72)	-.812026	--
d_4	Regression coefficient for unemployment in LPRP (eq. 73)	-.413633	--
d_5	Regression coefficient for unemployment in LPRM (eq. 74)	-.439974	--
d_6	Regression coefficient for unemployment in LPRO (eq. 75)	-.382822	--
e_2	Regression coefficient for time in LPRT (eq. 71)	.005650	--
e_3	Regression coefficient for time in LPRY (eq. 72)	.005749	--
e_4	Regression coefficient for time in LPRP (eq. 73)	.005814	--
e_5	Regression coefficient for time in LPRM (eq. 74)	-.001564	--
e_6	Regression coefficient for time in LPRO (eq. 75)	-.003297	--

labor force. However, slight variations from year to year still exist. As explained by Hamilton et al. (14, p. 152), fluctuations in the labor force participation rate are resulted from changes in unemployment rate. As unemployment increases, some workable people withdraw from labor force because of the "discouraged worker effect." This suggests a negative relationship between labor force participation rate and rate of unemployment. Therefore, equations of labor force participation rate for various groups of workable people were estimated in the following form.

$$LPRT_t = c_2 + d_2(SUEM_{t-1}) + e_2(t) \quad (71)$$

$$LPRY_t = c_3 + d_3(SUEM_{t-1}) + e_3(t) \quad (72)$$

$$LPRP_t = c_4 + d_4(SUEM_{t-1}) + e_4(t) \quad (73)$$

$$LPRM_t = c_5 + d_5(SUEM_{t-1}) + e_5(t) \quad (74)$$

$$LPRO_t = c_6 + d_6(SUEM_{t-1}) + e_6(t) \quad (75)$$

Data from 1965 to 1974 on labor force participation rate for each age group (48, p. 222) (49, p. 216) (50, p. 212) (51, p. 214) (53, p. 220) (55, p. 344) and unemployment rate (52, p. 216) (56, p. 356) for the nation were applied to estimate coefficients for the above equations. These coefficients are presented in Table XIX.

Finally, the civilian labor force is computed by subtracting military workers from the total labor force:

$$CLBF_t = TLBF_t - MLTY_t \quad (76)$$

where

$CLBF_t$ = civilian labor force in the year t; and

$MLTY_t$ = number of military workers in the year t, which is assumed as a constant in the study.

Employment

Since employment is determined by the level of output, which in turn is a function of exogenous final demand, employment was also treated as exogenous in the demographic model. Employment projections of input-output industries for 1980 have been presented in Chapter IV (Table VIII). The additional number of jobs created by increased recreation demand has also been estimated in Chapter V. Projection for employment levels of government administrative workers was not made in this study. The estimated number of 1980 government workers, 80,900, as reported by the Oklahoma Employment Security Commission (26, p. 4), was used to calculate total employment of 1980. Therefore, under the impact model, the 1980 state employment would be 1,230,000. Based upon the 1970 employment, 938,000, shown in population census report (39, p. 159), there would be an average annual increase of 2.74 percent of employment for the decade from 1970 to 1980. This annual rate of change was applied in the model to estimate employment for each year since 1970. Hence,

$$TEMP_t = (TEMP_{t-1}) \ (1 + RCEM) \tag{77}$$

where

$TEMP_t$ = total state employment of the year t; and

RCEM = annual rate of change in total employment, which is assigned the value of .0274.

Then, the unemployment rate of the state can be calculated as follows:

$$SUEM_t = (CLBF_t - TEMP_t)/(CLBF_t) \tag{78}$$

The national unemployment rate which affects migration (see equations 65 to 69) was also an exogenous variable. Unemployment rates for each of the years from 1970 to 1976 were 4.9, 5.9, 5.6, 4.9, 5.6,

8.5, and 7.4, percent, respectively (56, p. 356). It is assumed that the unemployment rate remains at 7 percent from 1977 to 1980.

The demographic simulation system contains 39 equations specifying relationships among variables. A flow chart is presented in Figure 5 to illustrate the model.

Results of Simulation

The computer language, DYNAMO, was employed to conduct the simulation of the model. Features of DYNAMO have been discussed in detail in the user's manual (29). The computer program of the model will not be presented since the equation form used in the program is similar to the original form.

Population projections from 1971 to 1980 by age group are given in Table XX. Published data are also included for comparison purposes. Because young adults (ages 20 to 24) and prime aged (ages 25 to 44) are not separated in the published data, projected population for these two groups was combined to make the comparison. Results of the simulation are close to actual figures except for the population of children (Table XX). The number of children of the state has declined continuously since 1970, while the projections show a very slight increase over time. The decrease in the population of children in recent years does not necessarily suggest that the trend will continue permanently; it only indicates that the proportion of children of state population will decline in the future. The number of children will account for 22 percent of the projected population in 1980, down from 25 percent in 1970 (Table XX). The proportion of teenagers and middle aged also will decline. However, oldsters (over 65 years of age) and people

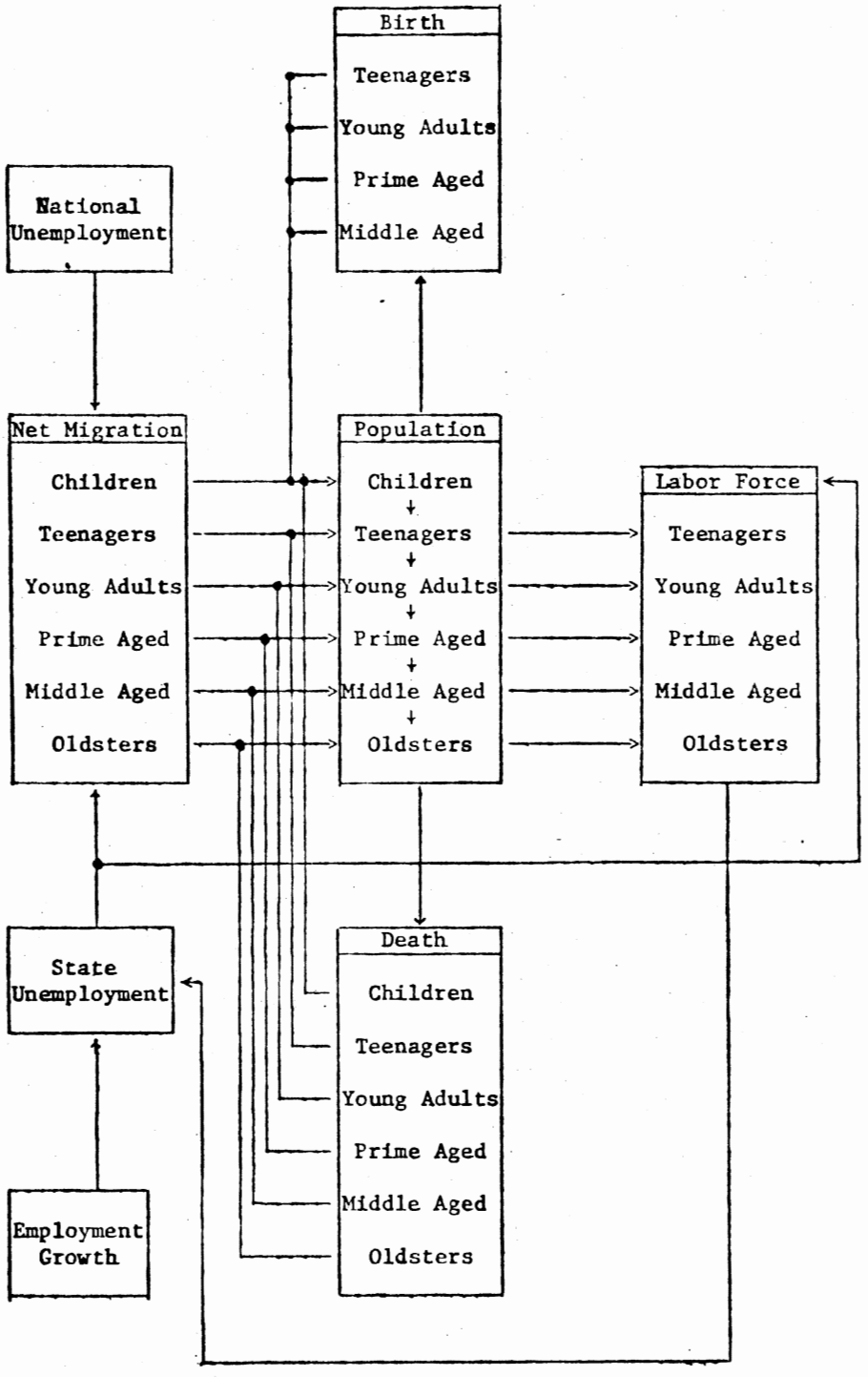

Figure 5. Flow Chart of the Simulation Model Used to Project Oklahoma Population

TABLE XX

POPULATION PROJECTIONS AND AGE STRUCTURE, OKLAHOMA, 1971-1980[a/]
(1000)

Year	Population	Children	Teenagers	Young Adults & Prime Aged	Middle Aged	Oldsters	Source
1970 Census	2,559	638	294	790	537	300	(38, p. 415)
	(100)	(25)	(11)	(31)	(21)	(12)	
1971 Proj.	2,592	640	293	812	536	311	--
	(100)	(25)	(11)	(31)	(21)	(12)	
1971 Publ.	2,600	635	296	811	540	308	(41, p. 3)
	(100)	(25)	(11)	(31)	(21)	(12)	
1972 Proj.	2,625	642	291	836	536	320	--
	(100)	(24)	(11)	(32)	(21)	(12)	
1972 Publ.	2,634	632	300	844	544	314	(33, p. 32)
	(100)	(24)	(11)	(32)	(21)	(12)	
1973 Proj.	2,650	641	289	855	535	330	--
	(100)	(24)	(11)	(32)	(20)	(13)	
1973 Publ.	2,663	624	308	862	548	321	(65, p. 32)
	(100)	(23)	(12)	(32)	(21)	(12)	
1974 Proj.	2,689	644	289	880	537	339	--
	(100)	(23)	(12)	(33)	(20)	(12)	
1974 Publ.	2,681	613	310	884	549	325	(55, p. 32)
	(11)	(23)	(12)	(33)	(20)	(12)	

TABLE XX (Continued)

Year	Population	Children	Teenagers	Young Adults & Prime Aged	Middle Aged	Oldsters	Source
1975 Proj.	2,714	642	287	898	539	348	--
	(100)	(24)	(10)	(33)	(20)	(13)	
1975 Publ.	2,712	608	313	905	551	334	(56, p. 28)
	(100)	(23)	(12)	(33)	(20)	(12)	
1976 Proj.	2,755	644	288	922	543	358	--
	(100)	(23)	(10)	(34)	(20)	(13)	
1977 Proj.	2,808	648	290	952	550	368	--
	(100)	(23)	(10)	(34)	(20)	(13)	
1978 Proj.	2,858	651	292	980	557	378	--
	(100)	(23)	(10)	(34)	(20)	(13)	
1979 Proj.	2,905	653	294	1,006	564	388	--
	(100)	(22)	(10)	(35)	(20)	(13)	
1980 Proj.	2,952	654	295	1,034	572	397	--
	(100)	(22)	(10)	(35)	(19)	(14)	

[a] Numbers in parentheses indicate percent distribution.

between 20 and 44 years of age will increase, both in absolute and relative terms.

The total population of the state can be expected to reach almost 3 million in 1980, which is an increase of 15 percent or 393 thousand persons from the 1970 level. Of course, accuracy of population projections in the study is subject to how industries respond to the advantages of waterway transportation. If firms do not expand capacity or locate plants in the state, or if another recession occurs, then downward adjustments of the population projections will be necessary.

Earlier unpublished population projections made by the Oklahoma Employment Security Commission (OESC) indicated a slightly slower growth of the state population, as compared to the simulation results. The OESC projection for 1980 was estimated at 2.9 million. However, the discrepancy is not substantial. The state population increase does not necessarily imply that every county and town in the state will have population growth. The OESC data indicated that some rural counties may lose population in the future. Further research effort would be required to forecast the geographical distribution of the population change.

Projected labor force and employment data from 1971 to 1980 are presented in Table XXI. Published data from 1971 to 1974 are also presented in the table to facilitate evaluating the results of simulution. The projections of labor force and employment seem to be slightly underestimated. However, the differences between projected and corresponding published data are less than 5 percent of the actual figures. The unemployment rate of the state in 1980 is expected to decline from the higher level of the early 1970s (Table XXI).

TABLE XXI

LABOR FORCE AND EMPLOYMENT PROJECTIONS, OKLAHOMA, 1971-1980

Year	Civilian Labor Force (1,000)	Employment (1,000)	Unemployment (Percent)	Source
1970 Census	981	938	4.4	(39, p. 159)
1971 Proj.	1,026	964	6.0	--
Publ.	1,037	985	4.9	(25, p. 4)
1972 Proj.	1,033	991	4.1	--
Publ.	1,074	1,025	4.5	(25, p. 4)
1973 Proj.	1,068	1,018	4.7	--
Publ.	1,111	1,064	4.2	(25, p. 4)
1974 Proj.	1,088	1,046	3.9	--
Publ.	1,136	1,086	4.4	(27, p. 27)
1975 Proj.	1,115	1,074	3.7	--
1976 Proj.	1,144	1,104	3.5	--
1977 Proj.	1,178	1,134	3.8	--
1978 Proj.	1,208	1,165	3.6	--
1979 Proj.	1,241	1,197	3.6	--
1980 Proj.	1,274	1,230	3.5	--

Although the employment projections by industry were not estimated in the simulation model, data presented in Tablex VIII and XVII may be used to disaggregate the total employment shown in Table XXI. Since the 1970-80 percent increase of labor force is greater than that of population, the rapid increases in the total labor force come from not only population growth but also the higher labor force participation rate. Therefore, the unemployment rate may increase if industries fail to expand at the same pace as estimated in the study.

The unemployment rate is difficult to predict, because it depends upon the employment level and the labor force. Forecasting the labor force is another intricate task. In this model, employment is assumed as exogenous and the labor force participation rate is a function of both the state unemployment rate and time. Obviously, factors determining labor force participation rates for various age groups would be more complicated than this model suggested. Although the regression coefficients (71 to 75) are negative (Table XIX), unemployment could have positive effect on the labor force participation rates. For instance, when a husband loses his job, secondary workers (wife and children) in the family may join the labor force (seek jobs). Unfortunately, the complex human behavior cannot be handled by economic theories alone; inputs from sociologists will be necessary.

Generally speaking, the performance of the simulation model seemed reasonable. Improvement in the migration data and development of sophisticated theories underlying the behavioral equations would strengthen the demographic impact analysis.

CHAPTER VII

SUMMARY AND CONCLUSIONS

Summary

Historically, eastern Oklahoma has been a rural, low-income region. Since the 1970 completion of the McClellan-Kerr Arkansas River Navigation System, a $1.2 billion project undertaken by the Corps of Engineers, the public has anticipated a rapid economic growth for that part of the state, particularly. The reason for this optimistic expectation is that the low-cost water transportation should attract new industries and firms into the region and thus create more jobs and higher incomes.

However, whether industrial expansion will be induced by the Arkansas River Navigation System as well as how industries will respond to the waterway project have not been systematically analyzed. Although economic growth has continued in Oklahoma during the past few years while the nation has suffered a recession, it does not imply that the available water transportation was the only factor causing growth of the state economy. Therefore, a study was needed on the effects of the Arkansas River Navigation System, which was isolated from other factors such as general trends.

The study area chosen for analysis was the state of Oklahoma. Although the impact of the Arkansas River affects other states, selection of the state of Oklahoma as the study region facilitated the data

collection. The state population was 2.56 million in 1970 and the land area is about 70 thousand square miles. The two largest metropolitan areas in the state, Oklahoma City and Tulsa, have 50 percent of the 1970 state population. Both of these cities have convenient access to the port facilities at Catoosa.

The major objective of the study was to estimate the net impact on the Oklahoma economy of the waterway transportation and the water-based recreation provided by the Arkansas River project. The specific objectives included, (1) determination of the relative importance of factors affecting location of industries; (2) estimation of the direct waterway impact on selected industries which might utilize water transport intensively; (3) estimation of the total impact of waterway transportation on the entire state economy; (4) measuring the economic effect from recreational visitations and recreational investments induced by the waterway; and (5) forecast of the demographic changes.

Data from various sources were required to accomplish the study. Results of several previous studies on location of industries (firms), based upon interview techniques, were used to show that transportation, among many factors, did play a role in the selection of location. However, the survey techniques applied in those studies were not applicable to the objectives of the present study. Thus, alternative methods were employed to analyze the effects of the Arkansas River Navigation System.

Because empirical studies showed different industries had different responses to location factors, procedures for studying the waterway impacts should be designed to reflect the effects on individual industries. Input-output techniques, by which specified industries may be handled with relative ease, seemed to fit the needs of the present study.

Hence, an input-output model was used as the basic analytical tool for the study.

The Arkansas River Navigation System provides a low-cost means of transportation. Producers using water transport to ship their products could expand their market areas. Raw materials imported from outside the state would be less expensive if they were shipped by barge. This suggested a change in the pattern of interregional trade. Consequently, an interregional input-output model for 1967, which included Oklahoma and the rest of the U. S., was estimated from the input-output coefficient matrices for both regions, and interregional trade coefficient matrix. Final demand projections for 1980, obtained from the publication of Harvard Economic Research Project (34), were applied to the 1967 model to estimate the 1980 projections of state output, employment, and income for the baseline model which reflected the economic structure "without" the waterway project.

As the Arkansas River Navigation System came into existence, the trade coefficients were expected to change due to the change in trade patterns. Before measuring the economic impact of the water transportation, major waterway user industries were first selected, according to the commodity shipment data. The relationship between average shipping distance and the proportion of total tonnage shipped by water was estimated. Then, for each of the selected industries, the effects of average shipping distance, geographical distance, and final demand on interregional trade were specified. The results were used to estimate the projections of interregional trade. Finally, a set of new trade coefficients, in which the effect of utilizing the water transportation by industries was incorporated, was computed from the trade projections.

The input-output coefficient matrix under the impact model, calculated from the new trade coefficients, and the 1980 final demand projections were applied to estimate the 1980 output, employment, and income. Therefore, by comparing the results of impact and baseline models, the net effects of the Arkansas River Navigation System on the state economy could be measured.

The economic impact of water-oriented recreation, another important function provided by the Arkansas River Navigation System, also was analyzed. Since the lakes and locks and dams supply a wide range of recreation activities, the Navigation System simulated the demand for water-based recreation. The increase in the demand resulted in higher levels of recreation expenditures and investments, i.e. additional final demand. Recreational expenditures included trip expenditures and annual expenditures by both on-site recreationists and recreation home owners. Recreational investments contained two components, investments in recreation equipment and recreation homes. The estimated aggregate recreation expenditures and investments were distributed to related input-output industries to estimate the economic impact on individual industries.

Finally, the estimates in the projected employment change were applied to forecast the changes in the demographic sector. A simulation model was constructed. In this model, the state population was disaggregated into six age groups. Equations specifying birth, death, migration, and labor force participation for those age groups were estimated. Population changes were expected to respond to the job opportunities (or lack of such opportunities). The results of the simulation model showed changes in the state population structure and labor force.

Conclusions

Empirical results of location studies discussed in the study showed that transportation was an important, but not the only, factor of selecting firm location. Since the Arkansas River Navigation System offers a low-cost means of transportation, expansion of industries can be expected to occur in Oklahoma. However, data obtained from the transportation census indicated that only several industries directly take advantage of water transport. This was explained by the "transportability" and other characteristics of products of different industries. Hence, only five input-output industries, namely, Chemicals (IO-27), Plastics and Synthetics (IO-28), Petroleum (IO-31), Primary Iron and Steel (IO-37), and Fabricated Metal (IO-40) industries were determined as major users of the waterway transportation.

It was found that for each industry the proportion of total tonnage shipped by water affected the average shipping distance and thus the volume of interregional trade. The trade, in both absolute and relative terms, was expected to increase in 1980 due to the adoption of water transport by those selected industries. The expansion of the trade area for the selected industries will result in higher levels of output for almost all input-output industries.

Given the final demand projections in 1980, the waterway transportation will bring about an increase of 7.8 percent, or $1.8 billion over the total output estimated for the baseline model. Major contributors of the increase are the Petroleum and Natural Gas (IO-8 and IO-31), Fabricated Metal (IO-40), and Real Estate (IO-71) industries. The increase in state employment, which was derived from the projected output change, will be 36,000 in 1980. The gain in employment will

primarily come from the waterway user industries and Crude Petroleum and Natural Gas (IO-8) industry; and the gain in the services sector will account for one-third of the total. The 1980 income will increase by $301 million or 4.5 percent over the baseline estimate. The main sources of the increase will be the Petroleum and Natural Gas (IO-8 and IO-31), Fabricated Metal (IO-40), and Transportation and Warehousing (IO-65) industries.

The increased recreation resulting from the development of the Arkansas River Navigation System was expected to yield about $118 million of additional final demand for the state of Oklahoma and $54 million for the rest of the U. S. in 1980. The increases in the final demand resulted from higher levels of recreational expenditures and investments by both on-site recreationists and recreational home owners. The 1980 state output will increase by $115 million due to greater recreation demand. An additional 7,400 jobs and $39 million of income will be created. The increases in output, employment, and income will primarily arise from the Wholesale and Retail (IO-69), Finance and Insurance (IO-70), Business Services (IO-73), and Petroleum and Natural Gas (IO-8 and IO-31) industries. Water transportation will have a greater impact on the manufacturing sector while recreation will have a significant effect on the services sector.

The projected population in 1980, estimated from the simulation model, is expected to reach almost 3,000,000, increasing from 2,560,000 in 1970. The population increase will come from the following groups: young adults; prime aged; middle aged; and oldsters; i.e. those groups of people 20 years of age and over. The increase in children and teenagers is insignificant, and the proportion of population under 20

years of age will decline. The proportion of children (under 14 years of age) will drop to 22 percent of the total population in 1980 from 25 percent in 1970; and oldsters will increase from 12 percent in 1970 to 14 percent in 1980. This indicates an "aging" of the state population. The main reasons for aging population are declining birth rates and death rates.

The results of simulation showed a continuous increase in the labor force. The total labor force will be 1.27 million in 1980, a 30 percent increase from the 1970 level (.98 million). Since the population increase for the same period is 15 percent, the growth of labor force must come from a higher labor force participation rate, in addition to the population change. However, the unemployment rate in the state will decline due to the rapid growth in employment.

Limitations of Study and Need for Further Research

There are several limitations in the study. First, the entire impact analysis was based on a static interregional input-output model. Should a drastic change in technologies occur, the accuracy of the projections would be reduced. Fortunately, technologies generally do not change rapidly in a short period of time. Second, the study implicitly assumed that the economy, both national and regional, will not suffer a serious recession or depression. The results of the analysis will not account for a nationwide depression. Third, the projections, though conservative, relied on the assumption that firms will respond to the availability of water transportation. Finally, the study did not specify where the economic growth will occur and how the population will be distributed in the state. However, information obtained from

The Sunday Oklahoma, July 18, 1976, may be used as a reference. It indicated that the population will concentrate in the eastern half of Oklahoma in 1980, and that there will be a development of an industrial corridor, running from Lawton, through Oklahoma City and Tulsa, to Miami, Oklahoma.

The lack of data on commodity transportation, consumption, production, interregional trade, and migration, especially at the state level, preclude the possibility of formulation of more sophisticated and complicated model for estimating the impact of the Arkansas River Navigation System. Although the results of the present study seemed reasonable, a dynamic model would be more useful when long-term projections are made. Again, developing a large-scale sophisticated model requires an improvement of the data system and inputs from many experts.

The static model used in the study can be strengthened by updating the final demand projections, interregional trade coefficients, and technical coefficients. Additional data collection for migration and related socio-economic variables will also improve the demographic model. Efforts to further refine the model by professionals from different areas, such as businessmen, engineers, government officials, sociologists, and economists, would be valuable. Similarly, full cooperation of all sectors in the state will be necessary to achieve the goal of economic development.

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APPENDIX

TECHNICAL COEFFICIENTS, OKLAHOMA ECONOMY 1967

TABLE XXII

TECHNICAL COEFFICIENTS, OKLAHOMA ECONOMY, 1967

INDUSTRY	1	2	3	4	5	6	7	8	9	10
1 LIVESTOCK. PRDTS.	0.194104	0.101698	0.419916	0.083244	0.0	0.0	0.0	0.000028	0.0	0.0
2 OTHER AGRIC. PRDTS.	0.243854	0.042601	0.322711	0.214550	0.0	0.000494	0.0	0.000084	0.000048	0.0
3 FORESTRY. FISHERIES	0.0	0.0	0.008530	0.0	0.0	0.0	0.0	0.000006	0.0	0.0
4 AGRI. FORES. FISH. SV.	0.006181	0.004055	0.018303	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5 IRON. FERRO. ORES MIN.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6 NONFERROUS ORES MINING	0.0	0.0	0.0	0.0	0.0	0.220256	0.000190	0.0	0.000763	0.0
7 COAL MINING	0.000085	0.000007	0.0	0.0	0.0	0.000988	0.000379	0.000003	0.000238	0.0
8 CRUDE PETRO., NATL GAS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.028507	0.0	0.0
9 STONE. CLAY MINING	0.000026	0.0	0.0	0.0	0.0	0.002469	0.001522	0.0	0.005582	0.0
10 CHEM FERT MIN MINING	0.0	0.000266	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11 NEW CONSTRUCTION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12 MAINT., REPAIR CONSTR.	0.000059	0.015947	0.0	0.0	0.0	0.012346	0.005325	0.034746	0.005868	0.0
13 ORDNANCE. ACCESSORIES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.000005	0.0	0.0
14 FOOD. KINDRED PRDTS.	0.097947	0.000266	0.012083	0.016714	0.0	0.009384	0.001332	0.001623	0.001527	0.0
15 TOBACCO MANUFACTURES	0.000009	0.000019	0.000178	0.000150	0.0	0.000988	0.000190	0.000131	0.000143	0.0
16 FABRICS	0.0	0.002333	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17 TEXTILE PRDTS.	0.000193	0.001342	0.015283	0.017641	0.0	0.0	0.0	0.000189	0.000048	0.0
18 APPAREL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.000005	0.0	0.0
19 MISC. TEXTILE PRDTS.	0.004927	0.001430	0.000355	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20 LUMBER. WOOD PRDTS.	0.000028	0.000041	0.0	0.0	0.0	0.015309	0.004776	0.000012	0.0	0.0
21 WOODEN CONTAINERS	0.0	0.000022	0.0	0.006139	0.0	0.0	0.0	0.0	0.0	0.0
22 HOUSEHOLD FURNITURE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23 OTHER FURNITURE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24 PAPER. ALLIED PRDTS.	0.000083	0.000056	0.000178	0.000050	0.0	0.000494	0.000571	0.000246	0.002863	0.0
25 PAPERBOARD CONTAINERS	0.000036	0.000037	0.0	0.037488	0.0	0.0	0.0	0.0	0.0	0.0
26 PRINTING. PUBLISHING	0.000096	0.000214	0.000178	0.000125	0.0	0.000494	0.000190	0.000307	0.000286	0.0
27 CHEM. SELECT. PRDTS.	0.001930	0.033717	0.000355	0.000401	0.0	0.056585	0.017756	0.009141	0.019541	0.0
28 PLASTICS. SYNTHETICS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29 DRUGS. COSMETICS	0.001323	0.000007	0.0	0.000050	0.0	0.0	0.0	0.000041	0.000048	0.0
30 PAINT. ALLIED PRDTS.	0.0	0.0	0.001066	0.0	0.0	0.0	0.0	0.000421	0.0	0.0
31 PETRO. RELATED INDS.	0.005457	0.060749	0.008530	0.001503	0.0	0.008349	0.010864	0.005869	0.038405	0.0
32 RUBBER. MISC. PLASTICS	0.001654	0.010107	0.000178	0.000025	0.0	0.010864	0.015596	0.001446	0.031440	0.0
33 LEATHER TANNING PRDTS.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
34 FOOTWEAR. LEAT. PRDTS.	0.000396	0.000002	0.0	0.001228	0.0	0.0	0.0	0.000024	0.0	0.0
35 GLASS. GLASS PRDTS.	0.000079	0.0	0.0	0.0	0.0	0.0	0.0	0.000003	0.0	0.0
36 STONE. CLAY PRDTS.	0.000049	0.000534	0.000178	0.0	0.0	0.000494	0.001712	0.003701	0.049235	0.0
37 PRIMARY IRON STEEL MFR	0.0	0.0	0.0	0.0	0.0	0.012346	0.017172	0.002906	0.014027	0.0
38 PRIMARY NONFERROUS MFR	0.000034	0.000039	0.0	0.0	0.0	0.000494	0.0	0.0	0.000716	0.0
39 METAL CONTAINERS	0.000154	0.000266	0.005331	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40 FABRICATED METAL PRDTS	0.0	0.0	0.0	0.0	0.0	0.001482	0.0	0.001746	0.000906	0.0

TABLE XXII (Continued)

INDUSTRY	1	2	3	4	5	6	7	8	9	10
41 SCREW MACH PRDTS. ETC.	0.000542	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42 OTHER FAB. METAL PRDTS	0.000572	0.001979	0.003731	0.057183	0.0	0.005432	0.006086	0.001185	0.002147	0.0
43 ENGINES. TURBINES	0.0	0.0	0.0	0.0	0.0	0.016791	0.011221	0.001878	0.019417	0.0
44 FARM MACH.. EQUIP.	0.000269	0.018101	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
45 CONSTRUC. MACH. EQUIP.	0.0	0.0	0.0	0.0	0.0	0.028700	0.047357	0.002253	0.028029	0.0
46 MATERIAL HANDLING MACH	0.0	0.0	0.0	0.0	0.0	0.001975	0.000190	0.0	0.006012	0.0
47 METALWORKING MACHINERY	0.0	0.0	0.0	0.0	0.0	0.006988	0.002283	0.0	0.0	0.0
48 SPECIAL MACH. EQUIP.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
49 GENERAL MACH. EQUIP.	0.0	0.0	0.000178	0.0	0.0	0.000494	0.000951	0.002247	0.006966	0.0
50 MACHINE SHOP PRDTS.	0.000132	0.000407	0.0	0.0	0.0	0.053336	0.004564	0.000038	0.003674	0.0
51 OFFICE. COMPUT. MACHS.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.000003	0.0	0.0
52 SERVICE IND. MACHINES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
53 ELECT. TRANSMISS. EQP.	0.0	0.0	0.0	0.0	0.0	0.0	0.003803	0.007412	0.003865	0.0
54 HOUSEHOLD APPLIANCES	0.000002	0.000005	0.0	0.000025	0.0	0.0	0.0	0.000029	0.0	0.0
55 ELECT. LIGHTING EQUIP.	0.000036	0.000090	0.000885	0.0	0.0	0.000988	0.005325	0.000026	0.000620	0.0
56 RADIO TV. ETC..EQUIP.	0.000004	0.000007	0.0	0.000050	0.0	0.000494	0.0	0.000412	0.000048	0.0
57 ELECTRONIC COMPONENTS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.001342	0.0	0.0
58 MISC. ELECTRICAL MACH.	0.000277	0.002035	0.000533	0.0	0.0	0.000494	0.000571	0.000076	0.000620	0.0
59 MOTOR VEHICLES. EQUIP.	0.000410	0.001245	0.000178	0.000025	0.0	0.002469	0.003994	0.000297	0.007156	0.0
60 AIRCRAFT. PARTS	0.0	0.0	0.0	0.000176	0.0	0.0	0.0	0.0	0.0	0.0
61 OTHER TRANSPORT. EQUIP	0.000006	0.000341	0.005154	0.0	0.0	0.0	0.004564	0.0	0.000048	0.0
62 PROF. SCIEN. INSTRU.	0.0	0.0	0.000178	0.0	0.0	0.0	0.0	0.000438	0.0	0.0
63 MEDICAL. PHOTO. EQUIP.	0.000002	0.000005	0.0	0.000025	0.0	0.0	0.0	0.000045	0.000048	0.0
64 MISC. MANUFACTURING	0.000019	0.000032	0.000178	0.000075	0.0	0.001975	0.0	0.000108	0.000095	0.0
65 TRANSP.. WAREHOUSING	0.018807	0.011506	0.003909	0.013958	0.0	0.035557	0.014074	0.005928	0.010830	0.0
66 COMMUNICA. EX BROCAST.	0.001802	0.003975	0.0	0.0	0.0	0.001482	0.001332	0.000789	0.000334	0.0
67 RADIO. TV BROADCASTING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
68 ELEC.GAS.WATER SAN.SV.	0.002028	0.002711	0.0	0.000351	0.0	0.036927	0.000737	0.011139	0.044179	0.0
69 WHOLESALE RETAIL TRADE	0.023088	0.038448	0.011906	0.018719	0.0	0.018273	0.027959	0.009730	0.023091	0.0
70 FINANCE. INSURANCE	0.006823	0.018989	0.000178	0.002481	0.0	0.019260	0.010841	0.007851	0.014742	0.0
71 REAL ESTATE. RENTAL	0.007726	0.066056	0.0	0.017867	0.0	0.032594	0.027578	0.205763	0.023473	0.0
72 HOTELS. PERSONAL SERV.	0.000057	0.000122	0.000533	0.000902	0.0	0.004445	0.000571	0.000791	0.000763	0.0
73 BUSINESS SERVICES	0.006794	0.061969	0.000178	0.000025	0.0	0.010864	0.010841	0.009896	0.011402	0.0
74 RESEARCH. DEVELOPMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
75 AUTO. REPAIR. SERVICES	0.004665	0.014146	0.001599	0.000376	0.0	0.001975	0.002853	0.003854	0.009875	0.0
76 AMUSEMENTS	0.000009	0.000019	0.000178	0.000150	0.0	0.000494	0.000190	0.000128	0.000143	0.0
77 MED.. EDUC. SERVICES	0.003754	0.003515	0.0	0.000050	0.0	0.000988	0.000761	0.000476	0.000238	0.0
78 FEDERAL GOVT. ENTERPR.	0.000047	0.000115	0.0	0.000125	0.0	0.000988	0.000761	0.000480	0.000525	0.0
79 STATE LOCAL GOVT. ENT.	0.000007	0.000022	0.0	0.000025	0.0	0.000494	0.000190	0.000287	0.001193	0.0

TABLE XXII (Continued)

INDUSTRY	11	12	13	14	15	16	17	18	19	20
1 LIVESTOCK. PRDTS.	0.000022	0.000035	0.0	0.289136	0.0	0.003387	0.030077	0.000021	0.0	0.000033
2 OTHER AGRIC. PRDTS.	0.005053	0.000123	0.0	0.083354	0.0	0.096756	0.004259	0.000082	0.0	0.087429
3 FORESTRY. FISHERIES	0.000004	0.000008	0.0	0.002354	0.0	0.0	0.0	0.007571	0.0	0.016601
4 AGRI. FORES. FISH. SV.	0.000034	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5 IRON. FERRO. ORES MIN.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6 NONFERROUS ORES MINING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7 COAL MINING	0.0	0.0	0.0	0.000452	0.0	0.001172	0.0	0.000063	0.0	0.000330
8 CRUDE PETRO., NATL GAS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9 STONE. CLAY MINING	0.011326	0.013129	0.0	0.000162	0.0	0.0	0.0	0.0	0.0	0.000033
10 CHEM FERT MIN MINING	0.0	0.0	0.0	0.000099	0.0	0.0	0.0	0.0	0.0	0.000033
11 NEW CONSTRUCTION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12 MAINT., REPAIR CONSTR.	0.000225	0.000363	0.0	0.001905	0.0	0.001759	0.001474	0.000547	0.001373	0.003234
13 ORDNANCE. ACCESSORIES	0.000041	0.000008	0.000219	0.000003	0.0	0.0	0.0	0.0	0.0	0.0
14 FOOD. KINDRED PRDTS.	0.001610	0.002205	0.000021	0.172295	0.0	0.002932	0.004424	0.001493	0.001602	0.001221
15 TOBACCO MANUFACTURES	0.000101	0.000167	0.0	0.000073	0.0	0.0	0.0	0.000126	0.000229	0.000099
16 FABRICS	0.000964	0.0	0.0	0.000042	0.0	0.307272	0.041291	0.269434	0.264889	0.0
17 TEXTILE PRDTS.	0.000756	0.000139	0.0	0.000029	0.0	0.034209	0.022704	0.003764	0.106677	0.0
18 APPAREL	0.000456	0.000676	0.0	0.000674	0.0	0.051603	0.011797	0.189420	0.033421	0.001485
19 MISC. TEXTILE PRDTS.	0.000056	0.000008	0.0	0.002113	0.0	0.041634	0.064887	0.017960	0.100613	0.000033
20 LUMBER. WOOD PRDTS.	0.036454	0.036666	0.009021	0.000105	0.0	0.0	0.0	0.0	0.002975	0.339353
21 WOODEN CONTAINERS	0.0	0.0	0.0	0.000968	0.0	0.0	0.0	0.0	0.0	0.000165
22 HOUSEHOLD FURNITURE	0.003139	0.0	0.0	0.000002	0.0	0.000586	0.014747	0.0	0.001602	0.001914
23 OTHER FURNITURE	0.001743	0.000217	0.000106	0.0	0.0	0.0	0.0	0.0	0.000229	0.000033
24 PAPER. ALLIED PRDTS.	0.002131	0.003672	0.0	0.012969	0.0	0.004105	0.007373	0.000820	0.005952	0.001716
25 PAPERBOARD CONTAINERS	0.000034	0.0	0.0	0.014983	0.0	0.004691	0.002950	0.006036	0.010530	0.002244
26 PRINTING. PUBLISHING	0.000161	0.000274	0.0	0.006150	0.0	0.001172	0.019171	0.000673	0.000687	0.000561
27 CHEM. SELECT. PRDTS.	0.007476	0.002745	0.000021	0.002915	0.0	0.024629	0.002950	0.000336	0.000229	0.014456
28 PLASTICS. SYNTHETICS	0.000007	0.0	0.0	0.001180	0.0	0.078919	0.070230	0.004201	0.010301	0.001485
29 DRUGS. COSMETICS	0.000050	0.000054	0.0	0.003274	0.0	0.002346	0.001474	0.000273	0.000229	0.000132
30 PAINT. ALLIED PRDTS.	0.003353	0.004419	0.0	0.000002	0.0	0.000586	0.0	0.0	0.0	0.006304
31 PETRO. RELATED INDS.	0.033895	0.027367	0.000021	0.002723	0.0	0.001759	0.011797	0.000757	0.000687	0.004983
32 RUBBER. MISC. PLASTICS	0.006029	0.007055	0.000783	0.004610	0.0	0.001172	0.457156	0.002334	0.048988	0.002641
33 LEATHER TANNING PRDTS.	0.000008	0.0	0.0	0.000030	0.0	0.0	0.0	0.002586	0.0	0.000165
34 FOOTWEAR. LEAT. PRDTS.	0.000032	0.000031	0.0	0.000013	0.0	0.0	0.0	0.000442	0.001373	0.000099
35 GLASS. GLASS PRDTS.	0.001193	0.004731	0.0	0.006570	0.0	0.002932	0.0	0.0	0.009157	0.001782
36 STONE. CLAY PRDTS.	0.079655	0.029771	0.0	0.000013	0.0	0.002932	0.060463	0.0	0.001373	0.006535
37 PRIMARY IRON STEEL MFR	0.060779	0.016084	0.000350	0.000005	0.0	0.0	0.0	0.0	0.000915	0.003498
38 PRIMARY NONFERROUS MFR	0.011760	0.010570	0.002311	0.000007	0.0	0.0	0.002950	0.0	0.000915	0.000627
39 METAL CONTAINERS	0.0	0.0	0.0	0.015526	0.0	0.0	0.0	0.0	0.0	0.0
40 FABRICATED METAL PRDTS	0.070877	0.028815	0.003937	0.0	0.0	0.0	0.002950	0.0	0.000915	0.003862

TABLE XXII (Continued)

INDUSTRY	11	12	13	14	15	16	17	18	19	20
41 SCREW MACH PRDTS. ETC.	0.002534	0.000954	0.000894	0.001598	0.0	0.0	0.0	0.0	0.000229	0.001155
42 OTHER FAB. METAL PRDTS	0.013610	0.013620	0.009149	0.002104	0.0	0.012901	0.001474	0.001093	0.001832	0.019440
43 ENGINES. TURBINES	0.000298	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
44 FARM MACH.. EQUIP.	0.000047	0.000031	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
45 CONSTRUC. MACH. EQUIP.	0.010925	0.003618	0.001915	0.0	0.0	0.0	0.0	0.0	0.0	0.0
46 MATERIAL HANDLING MACH	0.001865	0.004858	0.0	0.000088	0.0	0.0	0.0	0.000126	0.0	0.000396
47 METALWORKING MACHINERY	0.000082	0.000019	0.000087	0.0	0.0	0.0	0.0	0.0	0.0	0.0
48 SPECIAL MACH. EQUIP.	0.0	0.0	0.000043	0.000434	0.0	0.005277	0.001474	0.000084	0.0	0.003234
49 GENERAL MACH. EQUIP.	0.001672	0.002182	0.001724	0.000050	0.0	0.0	0.0	0.000021	0.002747	0.001056
50 MACHINE SHOP PRDTS.	0.000297	0.000046	0.000021	0.000052	0.0	0.0	0.0	0.000021	0.0	0.000099
51 OFFICE. COMPUT. MACHS.	0.000001	0.0	0.0	0.000003	0.0	0.0	0.0	0.0	0.0	0.0
52 SERVICE IND. MACHINES	0.003115	0.005881	0.001362	0.000002	0.0	0.0	0.0	0.0	0.0	0.000099
53 ELECT. TRANSMISS. EQP.	0.003172	0.002854	0.000087	0.0	0.0	0.0	0.0	0.0	0.000229	0.0
54 HOUSEHOLD APPLIANCES	0.002448	0.005051	0.000064	0.000015	0.0	0.0	0.0	0.000021	0.0	0.000033
55 ELECT. LIGHTING EQUIP.	0.015315	0.009295	0.000153	0.000008	0.0	0.0	0.0	0.0	0.0	0.0
56 RADIO TV. ETC..EQUIP.	0.000882	0.001066	0.016109	0.000022	0.0	0.0	0.0	0.000042	0.0	0.000297
57 ELECTRONIC COMPONENTS	0.000013	0.000050	0.000681	0.0	0.0	0.0	0.0	0.0	0.000687	0.000033
58 MISC. ELECTRICAL MACH.	0.000794	0.000510	0.000064	0.000090	0.0	0.0	0.0	0.000021	0.0	0.000099
59 MOTOR VEHICLES. EQUIP.	0.001094	0.000706	0.000021	0.000201	0.0	0.0	0.0	0.000042	0.0	0.000231
60 AIRCRAFT. PARTS	0.0	0.0	0.963480	0.0	0.0	0.0	0.0	0.0	0.003892	0.001122
61 OTHER TRANSPORT. EQUIP	0.000064	0.000004	0.001170	0.0	0.0	0.0	0.0	0.0	0.0	0.000056
62 PROF. SCIEN. INSTRU.	0.001494	0.003553	0.000674	0.000096	0.0	0.0	0.023595	0.000589	0.002060	0.000330
63 MEDICAL. PHOTO. EQUIP.	0.000089	0.000050	0.000085	0.000081	0.0	0.0	0.0	0.000231	0.000229	0.000165
64 MISC. MANUFACTURING	0.001274	0.004027	0.0	0.000185	0.0	0.0	0.010323	0.022271	0.009157	0.001584
65 TRANSP.. WAREHOUSING	0.032463	0.028011	0.003064	0.034712	0.0	0.016063	0.007502	0.007704	0.010014	0.031322
66 COMMUNICA. EX BRDCAST.	0.002290	0.003981	0.000064	0.002472	0.0	0.001759	0.001474	0.004395	0.004120	0.003135
67 RADIO. TV BROADCASTING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
68 ELEC.GAS.WATER SAN.SV.	0.032619	0.004537	0.000021	0.006381	0.0	0.009383	0.002950	0.003133	0.004350	0.009703
69 WHOLESALE RETAIL TRADE	0.075004	0.086711	0.003106	0.034658	0.0	0.026178	0.018006	0.035751	0.051437	0.024555
70 FINANCE. INSURANCE	0.006891	0.008171	0.000021	0.004852	0.0	0.002932	0.001474	0.004964	0.005952	0.005875
71 REAL ESTATE. RENTAL	0.004044	0.006808	0.000043	0.004469	0.0	0.004105	0.002950	0.012387	0.009385	0.009604
72 HOTELS. PERSONAL SERV.	0.000611	0.001008	0.000021	0.002836	0.0	0.000586	0.0	0.003925	0.001832	0.000561
73 BUSINESS SERVICES	0.045974	0.014234	0.003128	0.026029	0.0	0.008796	0.002950	0.012723	0.010072	0.013136
74 RESEARCH. DEVELOPMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
75 AUTO. REPAIR. SERVICES	0.003069	0.005128	0.0	0.002416	0.0	0.000586	0.0	0.000652	0.000687	0.002211
76 AMUSEMENTS	0.000099	0.000163	0.0	0.000070	0.0	0.0	0.0	0.000126	0.000229	0.000099
77 MED.. EDUC. SERVICES	0.000774	0.001234	0.0	0.000464	0.0	0.0	0.0	0.000568	0.000458	0.000462
78 FEDERAL GOVT. INTERPR.	0.000232	0.000401	0.000021	0.000686	0.0	0.000586	0.0	0.002734	0.001832	0.000726
79 STATE LOCAL GOVT. ENT.	0.000788	0.000499	0.0	0.000338	0.0	0.0	0.0	0.000042	0.000229	0.000165

TABLE XXII (Continued)

INDUSTRY	21	22	23	24	25	26	27	28	29	30
1 LIVESTOCK, PRDTS.	0.0	0.0	0.0	0.0	0.0	0.000072	0.000016	0.0	0.000162	0.000157
2 OTHER AGRIC. PRDTS.	0.0	0.000082	0.0	0.000071	0.000061	0.000230	0.001308	0.0	0.000458	0.000315
3 FORESTRY, FISHERIES	0.0	0.0	0.0	0.0	0.0	0.000012	0.002027	0.0	0.0	0.0
4 AGRI. FORES. FISH. SV.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5 IRON, FERRO. ORES MIN.	0.0	0.0	0.0	0.0	0.0	0.0	0.000229	0.0	0.0	0.0
6 NONFERROUS ORES MINING	0.0	0.0	0.0	0.0	0.0	0.0	0.000474	0.0	0.0	0.0
7 COAL MINING	0.0	0.000329	0.000176	0.005909	0.000182	0.000037	0.000478	0.000640	0.000162	0.000157
8 CRUDE PETRO.. NATL GAS	0.0	0.0	0.0	0.0	0.0	0.0	0.004872	0.0	0.0	0.0
9 STONE, CLAY MINING	0.0	0.0	0.0	0.001990	0.000061	0.0	0.000654	0.0	0.000486	0.001891
10 CHEM FERT MIN MINING	0.0	0.0	0.0	0.000427	0.0	0.0	0.013210	0.0	0.000162	0.0
11 NEW CONSTRUCTION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12 MAINT., REPAIR CONSTR.	0.0	0.001151	0.001586	0.002133	0.002604	0.001878	0.001978	0.000640	0.001458	0.002205
13 ORDNANCE, ACCESSORIES	0.0	0.0	0.0	0.0	0.0	0.000012	0.0	0.0	0.0	0.0
14 FOOD, KINDRED PRDTS.	0.0	0.001572	0.001762	0.009313	0.001090	0.005078	0.022642	0.005123	0.122214	0.044583
15 TOBACCO MANUFACTURES	0.0	0.000164	0.000176	0.000071	0.000061	0.000351	0.000082	0.0	0.000162	0.000315
16 FABRICS	0.0	0.049345	0.000353	0.001208	0.0	0.000158	0.0	0.0	0.0	0.000157
17 TEXTILE PRDTS.	0.0	0.024163	0.005895	0.001421	0.0	0.001103	0.0	0.0	0.0	0.0
18 APPAREL	0.0	0.001644	0.001233	0.000711	0.001029	0.000012	0.000213	0.0	0.000324	0.000472
19 MISC. TEXTILE PRDTS.	0.0	0.000329	0.000176	0.002133	0.0	0.0	0.001455	0.0	0.0	0.0
20 LUMBER, WOOD PRDTS.	0.0	0.135612	0.088143	0.068651	0.000848	0.001078	0.002812	0.000321	0.006315	0.000157
21 WOODEN CONTAINERS	0.0	0.000164	0.000176	0.0	0.000061	0.0	0.000130	0.0	0.000162	0.000315
22 HOUSEHOLD FURNITURE	0.0	0.017425	0.020439	0.0	0.000061	0.0	0.0	0.0	0.0	0.0
23 OTHER FURNITURE	0.0	0.005425	0.021497	0.0	0.000061	0.000606	0.0	0.0	0.0	0.0
24 PAPER, ALLIED PRDTS.	0.0	0.000987	0.000881	0.149499	0.395837	0.186892	0.008478	0.005527	0.005452	0.000630
25 PAPERBOARD CONTAINERS	0.0	0.012657	0.012686	0.036610	0.028762	0.002788	0.003400	0.000961	0.016215	0.007405
26 PRINTING, PUBLISHING	0.0	0.000739	0.001057	0.029430	0.012292	0.065476	0.000295	0.0	0.003284	0.000787
27 CHEM. SELECT. PRDTS.	0.0	0.001726	0.000353	0.035623	0.017137	0.020553	0.108614	0.186647	0.122734	0.191565
28 PLASTICS, SYNTHETICS	0.0	0.001644	0.0	0.014744	0.008092	0.001673	0.003079	0.002562	0.000648	0.089323
29 DRUGS, COSMETICS	0.0	0.000164	0.000176	0.000996	0.000121	0.000230	0.002364	0.000816	0.032706	0.004726
30 PAINT, ALLIED PRDTS.	0.0	0.021946	0.019507	0.000071	0.0	0.001187	0.003237	0.008805	0.002914	0.000157
31 PETRO, RELATED INDS.	0.0	0.001479	0.001762	0.010743	0.007327	0.002872	0.579428	0.523960	0.123539	0.056871
32 RUBBER, MISC. PLASTICS	0.0	0.076764	0.046290	0.047385	0.006318	0.003284	0.004708	0.179296	0.063454	0.017644
33 LEATHER TANNING PRDTS.	0.0	0.001069	0.000176	0.000143	0.000061	0.000024	0.000033	0.0	0.0	0.0
34 FOOTWEAR, LEAT. PRDTS.	0.0	0.0	0.0	0.000071	0.0	0.000072	0.000016	0.0	0.0	0.0
35 GLASS, GLASS PRDTS.	0.0	0.006587	0.029771	0.0	0.010416	0.000012	0.000130	0.000800	0.011075	0.001891
36 STONE, CLAY PRDTS.	0.0	0.0	0.007224	0.022748	0.0	0.000012	0.001243	0.000480	0.014086	0.009925
37 PRIMARY IRON STEEL MFR	0.0	0.022192	0.087952	0.000071	0.0	0.000084	0.002698	0.0	0.0	0.002363
38 PRIMARY NONFERROUS MFR	0.0	0.007644	0.009295	0.006326	0.004794	0.000303	0.006349	0.000321	0.0	0.010082
39 METAL CONTAINERS	0.0	0.0	0.0	0.0	0.002362	0.000024	0.005330	0.000321	0.015167	0.057224
40 FABRICATED METAL PRDTS	0.0	0.006657	0.030483	0.000498	0.000363	0.0	0.000196	0.000160	0.0	0.000630

TABLE XXII (Continued)

INDUSTRY	21	22	23	24	25	26	27	28	29	30
41 SCREW MACH PRDTS. ETC.	0.0	0.002302	0.009867	0.000071	0.001332	0.000012	0.000066	0.0	0.002429	0.0
42 OTHER FAB. METAL PRDTS	0.0	0.070029	0.049802	0.014146	0.005571	0.001394	0.000588	0.000640	0.031087	0.000787
43 ENGINES, TURBINES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
44 FARM MACH., EQUIP.	0.0	0.000411	0.001057	0.0	0.0	0.0	0.0	0.0	0.0	0.0
45 CONSTRUC. MACH. EQUIP.	0.0	0.0	0.0	0.0	0.0	0.0	0.000099	0.0	0.0	0.0
46 MATERIAL HANDLING MACH	0.0	0.000164	0.000176	0.000355	0.000121	0.000121	0.000099	0.0	0.0	0.000157
47 METALWORKING MACHINERY	0.0	0.0	0.000176	0.0	0.0	0.0	0.000049	0.0	0.0	0.0
48 SPECIAL MACH. EQUIP.	0.0	0.0	0.000176	0.002630	0.001635	0.001999	0.000409	0.0	0.0	0.0
49 GENERAL MACH. EQUIP.	0.0	0.000082	0.004581	0.001280	0.000061	0.000606	0.003041	0.0	0.000324	0.000472
50 MACHINE SHOP PRDTS.	0.0	0.0	0.000704	0.0	0.0	0.000049	0.000016	0.0	0.0	0.0
51 OFFICE, COMPUT. MACHS.	0.0	0.0	0.0	0.0	0.0	0.000012	0.0	0.0	0.0	0.0
52 SERVICE IND. MACHINES	0.0	0.0	0.007224	0.000071	0.0	0.000012	0.000016	0.0	0.0	0.000157
53 ELECT. TRANSMISS. EQP.	0.0	0.000082	0.000353	0.0	0.0	0.0	0.000735	0.0	0.0	0.0
54 HOUSEHOLD APPLIANCES	0.0	0.0	0.0	0.0	0.0	0.000072	0.000016	0.0	0.0	0.000157
55 ELECT. LIGHTING EQUIP.	0.0	0.000082	0.001939	0.0	0.0	0.000012	0.0	0.0	0.000162	0.0
56 RADIO TV, ETC., EQUIP.	0.0	0.000411	0.009282	0.000639	0.0	0.000109	0.000213	0.0	0.001296	0.000157
57 ELECTRONIC COMPONENTS	0.0	0.000329	0.000704	0.0	0.0	0.0	0.000016	0.0	0.0	0.0
58 MISC. ELECTRICAL MACH.	0.0	0.000082	0.000176	0.000498	0.000061	0.000109	0.000016	0.0	0.0	0.0
59 MOTOR VEHICLES, EQUIP.	0.0	0.000082	0.000176	0.000143	0.000061	0.000206	0.000066	0.0	0.0	0.0
60 AIRCRAFT, PARTS	0.0	0.0	0.008810	0.000284	0.0	0.001551	0.000033	0.000321	0.0	0.0
61 OTHER TRANSPORT. EQUIP	0.0	0.000411	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
62 PROF. SCIEN. INSTRU.	0.0	0.001315	0.006343	0.000853	0.000243	0.000291	0.000066	0.0	0.023153	0.000157
63 MEDICAL, PHOTO. EQUIP.	0.0	0.000246	0.000176	0.000143	0.000121	0.007429	0.000049	0.0	0.0	0.000157
64 MISC. MANUFACTURING	0.0	0.002384	0.001586	0.000924	0.000303	0.001818	0.000883	0.0	0.007124	0.000630
65 TRANSP., WAREHOUSING	0.0	0.024658	0.019735	0.036998	0.032335	0.018420	0.016430	0.003362	0.013439	0.027253
66 COMMUNICA. EX BRDCAST.	0.0	0.004685	0.005990	0.002772	0.004420	0.016348	0.001733	0.000640	0.002590	0.005041
67 RADIO, TV BROADCASTING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
68 ELEC.GAS.WATER SAN.SV.	0.0	0.005589	0.006519	0.019087	0.006177	0.005732	0.012964	0.001761	0.002428	0.004411
69 WHOLESALE RETAIL TRADE	0.0	0.042329	0.032774	0.038145	0.020951	0.023807	0.016054	0.004323	0.021048	0.048836
70 FINANCE, INSURANCE	0.0	0.008466	0.010925	0.004479	0.003391	0.006144	0.002714	0.000800	0.003562	0.006301
71 REAL ESTATE, RENTAL	0.0	0.023795	0.016035	0.026042	0.009939	0.039882	0.003907	0.001121	0.005505	0.008507
72 HOTELS, PERSONAL SERV.	0.0	0.001315	0.000704	0.001990	0.002301	0.004059	0.000671	0.000160	0.003076	0.005672
73 BUSINESS SERVICES	0.0	0.020137	0.010925	0.015030	0.017198	0.034308	0.011232	0.004162	0.094717	0.026466
74 RESEARCH, DEVELOPMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
75 AUTO. REPAIR, SERVICES	0.0	0.001315	0.001586	0.000924	0.001090	0.002714	0.000572	0.000160	0.000324	0.000945
76 AMUSEMENTS	0.0	0.000164	0.000176	0.000071	0.000061	0.000340	0.000082	0.0	0.000162	0.000315
77 MED., EDUC. SERVICES	0.0	0.000657	0.000704	0.000427	0.000605	0.001866	0.000229	0.0	0.000324	0.000787
78 FEDERAL GOVT. ENTERPR.	0.0	0.001233	0.001586	0.000782	0.000848	0.003768	0.003792	0.000160	0.001296	0.001418
79 STATE LOCAL GOVT. ENT.	0.0	0.000082	0.000176	0.000427	0.000061	0.000230	0.000099	0.0	0.0	0.000157

TABLE XXII (Continued)

INDUSTRY	31	32	33	34	35	36	37	38	39	40
1 LIVESTOCK. PRDTS.	0.000006	0.000038	0.0	0.0	0.000030	0.000036	0.000033	0.000012	0.0	0.000046
2 OTHER AGRIC. PRDTS.	0.000018	0.000106	0.0	0.0	0.000090	0.000142	0.000065	0.000035	0.0	0.000133
3 FORESTRY. FISHERIES	0.000001	0.000010	0.0	0.0	0.0	0.000012	0.0	0.0	0.0	0.000007
4 AGRI. FORES. FISH. SV.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5 IRON. FERRO. ORES MIN.	0.0	0.0	0.0	0.0	0.0	0.000735	0.027275	0.003342	0.0	0.0
6 NONFERROUS ORES MINING	0.0	0.0	0.0	0.0	0.000030	0.0	0.000163	0.191435	0.0	0.0
7 COAL MINING	0.000445	0.001309	0.0	0.0	0.000996	0.013673	0.010373	0.002279	0.0	0.000107
8 CRUDE PETRO.. NATL GAS	0.493983	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9 STONE. CLAY MINING	0.001201	0.001873	0.0	0.0	0.013054	0.104015	0.003314	0.003000	0.0	0.000013
10 CHEM FERT MIN MINING	0.000025	0.000057	0.0	0.0	0.000482	0.000071	0.000292	0.0	0.0	0.0
11 NEW CONSTRUCTION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12 MAINT.. REPAIR CONSTR.	0.016973	0.002631	0.0	0.001124	0.004588	0.005452	0.004967	0.003957	0.001195	0.001824
13 ORDNANCE. ACCESSORIES	0.000031	0.000010	0.0	0.0	0.0	0.000012	0.0	0.0	0.0	0.000013
14 FOOD. KINDRED PRDTS.	0.001583	0.002036	0.0	0.001798	0.001917	0.001777	0.001104	0.001925	0.011952	0.002623
15 TOBACCO MANUFACTURES	0.000028	0.000163	0.0	0.000225	0.000151	0.000142	0.000097	0.000047	0.0	0.000213
16 FABRICS	0.000001	0.004217	0.0	0.034386	0.0	0.000178	0.0	0.000378	0.0	0.0
17 TEXTILE PRDTS.	0.0	0.098488	0.0	0.089898	0.0	0.000118	0.0	0.000094	0.0	0.000040
18 APPAREL	0.000144	0.000958	0.0	0.011686	0.001373	0.000901	0.001039	0.000378	0.000598	0.001065
19 MISC. TEXTILE PRDTS.	0.0	0.000086	0.0	0.035060	0.000015	0.000130	0.0	0.0	0.0	0.000013
20 LUMBER. WOOD PRDTS.	0.000160	0.001344	0.0	0.008316	0.019317	0.002749	0.001396	0.000201	0.000598	0.001918
21 WOODEN CONTAINERS	0.000009	0.000355	0.0	0.001798	0.004045	0.000189	0.000163	0.000012	0.0	0.000160
22 HOUSEHOLD FURNITURE	0.0	0.000097	0.0	0.0	0.000649	0.000012	0.0	0.000012	0.0	0.000033
23 OTHER FURNITURE	0.0	0.0	0.0	0.000225	0.0	0.0	0.0	0.0	0.0	0.000193
24 PAPER. ALLIED PRDTS.	0.001424	0.001105	0.0	0.002922	0.003960	0.017693	0.000487	0.000319	0.000289	0.002017
25 PAPERBOARD CONTAINERS	0.002443	0.007232	0.0	0.005169	0.047372	0.000605	0.001267	0.000178	0.015046	0.003003
26 PRINTING. PUBLISHING	0.000276	0.000528	0.0	0.001798	0.000725	0.000498	0.000487	0.000201	0.031075	0.000766
27 CHEM. SELECT. PRDTS.	0.029172	0.046132	0.0	0.000225	0.046332	0.006021	0.013796	0.016762	0.002988	0.002729
28 PLASTICS. SYNTHETICS	0.0	0.142755	0.0	0.012966	0.0	0.000474	0.0	0.000900	0.000897	0.0
29 DRUGS. COSMETICS	0.002477	0.000125	0.0	0.000225	0.000151	0.003472	0.000130	0.000047	0.000598	0.000725
30 PAINT. ALLIED PRDTS.	0.000064	0.000173	0.0	0.0	0.001887	0.000047	0.0	0.000012	0.031673	0.011186
31 PETRO. RELATED INDS.	0.071853	0.001500	0.0	0.000898	0.002973	0.023962	0.006831	0.013961	0.002391	0.003182
32 RUBBER. MISC. PLASTICS	0.000053	0.028439	0.0	0.082480	0.022155	0.007928	0.001104	0.000331	0.002988	0.001092
33 LEATHER TANNING PRDTS.	0.000098	0.000076	0.0	0.092552	0.000075	0.000225	0.000163	0.000165	0.0	0.000066
34 FOOTWEAR. LEAT. PRDTS.	0.000005	0.000192	0.0	0.018653	0.000030	0.000024	0.0	0.000012	0.0	0.000040
35 GLASS. GLASS PRDTS.	0.0	0.000951	0.0	0.001798	0.066456	0.000451	0.0	0.000012	0.0	0.010346
36 STONE. CLAY PRDTS.	0.000692	0.007194	0.0	0.0	0.025762	0.111232	0.004653	0.002067	0.013148	0.001071
37 PRIMARY IRON STEEL MFR	0.000014	0.037127	0.0	0.000674	0.002414	0.009445	0.188048	0.003508	0.333290	0.257560
38 PRIMARY NONFERROUS MFR	0.002303	0.000759	0.0	0.001573	0.005342	0.000427	0.033199	0.295896	0.015412	0.077126
39 METAL CONTAINERS	0.006200	0.000010	0.0	0.0	0.0	0.0	0.000065	0.0	0.000299	0.000087
40 FABRICATED METAL PRDTS	0.000093	0.000259	0.0	0.0	0.002958	0.001541	0.004448	0.000815	0.017331	0.017231

TABLE XXII (Continued)

INDUSTRY	31	32	33	34	35	36	37	38	39	40
41 SCREW MACH PRDTS. ETC.	0.0	0.000884	0.0	0.000225	0.000422	0.000213	0.003669	0.000437	0.019422	0.008836
42 OTHER FAB. METAL PRDTS	0.000306	0.002536	0.0	0.028992	0.000317	0.008248	0.023052	0.002008	0.004482	0.035458
43 ENGINES, TURBINES	0.0	0.0	0.0	0.0	0.0	0.000189	0.0	0.000012	0.0	0.000007
44 FARM MACH., EQUIP.	0.0	0.0	0.0	0.0	0.0	0.0	0.002532	0.0	0.0	0.000026
45 CONSTRUC. MACH. EQUIP.	0.0	0.000135	0.0	0.0	0.0	0.004811	0.022079	0.000106	0.001195	0.008736
46 MATERIAL HANDLING MACH	0.000207	0.000202	0.0	0.000225	0.000241	0.001848	0.000455	0.000378	0.0	0.000346
47 METALWORKING MACHINERY	0.0	0.000182	0.0	0.0	0.001026	0.000593	0.002402	0.002682	0.000897	0.003269
48 SPECIAL MACH. EQUIP.	0.0	0.001652	0.0	0.0	0.0	0.000024	0.004416	0.000272	0.0	0.000226
49 GENERAL MACH. EQUIP.	0.000094	0.000144	0.0	0.0	0.000121	0.000889	0.012923	0.001937	0.0	0.006684
50 MACHINE SHOP PRDTS.	0.000098	0.000048	0.0	0.0	0.000015	0.000071	0.017338	0.004193	0.0	0.000366
51 OFFICE, COMPUT. MACHS.	0.000001	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.000007
52 SERVICE IND. MACHINES	0.0	0.000029	0.0	0.0	0.0	0.000367	0.000389	0.000201	0.0	0.004494
53 ELECT. TRANSMISS. EQP.	0.0	0.000182	0.0	0.0	0.000482	0.000439	0.004870	0.005256	0.001793	0.009814
54 HOUSEHOLD APPLIANCES	0.000006	0.000076	0.0	0.0	0.000030	0.000036	0.000097	0.000047	0.0	0.000114
55 ELECT. LIGHTING EQUIP.	0.000091	0.0	0.0	0.0	0.0	0.000272	0.000033	0.000082	0.0	0.000007
56 RADIO TV, ETC., EQUIP.	0.000015	0.001633	0.0	0.001573	0.000302	0.000249	0.000227	0.003851	0.0	0.000659
57 ELECTRONIC COMPONENTS	0.0	0.000019	0.0	0.0	0.0	0.000012	0.0	0.000024	0.0	0.000026
58 MISC. ELECTRICAL MACH.	0.000014	0.000019	0.0	0.0	0.000030	0.000118	0.000487	0.001842	0.0	0.000066
59 MOTOR VEHICLES, EQUIP.	0.000032	0.000874	0.0	0.0	0.000075	0.000391	0.003961	0.001323	0.0	0.000206
60 AIRCRAFT, PARTS	0.0	0.011526	0.0	0.0	0.000121	0.000059	0.000195	0.0	0.112649	0.005926
61 OTHER TRANSPORT. EQUIP	0.0	0.000010	0.0	0.0	0.0	0.0	0.000097	0.000012	0.0	0.001585
62 PROF. SCIEN. INSTRU.	0.000033	0.000317	0.0	0.006292	0.000332	0.000201	0.000616	0.000213	0.0	0.001246
63 MEDICAL, PHOTO. EQUIP.	0.000062	0.000125	0.0	0.000449	0.000181	0.000118	0.000130	0.000047	0.0	0.000406
64 MISC. MANUFACTURING	0.000094	0.001585	0.0	0.000680	0.001962	0.000576	0.001721	0.000189	0.0	0.000373
65 TRANSP., WAREHOUSING	0.040143	0.023935	0.0	0.013035	0.024257	0.075596	0.035547	0.027765	0.021246	0.021383
66 COMMUNICA. EX BRDCAST.	0.001138	0.002536	0.0	0.004494	0.003426	0.004575	0.004903	0.002044	0.001195	0.006552
67 RADIO, TV BROADCASTING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
68 ELEC.GAS.WATER SAN.SV.	0.018347	0.009738	0.0	0.003821	0.040174	0.040285	0.031353	0.045002	0.005976	0.007211
69 WHOLESALE RETAIL TRADE	0.015898	0.025174	0.0	0.036408	0.033625	0.021212	0.028596	0.012768	0.025612	0.031406
70 FINANCE, INSURANCE	0.009721	0.005677	0.0	0.008090	0.007455	0.008094	0.008572	0.004264	0.006275	0.006038
71 REAL ESTATE, RENTAL	0.020317	0.005878	0.0	0.012136	0.008466	0.006021	0.003214	0.001901	0.005975	0.013895
72 HOTELS, PERSONAL SERV.	0.000697	0.001854	0.0	0.001124	0.001706	0.001209	0.000974	0.000331	0.000897	0.004960
73 BUSINESS SERVICES	0.023004	0.030716	0.0	0.028092	0.023468	0.021415	0.012923	0.006993	0.016733	0.016272
74 RESEARCH, DEVELOPMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
75 AUTO. REPAIR. SERVICES	0.000382	0.000605	0.0	0.000898	0.000921	0.003164	0.000844	0.000354	0.000598	0.001205
76 AMUSEMENTS	0.000038	0.000163	0.0	0.000225	0.000151	0.000142	0.000097	0.000047	0.0	0.000206
77 MED., EDUC. SERVICES	0.000130	0.000462	0.0	0.000674	0.000482	0.000652	0.000455	0.000189	0.000299	0.000819
78 FEDERAL GOVT. ENTERPR.	0.000654	0.000846	0.0	0.003147	0.001252	0.000652	0.000715	0.000295	0.000299	0.001086
79 STATE LOCAL GOVT. ENT.	0.000109	0.000182	0.0	0.0	0.000211	0.001185	0.000292	0.000106	0.0	0.000094

TABLE XXII (Continued)

INDUSTRY	41	42	43	44	45	46	47	48	49	50
1 LIVESTOCK. PRDTS.	0.0	0.000049	0.0	0.0	0.000039	0.0	0.0	0.0	0.000038	0.000071
2 OTHER AGRIC. PRDTS.	0.000124	0.000146	0.0	0.000123	0.000110	0.0	0.0	0.000089	0.000113	0.000142
3 FORESTRY. FISHERIES	0.0	0.000016	0.0	0.0	0.000008	0.0	0.0	0.0	0.0	0.0
4 AGRI. FORES. FISH. SV.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5 IRON. FERRO. ORES MIN.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6 NONFERROUS ORES MINING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7 COAL MINING	0.000124	0.000342	0.0	0.000617	0.000180	0.000193	0.0	0.000177	0.000245	0.000071
8 CRUDE PETRO., NATL GAS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9 STONE. CLAY MINING	0.0	0.000163	0.0	0.0	0.0	0.0	0.0	0.0	0.000038	0.0
10 CHEM FERT MIN MINING	0.0	0.000016	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11 NEW CONSTRUCTION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12 MAINT., REPAIR CONSTR.	0.001113	0.001462	0.0	0.000986	0.002523	0.000770	0.000966	0.001150	0.001753	0.002988
13 ORDNANCE. ACCESSORIES	0.000124	0.000016	0.000204	0.0	0.000008	0.0	0.0	0.0	0.0	0.0
14 FOOD. KINDRED PRDTS.	0.002101	0.002762	0.0	0.001726	0.002137	0.000963	0.001158	0.002309	0.003072	0.002988
15 TOBACCO MANUFACTURES	0.000124	0.000228	0.0	0.000123	0.000173	0.0	0.000194	0.000177	0.000188	0.000213
16 FABRICS	0.0	0.000033	0.0	0.0	0.0	0.000770	0.0	0.000531	0.0	0.000783
17 TEXTILE PRDTS.	0.0	0.003364	0.0	0.0	0.0	0.0	0.0	0.000266	0.0	0.0
18 APPAREL	0.000989	0.001122	0.0	0.000740	0.000936	0.000385	0.000580	0.000884	0.000961	0.001423
19 MISC. TEXTILE PRDTS.	0.000124	0.000033	0.0	0.0	0.0	0.0	0.000194	0.0	0.0	0.0
20 LUMBER. WOOD PRDTS.	0.002720	0.002340	0.0	0.002220	0.001069	0.000385	0.000772	0.003538	0.001809	0.000712
21 WOODEN CONTAINERS	0.000495	0.000943	0.0	0.000493	0.000141	0.0	0.0	0.000177	0.000339	0.000570
22 HOUSEHOLD FURNITURE	0.000124	0.000634	0.0	0.000123	0.0	0.0	0.000580	0.000089	0.0	0.0
23 OTHER FURNITURE	0.001855	0.000309	0.0	0.000740	0.0	0.001541	0.0	0.0	0.0	0.0
24 PAPER. ALLIED PRDTS.	0.000989	0.003413	0.0	0.000617	0.000692	0.000385	0.000386	0.000619	0.001338	0.000712
25 PAPERBOARD CONTAINERS	0.007789	0.011115	0.0	0.002836	0.001352	0.000578	0.000966	0.001061	0.002713	0.003984
26 PRINTING. PUBLISHING	0.000495	0.000975	0.0	0.000740	0.000809	0.000385	0.000772	0.000973	0.000886	0.000783
27 CHEM. SELECT. PRDTS.	0.006305	0.013310	0.0	0.002343	0.001965	0.000578	0.001352	0.002653	0.003241	0.002277
28 PLASTICS. SYNTHETICS	0.000865	0.0	0.0	0.0	0.0	0.0	0.0	0.001061	0.0	0.0
29 DRUGS. COSMETICS	0.000495	0.000487	0.0	0.000123	0.000259	0.0	0.000194	0.000531	0.000226	0.000426
30 PAINT. ALLIED PRDTS.	0.000989	0.007264	0.0	0.004686	0.002358	0.002696	0.000194	0.000353	0.000565	0.0
31 PETRO. RELATED INDS.	0.003215	0.009279	0.000204	0.002096	0.003631	0.001732	0.001723	0.005660	0.005954	0.002348
32 RUBBER. MISC. PLASTICS	0.020895	0.015227	0.0	0.018126	0.020581	0.010877	0.054462	0.022238	0.005615	0.004980
33 LEATHER TANNING PRDTS.	0.0	0.000349	0.0	0.004316	0.000086	0.0	0.0	0.000884	0.000546	0.000071
34 FOOTWEAR. LEAT. PRDTS.	0.0	0.000098	0.0	0.0	0.000031	0.0	0.000194	0.0	0.000038	0.000071
35 GLASS. GLASS PRDTS.	0.001236	0.002746	0.0	0.0	0.0	0.0	0.001158	0.002742	0.0	0.000284
36 STONE. CLAY PRDTS.	0.005193	0.008597	0.000204	0.003083	0.001430	0.000193	0.006282	0.002919	0.008800	0.013375
37 PRIMARY IRON STEEL MFR	0.167531	0.120516	0.004367	0.122419	0.159360	0.061867	0.044605	0.074705	0.110736	0.080684
38 PRIMARY NONFERROUS MFR	0.053291	0.090961	0.001034	0.007275	0.010123	0.007685	0.058324	0.028214	0.035931	0.041679
39 METAL CONTAINERS	0.002720	0.000016	0.0	0.0	0.0	0.0	0.000194	0.0	0.0	0.0
40 FABRICATED METAL PRDTS	0.066889	0.019582	0.002656	0.012331	0.002815	0.032348	0.011974	0.045372	0.023817	0.010458

TABLE XXII (Continued)

INDUSTRY	41	42	43	44	45	46	47	48	49	50
41 SCREW MACH PRDTS. ETC.	0.011869	0.015751	0.000597	0.025963	0.016580	0.008540	0.025287	0.007020	0.006407	0.007043
42 OTHER FAB. METAL PRDTS	0.029302	0.051946	0.000541	0.023100	0.033370	0.042360	0.160062	0.014947	0.025305	0.020916
43 ENGINES. TURBINES	0.000124	0.0	0.002744	0.040371	0.015619	0.001658	0.0	0.005660	0.002845	0.0
44 FARM MACH.. EQUIP.	0.006182	0.000179	0.012260	0.044515	0.001698	0.002696	0.006566	0.002742	0.000782	0.0
45 CONSTRUC. MACH. EQUIP.	0.001236	0.013634	0.163873	0.084705	0.063296	0.406080	0.047895	0.121257	0.025475	0.000570
46 MATERIAL HANDLING MACH	0.000247	0.000569	0.0	0.000493	0.000621	0.011938	0.000966	0.002211	0.000886	0.000213
47 METALWORKING MACHINERY	0.005564	0.009636	0.000620	0.012598	0.038294	0.008857	0.033888	0.018043	0.017617	0.034233
48 SPECIAL MACH. EQUIP.	0.001113	0.000975	0.004290	0.001356	0.000149	0.009242	0.016609	0.052447	0.003147	0.000641
49 GENERAL MACH. EQUIP.	0.035608	0.008807	0.045788	0.085431	0.035032	0.078165	0.040591	0.060814	0.078535	0.011667
50 MACHINE SHOP PRDTS.	0.0	0.000016	0.026135	0.026239	0.001620	0.005969	0.015064	0.009375	0.002562	0.099172
51 OFFICE. COMPUT. MACHS.	0.0	0.000098	0.0	0.0	0.000031	0.000193	0.004781	0.000884	0.000207	0.0
52 SERVICE IND. MACHINES	0.000619	0.001966	0.000408	0.001110	0.000086	0.010975	0.004056	0.001150	0.004579	0.000071
53 ELECT. TRANSMISS. EQP.	0.000619	0.003559	0.000408	0.002466	0.003298	0.028816	0.014415	0.026154	0.022894	0.005976
54 HOUSEHOLD APPLIANCES	0.000371	0.000309	0.0	0.001233	0.000039	0.0	0.005408	0.000796	0.000471	0.000071
55 ELECT. LIGHTING EQUIP.	0.0	0.000098	0.0	0.000453	0.000008	0.0	0.0	0.000089	0.000358	0.0
56 RADIO TV. ETC..EQUIP.	0.026954	0.003104	0.136902	0.017387	0.000118	0.0	0.009271	0.008756	0.004541	0.000996
57 ELECTRONIC COMPONENTS	0.000371	0.000309	0.0	0.000370	0.000016	0.002888	0.0	0.000089	0.001356	0.001423
58 MISC. ELECTRICAL MACH.	0.000495	0.000650	0.009604	0.008878	0.000488	0.001541	0.001352	0.001769	0.000735	0.005478
59 MOTOR VEHICLES. EQUIP.	0.023738	0.001397	0.006334	0.010975	0.001875	0.008279	0.019892	0.002300	0.002562	0.001067
60 AIRCRAFT. PARTS	0.010880	0.023645	0.549446	0.001480	0.004748	0.005969	0.066822	0.002122	0.020783	0.034077
61 OTHER TRANSPORT. EQUIP	0.000124	0.000585	0.020638	0.005549	0.000511	0.000963	0.000580	0.004068	0.000980	0.001494
62 PROF. SCIEN. INSTRU.	0.005069	0.001658	0.000204	0.001233	0.000354	0.000458	0.007853	0.001503	0.006877	0.004766
63 MEDICAL. PHOTO. EQUIP.	0.000124	0.000163	0.0	0.000247	0.000165	0.0	0.0	0.000177	0.000169	0.000213
64 MISC. MANUFACTURING	0.003215	0.001576	0.0	0.004193	0.000331	0.000385	0.005021	0.000619	0.000395	0.000426
65 TRANSP.. WAREHOUSING	0.012982	0.016121	0.000406	0.017179	0.013543	0.007702	0.005214	0.010967	0.013076	0.014868
66 COMMUNICA. EX BRDCAST.	0.005935	0.004030	0.0	0.003329	0.005077	0.002503	0.002124	0.004246	0.005446	0.004553
67 RADIO. TV BROADCASTING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
68 ELEC.GAS.WATER SAN.SV.	0.007542	0.009604	0.000204	0.005426	0.008213	0.002503	0.003476	0.004865	0.007801	0.004466
69 WHOLESALE RETAIL TRADE	0.016197	0.026440	0.000813	0.035078	0.032414	0.017521	0.012167	0.027949	0.029564	0.025398
70 FINANCE. INSURANCE	0.005811	0.006516	0.0	0.006782	0.008779	0.002808	0.003090	0.005837	0.004974	0.008680
71 REAL ESTATE. RENTAL	0.008778	0.010255	0.0	0.003823	0.006681	0.004044	0.003638	0.021757	0.006859	0.013019
72 HOTELS. PERSONAL SERV.	0.001484	0.001982	0.0	0.001850	0.001831	0.000770	0.000966	0.001592	0.001885	0.002134
73 BUSINESS SERVICES	0.013724	0.013781	0.000408	0.023922	0.016364	0.006354	0.037659	0.012825	0.017674	0.017999
74 RESEARCH. DEVELOPMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
75 AUTO. REPAIR. SERVICES	0.000619	0.000878	0.0	0.000863	0.001234	0.000578	0.000386	0.000888	0.001112	0.000925
76 AMUSEMENTS	0.000124	0.000212	0.0	0.000123	0.000165	0.0	0.0	0.000177	0.000188	0.000213
77 MED.. EDUC. SERVICES	0.000619	0.000682	0.0	0.000617	0.000888	0.000385	0.000386	0.000796	0.000942	0.000854
78 FEDERAL GOVT. ENTERPR.	0.000989	0.001049	0.0	0.001233	0.001415	0.000770	0.000580	0.001238	0.001469	0.001280
79 STATE LOCAL GOVT. ENT.	0.000124	0.000179	0.0	0.000123	0.000133	0.0	0.0	0.000089	0.000132	0.000071

TABLE XXII (Continued)

INDUSTRY	51	52	53	54	55	56	57	58	59	60
1 LIVESTOCK, PRDTS.	0.0	0.000048	0.000046	0.0	0.0	0.000051	0.0	0.0	0.000015	0.000054
2 OTHER AGRIC. PRDTS.	0.0	0.000096	0.000138	0.0	0.0	0.000152	0.000101	0.000137	0.000031	0.000161
3 FORESTRY, FISHERIES	0.0	0.0	0.0	0.0	0.0	0.000011	0.0	0.0	0.0	0.000010
4 AGRI. FORES. FISH. SV.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5 IRON, FERRO. ORES MIN.	0.0	0.0	0.0	0.0	0.000578	0.0	0.0	0.0	0.0	0.0
6 NONFERROUS ORES MINING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7 COAL MINING	0.0	0.000240	0.000232	0.000200	0.0	0.000135	0.000101	0.000275	0.000367	0.000115
8 CRUDE PETRO.,'NATL GAS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9 STONE, CLAY MINING	0.0	0.0	0.000046	0.0	0.0	0.0	0.0	0.0	0.000046	0.0
10 CHEM FERT MIN MINING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11 NEW CONSTRUCTION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12 MAINT., REPAIR CONSTR.	0.001369	0.001582	0.001620	0.000401	0.0	0.000871	0.001314	0.000687	0.001713	0.001592
13 ORDNANCE, ACCESSORIES	0.0	0.0	0.000092	0.0	0.0	0.002983	0.0	0.0	0.000015	0.000032
14 FOOD, KINDRED PRDTS.	0.002053	0.002780	0.002824	0.001403	0.000578	0.002933	0.002124	0.002335	0.000719	0.003081
15 TOBACCO MANUFACTURES	0.0	0.000143	0.000232	0.0	0.0	0.000236	0.000202	0.000137	0.000061	0.000247
16 FABRICS	0.0	0.0	0.000602	0.000802	0.0	0.000135	0.0	0.000687	0.000352	0.000465
17 TEXTILE PRDTS.	0.000342	0.001391	0.000602	0.0	0.000578	0.0	0.0	0.0	0.003105	0.000169
18 APPAREL	0.000342	0.000719	0.000926	0.000401	0.000578	0.000893	0.000808	0.000824	0.000413	0.000865
19 MISC. TEXTILE PRDTS.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.009558	0.0
20 LUMBER, WOOD PRDTS.	0.0	0.001966	0.000880	0.001002	0.001154	0.000281	0.0	0.000412	0.000719	0.000210
21 WOODEN CONTAINERS	0.000342	0.002710	0.000463	0.000743	0.0	0.000438	0.000202	0.000412	0.000168	0.000276
22 HOUSEHOLD FURNITURE	0.0	0.000384	0.0	0.001604	0.001154	0.001339	0.0	0.0	0.000015	0.0
23 OTHER FURNITURE	0.007185	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.000031	0.002863
24 PAPER, ALLIED PRDTS.	0.002737	0.001199	0.006157	0.000601	0.0	0.001905	0.007684	0.000550	0.000321	0.000817
25 PAPERBOARD CONTAINERS	0.000684	0.006137	0.003056	0.006618	0.005317	0.001354	0.003134	0.007694	0.000321	0.000815
26 PRINTING, PUBLISHING	0.003079	0.000719	0.002546	0.000601	0.0	0.001624	0.003708	0.000412	0.000260	0.001033
27 CHEM, SELECT. PRDTS.	0.001026	0.005417	0.005602	0.003209	0.001732	0.001477	0.010866	0.020974	0.001009	0.001237
28 PLASTICS, SYNTHETICS	0.000342	0.0	0.003102	0.002005	0.002972	0.001410	0.002932	0.004122	0.000301	0.001315
29 DRUGS, COSMETICS	0.0	0.000192	0.000186	0.000601	0.0	0.000197	0.000101	0.000137	0.000061	0.000229
30 PAINT, ALLIED PRDTS.	0.000342	0.006329	0.003834	0.004211	0.001732	0.000202	0.000607	0.000137	0.004532	0.001126
31 PETRO, RELATED INDS.	0.001026	0.002253	0.004769	0.000802	0.002888	0.002399	0.001415	0.001374	0.001667	0.003546
32 RUBBER, MISC. PLASTICS	0.007773	0.022156	0.013352	0.027235	0.010454	0.007183	0.010616	0.038610	0.026395	0.005849
33 LEATHER TANNING PRDTS.	0.0	0.000048	0.000046	0.0	0.0	0.000028	0.0	0.0	0.000031	0.000045
34 FOOTWEAR, LEAT. PRDTS.	0.0	0.000048	0.000046	0.000401	0.0	0.000045	0.0	0.0	0.000015	0.000045
35 GLASS, GLASS PRDTS.	0.001026	0.001391	0.001342	0.017245	0.093395	0.001258	0.015536	0.000550	0.008915	0.000080
36 STONE, CLAY PRDTS.	0.044136	0.006712	0.009320	0.005614	0.045616	0.000011	0.004752	0.006321	0.001957	0.002274
37 PRIMARY IRON STEEL MFR	0.008397	0.051372	0.053577	0.034959	0.036212	0.006259	0.009449	0.025595	0.080310	0.020011
38 PRIMARY NONFERROUS MFR	0.006442	0.043048	0.067708	0.022134	0.138620	0.018864	0.028005	0.111933	0.014764	0.041268
39 METAL CONTAINERS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40 FABRICATED METAL PRDTS	0.001026	0.086923	0.003426	0.114903	0.228655	0.000157	0.004955	0.000824	0.005092	0.000198

TABLE XXII (Continued)

INDUSTRY	51	52	53	54	55	56	57	58	59	60
41 SCREW MACH PRDTS, ETC.	0.007281	0.029845	0.012996	0.025268	0.008195	0.017045	0.015782	0.009128	0.032466	0.012770
42 OTHER FAB. METAL PRDTS	0.007185	0.045219	0.019052	0.022918	0.030026	0.013110	0.028917	0.011679	0.028264	0.014056
43 ENGINES, TURBINES	0.0	0.000767	0.002222	0.0	0.0	0.0	0.0	0.0	0.002722	0.000216
44 FARM MACH., EQUIP.	0.001026	0.0	0.000556	0.015241	0.0	0.000006	0.0	0.0	0.000811	0.000002
45 CONSTRUC. MACH. EQUIP.	0.002395	0.000959	0.012917	0.0	0.002310	0.000022	0.0	0.000137	0.018520	0.000644
46 MATERIAL HANDLING MACH	0.0	0.000671	0.000186	0.002808	0.0	0.000107	0.001415	0.000137	0.000413	0.000181
47 METALWORKING MACHINERY	0.003763	0.006856	0.010244	0.004813	0.002310	0.010275	0.004752	0.009475	0.013045	0.021617
48 SPECIAL MACH. EQUIP.	0.000684	0.001158	0.002232	0.001403	0.007506	0.000056	0.000506	0.004397	0.000122	0.000033
49 GENERAL MACH. EQUIP.	0.049611	0.027041	0.008935	0.024866	0.003464	0.003068	0.037005	0.012504	0.012555	0.006538
50 MACHINE SHOP PRDTS.	0.000342	0.000348	0.003518	0.002407	0.0	0.003820	0.000202	0.003436	0.011790	0.041692
51 OFFICE, COMPUT. MACHS.	0.097169	0.000240	0.0	0.003409	0.0	0.003837	0.0	0.0	0.000107	0.000096
52 SERVICE IND. MACHINES	0.017792	0.057534	0.010695	0.016443	0.010394	0.000629	0.003134	0.010993	0.005658	0.000140
53 ELECT. TRANSMISS. EQP.	0.007217	0.070911	0.068381	0.167040	0.069290	0.021355	0.034983	0.025557	0.001652	0.002041
54 HOUSEHOLD APPLIANCES	0.0	0.007048	0.002917	0.007219	0.002310	0.000095	0.001314	0.001786	0.000198	0.000062
55 ELECT. LIGHTING EQUIP.	0.004447	0.004459	0.007685	0.004813	0.009238	0.008010	0.003438	0.007969	0.004328	0.000657
56 RADIO TV, ETC.,EQUIP.	0.261741	0.000479	0.055464	0.0	0.068712	0.067379	0.352053	0.112395	0.002875	0.042311
57 ELECTRONIC COMPONENTS	0.035947	0.000048	0.022979	0.000259	0.024252	0.136657	0.026489	0.006548	0.001529	0.009024
58 MISC. ELECTRICAL MACH.	0.003421	0.010404	0.001250	0.000200	0.013280	0.001838	0.000808	0.041770	0.012586	0.002416
59 MOTOR VEHICLES, EQUIP.	0.007869	0.005562	0.002315	0.013235	0.017322	0.000112	0.0	0.015801	0.317353	0.000152
60 AIRCRAFT, PARTS	0.048926	0.045068	0.014769	0.193711	0.002310	0.031041	0.048633	0.000137	0.007096	0.165900
61 OTHER TRANSPORT. EQUIP	0.0	0.000192	0.006481	0.004813	0.000578	0.000006	0.0	0.000275	0.000382	0.000049
62 PROF. SCIEN. INSTRU.	0.008212	0.015089	0.010973	0.014565	0.009238	0.001477	0.005358	0.005908	0.006254	0.016082
63 MEDICAL, PHOTO. EQUIP.	0.0	0.000143	0.000138	0.0	0.0	0.000365	0.000202	0.000275	0.000214	0.002974
64 MISC. MANUFACTURING	0.000684	0.002013	0.003602	0.005013	0.002310	0.000556	0.000910	0.000687	0.000122	0.000422
65 TRANSP., WAREHOUSING	0.005458	0.013490	0.013947	0.008091	0.004620	0.008473	0.007583	0.012916	0.016287	0.012084
66 COMMUNICA. EX BRDCAST.	0.003763	0.004075	0.004769	0.001604	0.001154	0.007787	0.003438	0.003022	0.001621	0.008277
67 RADIO, TV BROADCASTING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
68 ELEC.GAS.WATER SAN.SV.	0.002053	0.004986	0.007037	0.003209	0.001732	0.004432	0.004651	0.006321	0.003977	0.006388
69 WHOLESALE RETAIL TRADE	0.011941	0.040660	0.028722	0.019015	0.010970	0.026552	0.021637	0.035724	0.022190	0.021547
70 FINANCE, INSURANCE	0.003421	0.003452	0.007731	0.001804	0.000578	0.003034	0.002629	0.002748	0.002860	0.003727
71 REAL ESTATE, RENTAL	0.007527	0.005753	0.009537	0.002607	0.002310	0.008793	0.005662	0.005221	0.001820	0.004717
72 HOTELS, PERSONAL SERV.	0.001026	0.001007	0.002037	0.000601	0.000578	0.001882	0.001618	0.001649	0.000704	0.004431
73 BUSINESS SERVICES	0.010606	0.013712	0.013843	0.025467	0.005774	0.021389	0.012335	0.012092	0.011607	0.023237
74 RESEARCH, DEVELOPMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
75 AUTO. REPAIR, SERVICES	0.000684	0.000815	0.001064	0.000200	0.0	0.001635	0.000708	0.000824	0.009359	0.001542
76 AMUSEMENTS	0.0	0.000143	0.000232	0.0	0.0	0.000230	0.000202	0.000137	0.000061	0.000243
77 MED., EDUC. SERVICES	0.000342	0.000471	0.000880	0.000200	0.0	0.001471	0.000708	0.000550	0.000198	0.001398
78 FEDERAL GOVT. ENTERPR.	0.000684	0.001151	0.001018	0.001002	0.0	0.002379	0.000858	0.000687	0.000948	0.001446
79 STATE LOCAL GOVT. ENT.	0.0	0.000096	0.000138	0.0	0.0	0.000124	0.000101	0.000137	0.000092	0.000144

TABLE XXII (Continued)

	INDUSTRY	61	62	63	64	65	66	67	68	69	70
1	LIVESTOCK. PRDTS.	0.000062	0.000066	0.0	0.000054	0.000069	0.000035	0.000105	0.000019	0.000043	0.000060
2	OTHER AGRIC. PRDTS.	0.000186	0.000267	0.0	0.002269	0.002962	0.000100	0.000316	0.000054	0.000128	0.000174
3	FORESTRY. FISHERIES	0.0	0.0	0.0	0.000756	0.000006	0.000006	0.0	0.000003	0.000009	0.000012
4	AGRI. FORLS. FISH. SV.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.001271	0.0
5	IRON. FERRO. ORES MIN.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	NONFERROUS ORES MINING	0.0	0.000066	0.0	0.0	0.0	0.0	0.0	0.000008	0.000004	0.0
7	COAL MINING	0.000124	0.000066	0.0	0.000216	0.000062	0.0	0.0	0.021078	0.000004	0.0
8	CRUDE PETRO.. NATL GAS	0.0	0.0	0.0	0.0	0.005110	0.0	0.0	0.007872	0.000381	0.0
9	STONE. CLAY MINING	0.0	0.0	0.0	0.000271	0.0	0.0	0.0	0.000003	0.000036	0.0
10	CHEM FERT MIN MINING	0.0	0.0	0.0	0.0	0.000010	0.0	0.0	0.0	0.0	0.0
11	NEW CONSTRUCTION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	MAINT.. REPAIR CONSTR.	0.000742	0.001132	0.0	0.002378	0.033681	0.028601	0.0	0.029911	0.003406	0.003874
13	ORDNANCE. ACCESSORIES	0.0	0.0	0.0	0.0	0.000006	0.000006	0.0	0.000003	0.000010	0.000012
14	FOOD. KINDRED PRDTS.	0.003462	0.003595	0.001096	0.006864	0.005532	0.001895	0.006586	0.001057	0.007251	0.003370
15	TOBACCO MANUFACTURES	0.000247	0.000267	0.0	0.000216	0.000132	0.000153	0.000527	0.000081	0.000198	0.000270
16	FABRICS	0.001361	0.001379	0.0	0.015780	0.0	0.0	0.0	0.0	0.000002	0.0
17	TEXTILE PRDTS.	0.017868	0.000066	0.0	0.005512	0.000123	0.0	0.0	0.0	0.000072	0.000003
18	APPAREL	0.000989	0.000932	0.0	0.002594	0.000259	0.000329	0.0	0.000229	0.000289	0.000312
19	MISC. TEXTILE PRDTS.	0.000618	0.000066	0.0	0.000540	0.0	0.0	0.0	0.0	0.000099	0.0
20	LUMBER. WOOD PRDTS.	0.101583	0.000866	0.0	0.025237	0.000056	0.000006	0.0	0.000022	0.000277	0.000006
21	WOODEN CONTAINERS	0.0	0.000599	0.0	0.000432	0.0	0.0	0.0	0.0	0.000352	0.0
22	HOUSEHOLD FURNITURE	0.027513	0.000799	0.0	0.000702	0.0	0.0	0.0	0.0	0.000055	0.0
23	OTHER FURNITURE	0.000186	0.000066	0.0	0.0	0.0	0.0	0.0	0.0	0.000045	0.0
24	PAPER. ALLIED PRDTS.	0.009460	0.002431	0.001125	0.017833	0.000742	0.001494	0.000369	0.000592	0.006815	0.009389
25	PAPERBOARD CONTAINERS	0.0	0.003041	0.0	0.019617	0.000184	0.0	0.0	0.000011	0.004885	0.0
26	PRINTING. PUBLISHING	0.000433	0.001132	0.004385	0.012484	0.001922	0.002489	0.001106	0.000554	0.002650	0.019530
27	CHEM. SELECT. PRDTS.	0.000557	0.001797	0.001125	0.007728	0.000738	0.000135	0.0	0.001378	0.000323	0.000117
28	PLASTICS. SYNTHETICS	0.000575	0.000999	0.005481	0.025723	0.0	0.0	0.0	0.0	0.000312	0.0
29	DRUGS. COSMETICS	0.000186	0.000866	0.0	0.000648	0.000106	0.000047	0.000158	0.000027	0.000489	0.000084
30	PAINT. ALLIED PRDTS.	0.006307	0.000866	0.001096	0.008917	0.000086	0.0	0.0	0.0	0.000086	0.0
31	PETRO. RELATED INDS.	0.001298	0.001598	0.0	0.004539	0.042066	0.006349	0.000580	0.007597	0.012458	0.002459
32	RUBBER. MISC. PLASTICS	0.027266	0.033367	0.008521	0.073388	0.003692	0.001130	0.000316	0.000197	0.002784	0.000333
33	LEATHER TANNING PRDTS.	0.0	0.000066	0.0	0.003188	0.000032	0.0	0.0	0.0	0.0	0.0
34	FOOTWEAR. LEAT. PRDTS.	0.000062	0.000133	0.0	0.002486	0.000023	0.000029	0.000105	0.000016	0.000099	0.000048
35	GLASS. GLASS PRDTS.	0.008594	0.002663	0.232303	0.004161	0.000067	0.000006	0.0	0.000003	0.000406	0.000006
36	STONE. CLAY PRDTS.	0.011191	0.000799	0.003288	0.003513	0.000934	0.000012	0.0	0.000027	0.001146	0.000006
37	PRIMARY IRON STEEL MFR	0.052246	0.016852	0.005481	0.030100	0.004034	0.000006	0.0	0.000191	0.000049	0.000033
38	PRIMARY NONFERROUS MFR	0.048043	0.038125	0.006559	0.024264	0.000119	0.000500	0.0	0.000433	0.000212	0.0
39	METAL CONTAINERS	0.0	0.000333	0.0	0.0	0.0	0.0	0.0	0.0	0.000005	0.0
40	FABRICATED METAL PRDTS	0.087672	0.001264	0.003288	0.003837	0.0	0.0	0.0	0.000008	0.001716	0.0

TABLE XXII (Continued)

INDUSTRY	61	62	63	64	65	66	67	68	69	70
41 SCREW MACH PRDTS. ETC.	0.009581	0.012722	0.003014	0.011565	0.000125	0.0	0.0	0.0	0.000251	0.0
42 OTHER FAB. METAL PRDTS	0.019442	0.021670	0.005481	0.015834	0.001834	0.000018	0.0	0.000005	0.000791	0.000060
43 ENGINES. TURBINES	0.002847	0.0	0.0	0.0	0.001400	0.0	0.0	0.0	0.000001	0.0
44 FARM MACH.. EQUIP.	0.003855	0.000133	0.0	0.000865	0.0	0.0	0.0	0.000008	0.000035	0.0
45 CONSTRUC. MACH. EQUIP.	0.002040	0.001132	0.0	0.000540	0.0	0.0	0.0	0.0	0.001286	0.0
46 MATERIAL HANDLING MACH	0.000247	0.000133	0.0	0.000432	0.000023	0.0	0.0	0.0	0.000024	0.0
47 METALWORKING MACHINERY	0.000557	0.010869	0.0	0.0	0.000376	0.0	0.0	0.0	0.000049	0.0
48 SPECIAL MACH. EQUIP.	0.000310	0.000866	0.003288	0.000271	0.0	0.0	0.0	0.0	0.000112	0.0
49 GENERAL MACH. EQUIP.	0.008594	0.010052	0.008769	0.008268	0.001039	0.0	0.0	0.000003	0.000450	0.0
50 MACHINE SHOP PRDTS.	0.000928	0.000066	0.001096	0.000054	0.000177	0.000053	0.0	0.000008	0.000097	0.000006
51 OFFICE. COMPUT. MACHS.	0.000186	0.0	0.0	0.0	0.000006	0.000018	0.0	0.000003	0.000025	0.000069
52 SERVICE IND. MACHINES	0.001051	0.012249	0.049560	0.000432	0.000010	0.0	0.0	0.0	0.000179	0.0
53 ELECT. TRANSMISS. EQP.	0.001112	0.021009	0.004385	0.007133	0.000945	0.0	0.0	0.000003	0.000108	0.0
54 HOUSEHOLD APPLIANCES	0.038457	0.000199	0.009966	0.000702	0.000029	0.000035	0.000105	0.000019	0.000065	0.000060
55 ELECT. LIGHTING EQUIP.	0.009027	0.005060	0.002193	0.002324	0.000238	0.000024	0.0	0.000808	0.000351	0.000009
56 RADIO TV. ETC..EQUIP.	0.000124	0.219550	0.279534	0.004378	0.000123	0.012774	0.003161	0.000070	0.000546	0.000084
57 ELECTRONIC COMPONENTS	0.000186	0.014211	0.024117	0.000054	0.001322	0.0	0.0	0.0	0.000033	0.0
58 MISC. ELECTRICAL MACH.	0.000371	0.000133	0.0	0.000054	0.001882	0.000235	0.0	0.000049	0.000513	0.000063
59 MOTOR VEHICLES. EQUIP.	0.037035	0.003595	0.001096	0.000540	0.001849	0.000282	0.0	0.000065	0.000554	0.000069
60 AIRCRAFT. PARTS	0.054347	0.101787	0.134833	0.029993	0.010937	0.0	0.0	0.0	0.003072	0.0
61 OTHER TRANSPORT. EQUIP	0.040497	0.002862	0.0	0.003405	0.000945	0.0	0.0	0.0	0.000042	0.0
62 PROF. SCIEN. INSTRU.	0.000371	0.040675	0.052618	0.001242	0.000501	0.000012	0.000053	0.000005	0.000148	0.000018
63 MEDICAL. PHOTO. EQUIP.	0.000124	0.000732	0.018635	0.001081	0.000123	0.000347	0.000896	0.000065	0.000166	0.001220
64 MISC. MANUFACTURING	0.004142	0.004061	0.004385	0.072847	0.000261	0.000635	0.000316	0.000146	0.001060	0.002417
65 TRANSP.. WAREHOUSING	0.024422	0.009453	0.003288	0.016807	0.058266	0.004160	0.010643	0.020934	0.010858	0.006561
66 COMMUNICA. EX BROCAST.	0.002226	0.006125	0.002193	0.004972	0.009276	0.007349	0.044367	0.002609	0.010290	0.023764
67 RADIO. TV BROADCASTING	0.0	0.0	0.0	0.0	0.0	0.0	0.005638	0.0	0.0	0.0
68 ELEC.GAS.WATER SAN.SV.	0.002906	0.003927	0.001096	0.305620	0.013936	0.010797	0.003958	0.191976	0.017745	0.017901
69 WHOLESALE RETAIL TRADE	0.027637	0.022235	0.012059	0.038856	0.023963	0.009614	0.013120	0.005881	0.017703	0.012081
70 FINANCE. INSURANCE	0.003586	0.004992	0.001096	0.005242	0.014241	0.008402	0.010275	0.007492	0.015711	0.167791
71 REAL ESTATE. RENTAL	0.006430	0.007922	0.003288	0.014321	0.022007	0.018663	0.022658	0.005769	0.054464	0.049186
72 HOTELS. PERSONAL SERV.	0.002040	0.002263	0.001096	0.001946	0.001291	0.001241	0.003214	0.000498	0.003489	0.001643
73 BUSINESS SERVICES	0.010387	0.025497	0.007673	0.035505	0.017731	0.017404	0.040519	0.017060	0.046707	0.081708
74 RESEARCH. DEVELOPMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
75 AUTO. REPAIR. SERVICES	0.000618	0.000932	0.0	0.003973	0.011199	0.007696	0.000211	0.001526	0.007608	0.002336
76 AMUSEMENTS	0.000247	0.000267	0.0	0.000216	0.000129	0.000300	0.262944	0.000081	0.000961	0.000276
77 MED.. EDUC. SERVICES	0.000433	0.000799	0.0	0.000702	0.001293	0.000959	0.000948	0.000310	0.001035	0.000751
78 FEDERAL GOVT. ENTERPR.	0.000804	0.001531	0.0	0.002376	0.002005	0.004783	0.001317	0.017605	0.010963	0.022453
79 STATE LOCAL GOVT. ENT.	0.000062	0.000133	0.0	0.000108	0.020655	0.000547	0.000158	0.101970	0.003641	0.002801

TABLE XXII (Continued)

INDUSTRY	71	72	73	74	75	76	77	78	79
1 LIVESTOCK. PRDTS.	0.021471	0.000067	0.000129	0.0	0.000021	0.002425	0.000263	0.000042	0.0
2 OTHER AGRIC. PRDTS.	0.023680	0.000195	0.000386	0.0	0.000062	0.000368	0.001329	0.000141	0.000234
3 FORESTRY. FISHERIES	0.000001	0.000013	0.000026	0.0	0.000007	0.000022	0.000014	0.000014	0.000014
4 AGRI. FORES. FISH. SV.	0.000259	0.0	0.0	0.0	0.0	0.0	0.000005	0.0	0.000082
5 IRON. FERRO. ORES MIN.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6 NONFERROUS ORES MINING	0.000021	0.0	0.000004	0.0	0.0	0.0	0.0	0.0	0.0
7 COAL MINING	0.000022	0.000081	0.000004	0.0	0.0	0.0	0.000325	0.011406	0.011241
8 CRUDE PETRO., NATL GAS	0.006384	0.0	0.000320	0.0	0.0	0.0	0.0	0.0	0.005332
9 STONE. CLAY MINING	0.000181	0.000094	0.000026	0.0	0.0	0.0	0.0	0.0	0.0
10 CHEM FERT MIN MINING	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.000247
11 NEW CONSTRUCTION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12 MAINT., REPAIR CONSTR.	0.078189	0.009740	0.000846	0.0	0.002166	0.010481	0.020172	0.007162	0.180682
13 ORDNANCE. ACCESSORIES	0.000001	0.000061	0.000029	0.0	0.000007	0.000022	0.000019	0.000014	0.0
14 FOOD. KINDRED PRDTS.	0.001230	0.003901	0.007492	0.0	0.001193	0.006908	0.013543	0.002735	0.000371
15 TOBACCO MANUFACTURES	0.000022	0.000303	0.000599	0.0	0.000096	0.000563	0.000358	0.000226	0.000027
16 FABRICS	0.000002	0.002892	0.000081	0.0	0.0	0.0	0.0	0.000451	0.0
17 TEXTILE PRDTS.	0.0	0.000377	0.000004	0.0	0.0	0.0	0.000010	0.000649	0.0
18 APPAREL	0.000105	0.004157	0.000029	0.0	0.000521	0.000022	0.000096	0.000014	0.000082
19 MISC. TEXTILE PRDTS.	0.000002	0.005664	0.0	0.0	0.000590	0.0	0.000492	0.001086	0.000247
20 LUMBER. WOOD PRDTS.	0.000100	0.000007	0.000011	0.0	0.0	0.0	0.000005	0.0	0.0
21 WOODEN CONTAINERS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22 HOUSEHOLD FURNITURE	0.000015	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23 OTHER FURNITURE	0.000009	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24 PAPER. ALLIED PRDTS.	0.000175	0.003519	0.002798	0.0	0.000370	0.000455	0.002313	0.002552	0.003436
25 PAPERBOARD CONTAINERS	0.000025	0.001581	0.000324	0.0	0.0	0.0	0.000053	0.000113	0.0
26 PRINTING. PUBLISHING	0.000792	0.001540	0.136205	0.0	0.000274	0.006952	0.016009	0.003271	0.001539
27 CHEM. SELECT. PRDTS.	0.002086	0.003854	0.002923	0.0	0.000500	0.007969	0.001453	0.000508	0.010980
28 PLASTICS. SYNTHETICS	0.000005	0.0	0.0	0.0	0.0	0.0	0.0	0.000296	0.0
29 DRUGS. COSMETICS	0.000032	0.016412	0.003228	0.0	0.000027	0.000173	0.018169	0.000888	0.000399
30 PAINT. ALLIED PRDTS.	0.000022	0.000484	0.000268	0.0	0.006862	0.0	0.0	0.000014	0.0
31 PETRO. RELATED INDS.	0.019111	0.009450	0.003548	0.0	0.011038	0.002296	0.004401	0.002862	0.007668
32 RUBBER. MISC. PLASTICS	0.000795	0.003787	0.000518	0.0	0.021623	0.000238	0.001338	0.001551	0.000921
33 LEATHER TANNING PRDTS.	0.0	0.000753	0.0	0.0	0.0	0.0	0.0	0.0	0.0
34 FOOTWEAR. LEAT. PRDTS.	0.000015	0.009787	0.000107	0.0	0.000021	0.000736	0.000067	0.000113	0.0
35 GLASS. GLASS PRDTS.	0.000302	0.000034	0.000011	0.0	0.006760	0.0	0.000129	0.000056	0.000014
36 STONE. CLAY PRDTS.	0.000294	0.004022	0.000283	0.0	0.010002	0.0	0.000081	0.000155	0.002639
37 PRIMARY IRON STEEL MFR	0.000035	0.000007	0.000004	0.0	0.0	0.0	0.000010	0.0	0.001635
38 PRIMARY NONFERROUS MFR	0.000106	0.000330	0.000077	0.0	0.0	0.0	0.0	0.000056	0.0
39 METAL CONTAINERS	0.000008	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40 FABRICATED METAL PRDTS	0.000730	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

TABLE XXII (Continued)

INDUSTRY	71	72	73	74	75	76	77	78	79
41 SCREW MACH PRDTS. ETC.	0.000018	0.0	0.0	0.0	0.011236	0.0	0.000067	0.000282	0.000014
42 OTHER FAB. METAL PRDTS	0.000112	0.003457	0.000349	0.0	0.007658	0.000022	0.000081	0.000056	0.000137
43 ENGINES, TURBINES	0.0	0.0	0.002562	0.0	0.003044	0.0	0.0	0.0	0.0
44 FARM MACH., EQUIP.	0.000018	0.0	0.002209	0.0	0.0	0.0	0.0	0.0	0.0
45 CONSTRUC. MACH. EQUIP.	0.000538	0.0	0.000360	0.0	0.0	0.0	0.0	0.0	0.0
46 MATERIAL HANDLING MACH	0.000010	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
47 METALWORKING MACHINERY	0.000008	0.0	0.000507	0.0	0.000096	0.0	0.0	0.0	0.000069
48 SPECIAL MACH. EQUIP.	0.000233	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
49 GENERAL MACH. EQUIP.	0.000164	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50 MACHINE SHOP PRDTS.	0.000040	0.000101	0.000055	0.0	0.010085	0.000022	0.000038	0.000014	0.000137
51 OFFICE, COMPUT. MACHS.	0.000024	0.000097	0.002048	0.0	0.0	0.0	0.000014	0.000014	0.000014
52 SERVICE IND. MACHINES	0.000022	0.0	0.002632	0.0	0.0	0.0	0.0	0.000070	0.0
53 ELECT. TRANSMISS. EQP.	0.000098	0.002085	0.002989	0.0	0.001474	0.0	0.0	0.0	0.000289
54 HOUSEHOLD APPLIANCES	0.000013	0.009565	0.000132	0.0	0.000021	0.000130	0.000081	0.000183	0.0
55 ELECT. LIGHTING EQUIP.	0.000001	0.000518	0.000029	0.0	0.001213	0.000022	0.000024	0.000099	0.002817
56 RADIO TV, ETC., EQUIP.	0.000225	0.000094	0.000301	0.0	0.000027	0.000173	0.000124	0.000070	0.000014
57 ELECTRONIC COMPONENTS	0.000020	0.026300	0.0	0.0	0.0	0.0	0.000096	0.000028	0.0
58 MISC. ELECTRICAL MACH.	0.000036	0.000303	0.000735	0.0	0.017811	0.000065	0.000134	0.000085	0.000289
59 MOTOR VEHICLES, EQUIP.	0.000077	0.000350	0.000121	0.0	0.078099	0.000065	0.000158	0.001410	0.000783
60 AIRCRAFT, PARTS	0.000611	0.0	0.000015	0.0	0.0	0.0	0.000024	0.0	0.0
61 OTHER TRANSPORT. EQUIP	0.000060	0.000552	0.000382	0.0	0.0	0.0	0.0	0.0	0.000728
62 PROF. SCIEN. INSTRU.	0.000052	0.000182	0.000191	0.0	0.000007	0.000043	0.007130	0.000056	0.000041
63 MEDICAL, PHOTO. EQUIP.	0.000040	0.008610	0.004507	0.0	0.000041	0.014553	0.002179	0.000155	0.000206
64 MISC. MANUFACTURING	0.000121	0.021130	0.005812	0.0	0.000089	0.004829	0.002074	0.000324	0.000467
65 TRANSP., WAREHOUSING	0.004488	0.012470	0.013676	0.0	0.009557	0.012885	0.010356	0.114751	0.011887
66 COMMUNICA. EX BRDCAST.	0.002309	0.000327	0.033083	0.0	0.006437	0.006973	0.012158	0.001551	0.004425
67 RADIO, TV BROADCASTING	0.000094	0.0	0.067240	0.0	0.0	0.0	0.000502	0.0	0.0
68 ELEC.GAS,WATER SAN.SV.	0.002259	0.014596	0.013636	0.0	0.006561	0.010915	0.028654	0.010983	0.096855
69 WHOLESALE RETAIL TRADE	0.014463	0.028822	0.023360	0.0	0.117937	0.018602	0.018714	0.007374	0.005469
70 FINANCE, INSURANCE	0.029769	0.014329	0.007555	0.0	0.015233	0.013557	0.005797	0.002538	0.014251
71 REAL ESTATE, RENTAL	0.033828	0.054010	0.040966	0.0	0.027971	0.093487	0.081256	0.023348	0.006926
72 HOTELS, PERSONAL SERV.	0.002385	0.027557	0.010628	0.0	0.001323	0.004223	0.006609	0.001875	0.000453
73 BUSINESS SERVICES	0.018577	0.026865	0.044642	0.0	0.010702	0.044524	0.019971	0.018427	0.034191
74 RESEARCH, DEVELOPMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
75 AUTO. REPAIR. SERVICES	0.001857	0.008233	0.005434	0.0	0.003400	0.302447	0.004550	0.002749	0.001869
76 AMUSEMENTS	0.000864	0.000424	0.003092	0.0	0.000096	0.192519	0.001281	0.000211	0.000055
77 MED., EDUC. SERVICES	0.000634	0.002852	0.001570	0.0	0.000569	0.002577	0.004481	0.000197	0.001072
78 FEDERAL GOVT. ENTERPR.	0.003856	0.002711	0.317915	0.0	0.000548	0.005955	0.007512	0.000352	0.000921
79 STATE LOCAL GOVT. ENT.	0.007092	0.000619	0.000460	0.0	0.010702	0.000282	0.000702	0.000381	0.000385

VITA

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