An Analysis of the Structure of Oklahoma's Economy by Districts

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Economic activity in Oklahoma varies from the predominantly agricultural districts in rural areas of the state to the more industrialized districts near the large cities. To understand the complex economic base of the state, it is necessary to consider the differences that exist in the economic structure of each district. The effects of a change in economic activity depends on the underlying structure and thus differ as structures differ. This is an important consideration for those actively concerned with economic development in the state. To assist in planning for economic growth and development, Oklahoma was divided into three relatively homogenous districts, and an economic structure analysis was conducted for each district.

Obectives of the Study

Separate district structural analyses were needed to measure the total impact (direct and secondary effects) of an economic change in each district. The direct effects are caused by the initial change in economic activity, whereas the secondary effects are changes resulting from the initial change. For example, the direct effect of a new plant on employment is the number of men it employs, while the secondary effects are the changes in employment in other businesses such as grocery stores, gas stations, etc. as a result of the establishment of the new plant. Needless to say, secondary effects are more difficult to ascertain than direct effects. To determine them, the interrelationship among sectors of the economy have to be determined. The general objective of this study was to measure the economic relationship among sectors in each district using an input-output analysis. The specific objectives were:

1. To formulate a structural model of the economy of each district
2. To show the direct and indirect effects of changes in economic activity in each district
3. To compute output, income and employment multipliers for each district

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4. To measure leakage associated with each multiplier
5. To predict some future development in the districts.

The empirical results are intended to provide a better picture of the state's economy through a comparison of the district models. The comparison should indicate differences in approach to the problem of economic growth in each district.

Previous Studies

Two prior research reports have particular bearing upon the analysis presented here. In the first report [6], the state was divided into three economic districts mainly on the basis of family income and unemployment data.[1] The report consisted of an extensive review of the economic and environmental conditions found within each district. Because the economic conditions within each district in this prior study were very similar, the district delineation of that study was used in this analysis.[2] The three economic districts used are outlined in Figure 1.

The second report [7] consisted of an input-output analysis for the state of Oklahoma. Much of the data used in this analysis originated from the state study. In fact, this study is an extension of the earlier analysis. The extension was deemed necessary to provide more information about the economic structure of Oklahoma. It provides an analysis of the interrelationship of the sectors on a district basis, thus providing more local-

[1]The numbers in the brackets refer to the references listed at the end.
[2]District IA delineated in [6] is included in District III for this study.

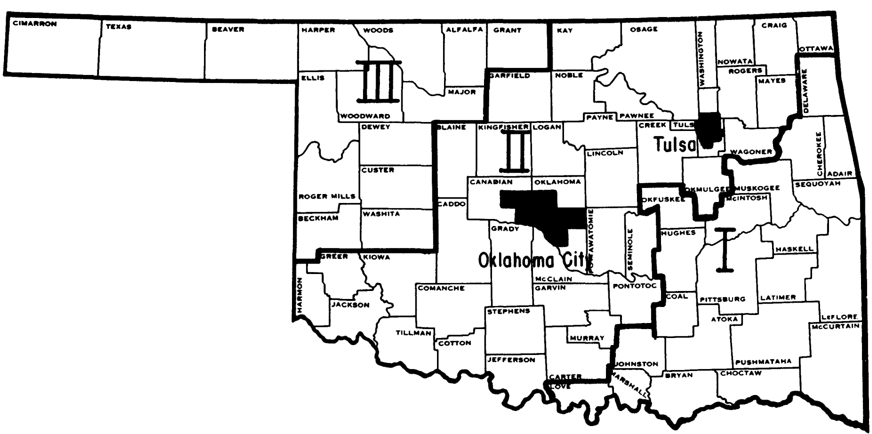

Figure 1. General Economic Districts in Oklahoma.
Source: Charles H. Little, *Economic Changes in Oklahoma.* Stillwater, Oklahoma, Technical Bulletin No. B-652 (January 1967).

ized information from which decisions concerning economic growth can be based than does the state study.

Some Economic Characteristics of the Districts

A brief comparison of some of the economic characteristics of the three districts will aid in comparing the economic structures of those districts. Most of the industrial activity in the state is located in District II, particularly around the two large urban centers of Oklahoma City and Tulsa. The economic activity in the other two districts is mainly related to agriculture, though the type of agriculture differs considerably in the two districts. Large farms and ranches are predominant in District III, while the farms in District I are smaller and more diversified.

Income and Population

Median family income was lowest in District I where the average for the district was only $2,562 in 1960 [6]. Median family income was much higher in Districts II and III, where the medians were $4,133 and $4,368, respectively. These figures indicate the disparity between District I and District II and III. Most of the counties in District I had median family income below the poverty level in 1960 [1].

A large percentage of Oklahoma's population is concentrated in District II. In 1960, 78 percent of the state's total population resided in this District. The majority of the people in District II were classified as urban in 1960 (Table 1), with only 8 percent of the population classified as rural farm. In District I and III, the majority of the population was rural. In District III the largest class is rural farm, reflecting the district's agriculture economy. In District I the largest class is rural nonfarm, indicating that most families live in rural areas but are not actively engaged in farming.

Table 1—Percent of Population by Place of Residence, 1960

	District I	District II	Ditsrict III	Oklahoma
		Percent		
Rural Population	69	28	68	37
Farm[1]	19	8	30	11
Nonfarm[2]	50	20	38	26
Urban Population[3]	31	72	32	63
	100	100	100	100

Source: U. S. Census of Population Oklahoma 1960 "General Social and Economic Characteristics," Table 91, pp. 38-244/38-249.

[1] Rural farm residents are those who sell more than $50 worth of agricultural goods and farm at least ten acres.

[2] Rural non-farm residents consist of those not classified as rural farm residents and living in places with a population of less than 2,500.

[3] Urban residents are those living in places with a population greater than 2,500.

Agriculture

Agricultural activity varies across the state. The northeast and north-central areas of the state specialize more in wheat production, whereas cotton production is concentrated in the southwest. The production of sorghum is found mainly in the northwestern and western counties of the state where average rainfall is more favorable. The production of peanuts is centered in the southcentral portion of the state, while vegetable production is concentrated around the urban centers of the state.

Cattle and calves are raised throughout the state. Dairying is important in a number of counties. The main dairy counties are located near Tulsa and Oklahoma City. These metropolitan areas constitute the bulk of the market for dairy products in Oklahoma. The main counties producing poultry and poultry products are located in the eastern part of the state. Other important poultry production counties are located around the two main consuming centers. Sheep and lamb production is concentrated in the northcentral counties, while hog production is greatest in the eastern half of the state.

Changes taking place in the agricultural sector in Oklahoma are similar to those occurring in agriculture elsewhere in the United States; the number of farms continues to decline, and farm size continues to increase (Table 2). According to the 1959 census, there were 94,676 farms in Oklahoma with an average size of 378.1 acres. This compares to 1964 census data which indicate a continuation of the trend as farm numbers reduced to 88,726 farms and the average farm size increased to 406.6 acres. The average size farm in 1959 was smallest for District I at 278.6, as compared with 337.0 acres for District II and 651.3 acres for District

Table 2—Agricultural Characteristics by Districts for 1959 and 1964

	1959				1964			
	Dist. I	Dist. II	Dist. III	Okla.	Dist. I	Dist. II	Dist. III	Okla.
No. of Farms	24,795	52,882	16,999	94,676	24,263	49,101	15,362	88,726
Avg. Size Farm	278.6	337.0	651.3	378.1	294 2	363.0	723.7	406.6
Value Crops Sold Per Farm	$ 825	$2,537	$ 5,646	$2,647	$1,013	$3,151	$ 5,000	$2,887
Value Lvstk. Sold Per Farm	$2,597	$3,472	$ 4,832	$3,486	$2,492	$3,870	$ 6,110	$3.881
Total	$3,422	$6,009	$10,478	$6,133	$3,505	$6,021	$11,110	$6,768

	District I	District II	District III	Oklahoma
Changes in Number of Farms 1959-1964	532	3781	1637	5950
Percent of Decrease	2.1	7.1	9.6	6.3

Source: U. S. Department of Agriculture, U. S. Census of Agriculture, 1959-64, Vol. I Counties, Part 36.

III. The 1964 census figures indicate an increase in farm size in District I to 294.2 acres, in District II to 363.0 acres, and to 723.7 acres in District III. The percent decrease in the number of farms has been much smaller in District I than in Districts II and III. The tendency for families to remain on small and often uneconomical farm units in District I, may partly explain the low income situation in the district.

Sales of agricultural products per farm were greater in District III than in I or II. In District III about half of total value of sales per farm was from crops. District I, which had a much smaller value of sales per farm, received the majority of its farm income from sales of livestock products. District II had an average total value of sales per farm of $6,009 in 1959 and $6,021 in 1964. Over half of this was from the sale of livestock products. The low returns from agriculture in District I helps explain the low income situation in that district, since most of the people are employed in agriculture. The value of crops and livestock sold per farm in District I is about one-half that in District II and less than one-third that in District III.

Mineral Resources

The mining sector has an important role in the economic activity in Oklahoma. The resources from the mining sector provide the base for much of the industrial activity of the state. This is especially true in District II where 86 percent of the total value of mineral production for the state was mined in 1959. District I produced 5 percent, and District III 9 percent [15].

Oil and natural gas are mined in a broad belt extending from the north-eastern to the southeastern and western parts of the state. Non-metals are mined in widely extended parts of the northeast, northcentral and central areas. Also some non-metals are found in the Arbuckle and Wichita Mountains, which are located in southwestern and southcentral Oklahoma. A significant part of the mineral output is processed by Oklahoma industries into semi-finished and finished products for both intra- and inter-state shipment and consumption.

Manufacturing Sector

The output of the agricultural and mineral sectors provide the base for the manufacturing activity of the state. Census data indicate that over 50 percent of the industrial activity in Oklahoma is processing of mineral and agricultural products.

District II includes Tulsa and Oklahoma Counties, which are the manufacturing centers in Oklahoma. Plants located here can take advantage of the available transportation facilities, distribution facilities, public utilities, and other service-type businesses generally located in a metropolitan complex. According to Census data, 83 percent of the value added on manufactured goods was in District II, compared to 6 percent in District I, 9 percent in District III, while the remaining percentage was not disclosed [14].

Public and Private Services

The role of the government has grown tremendously and plays a major role in the economy of Oklahoma. The Federal government collected 810 million dollars in taxes in 1959. Individual income tax collections at 363 million dollars made up the largest share. Manufacturing excise tax and corporation taxes were 190 million dollars and 142 dollars respectively. Employment taxes of 92 million dollars were also rather large [19], [20]. Most of the state and local revenues were obtained from sales taxes, transfer payments and property taxes. The total state [10] and local revenue [13] were 545 million dollars in 1959.

Expenditures of the state and local governments were concentrated mostly in three categories. The largest public expenditure in Oklahoma was for education. The two large state universities, both located in District II, accounted for much of the state's expenditures for higher education. The second largest expenditure was highway construction and repair, which was widely dispersed among all three districts. The amount spent for welfare was the third largest expenditure by state and local governments. Welfare payments vary sharply among counties and are greatest in the counties with the lowest median family income, namely those in District I.

The largest private service sector consists of retail and wholesale businesses. A major share of this sector's activities are centered around the large metropolitan areas in District II. Food stores account for the major portion of the retail sales, while automotive establishments are second in retail sales. These two account for 42 percent of retail sales [16]. Merchant wholesalers accounted for 46 percent of the wholesale sales [17]. The activities of the remaining service-type sectors also are concentrated near the towns and cities, mainly in Districts I and II. Included are the transportation, communication and public utilities, and finance insurance and real estate, and service sectors. The service sector includes such business activities as auto repair shops, hotels, recreation centers, and professional services such as personal and medical services.

District Models

An input-output model for each district was devised to take into account the differences in economic activity among the districts. The design of the input-output model for each district is the same as that for the state reported in [7]. The data used were for 1959, because available secondary data were most complete for this year.[3] The main secondary sources of data used to obtain the district models were: the 1959 agricultural census; annual manufacturing data [12]; mineral data [18]; government tax data [13 and 19]; wage and salary data [11]; wholesale and retail census data [16 and 17]; and employment data [11]. Industries were aggregated into the same sectors as for the state input-output table. Nine endogenous and seven exogenous sectors were considered. The sectors are:

Endogenous Sectors	Exogenous Sectors
Livestock and Livestock Products	Maintenance Construction
Crops	New Construction
Agricultural Processing	Federal Government
Manufacturing	State and Local Governments
Transportation, Communication and Public Utilities	Household
Real Estate, Finance and Insurance	Exports
Services	Imports
Wholesale and Retail	
Mining	

In constructing the district models, the state model was divided into three models to represent the economy of each district. It was necessary to begin with the state model unadjusted for imports. Three major steps were needed to convert the state model (unadjusted for imports) to represent each district. First, an adjustment was made for the production in each district. Census data provided most of the information needed to estimate total output or production for each sector in each district. It was assumed that each district required inputs in direct proportion to their production. For example, District I produced 19 percent of the livestock products produced in the state and thus required 19 percent of the state inputs for livestock production. Thus a simple multiplication provided the first approximation of the district models.

The second step consisted of an adjustment for difference in technology among the districts. Wage and salary data were used to adjust for technological differences [11]. As a district adopts new technology, several changes in wages and salary per unit of output are expected. In

[3] For a detailed explanation of the secondary data used in the state model and the sources of the data see [2, pp. 67-114].

primary and manufacturing sectors, capital will be substituted for labor. Thus the amount spent for wages and salaries per dollars worth of output becomes smaller. Also as an economy develops, the service-type sectors become more important. These sectors generally provide personal service often not found in less developed districts and thus a high proportion of the inputs for these sectors is wages and salaries. This adjustment was accomplished by entering the wage and salary data for each district into the models. Then each column of each table was adjusted percentage-wise upward or downward depending upon whether the sector paid more or less per unit of output than the state average for wages and salaries.

The third step consists of allowing for the effects of imports and exports. The export and import figures were computed by determining the total demand of each sector and the amount of the product demanded for final consumption within each district. The amount produced above these demands was the amount exported. The excess of demands above that which was produced within the district was imported. The amount imported by each sector was determined by assuming its share of the total imports was equal to the proportion it used of the total demand in the district. Therefore each sector had an import entry. By computing these figures in this manner, the resulting export and import entries are net figures. The end result was three input-output models corrected for production, technology and net imports and exports.

From all indications, the district models derived with these adjustments represent the economic structure of the districts. One place to check for reasonableness is in the export column. The columns of the inter-industry flow tables reflect some of the economic characteristics which exist in the districts. These adjustments indicate that District I has a very small export base as compared to the other two districts. It exports 88 million dollars worth of goods as compared to 456 million and 227 million for Districts II and III respectively [Tables 3, 4 and 5].

The structure of the economy and the adjusted model for District I indicate that livestock products and mineral resources are exported. District II exports goods and services from all sectors except from the manufacturing sector. It must be remembered that these are net figures, and even though District II produces most of the manufactured products of the state, it requires a large percentage of the states demand for them and thus is a net importer of manufactured goods. Many of the service-type requirements for District I and III are produced in the urban centers in District II. The adjusted models also indicate this as District II is a net exporter of service-type products. The structure of District III indicates that this area is characterized by large farms and ranches. This district also has a mining sector and a small demand for mineral prod-

Table 3—Interindustry Flows of Goods and Services, District I, Oklahoma Economy, 1959.

(Thousands of Dollars)

	Lvsk. & Lvsk. Products	Crops	Agric. Proc.	Manf.	Trans., Comm. & Pub. Ut.	Real Est. Fin. & Ins.	Service	Wholesale and Retail	Mining	Construction Maintn.	Construction New	Government Federal	Government State & Local	Household	Export	Total
Livestock and Livestock Products	15,560	[1]	4,361	11	-	292	22	-	-	-	-	-	19	2,576	53,469	76,310
Crops	17,774	1,396	2,260	204	42	430	42	170	-	-	443	2,712	-	3,116		28,589
Agricultural Processing	1,827	-	786	13	36	6	303	178	-	-	11	157	156	15,678		19,151
Manufacturing	302	847	333	2,141	1,537	727	2,078	2,398	1,545	3,083	8,032	4,255	1,988	23,878		53,144
Transportation, Communication and Public Utilities	2,656	942	733	2,311	9,149	714	3,401	4,299	2,431	1,275	4,109	4,971	3,915	27,774	1,904	70,584
Real Estate, Finance and Insurance	509	597	95	453	944	1,994	420	1,467	742	135	637	14	2,022	17,336		27,365
Services	220	322	301	605	1,569	549	1,708	4,132	2,536	236	2,801	1,466	1,715	26,001		44,161
Wholesale and Retail	2,040	1,274	477	2,807	1,728	812	1,085	2,572	2,102	3,860	7,324	5,593	2,615	64,001		98,290
Mining	19	114	13	9,938	2,386	54	22	11	3,373	493	1,241	471	320	351	27,496	46,302
Construction:																
Maintenance	696	495	75	59	4,617	1,841	133	709	430	-	-	723	13,825	55,453	5,073	84,129
New	289	206	42	533	3,192	639	46	246	1,808	-	9	279	5,324	18,315		30,928
Government:																
Federal	156	178	382	785	12,120	2,714	410	3,145	968	423	1,151	544	875	85,005		108,856
State and Local	2,304	1,337	275	852	4,745	430	166	2,417	2,786	476	1,293	8,166	-	38,158		63,405
Households																
Wages and Salaries	5,493	2,057	4,319	19,878	12,730	5,806	11,822	31,819	7,143	2,598	7,069	27,398	24,978	1,062		164,172
Proprietor Income	17,513	12,149	370	734	3,830	4,151	7,985	20,595	1,383	2,799	7,613	-	-	2,420		81,542
Rent Income	645	1,695	60	375	1,908	1,206	1,877	6,357	7,903	131	417	267	2,082	28,694		53,617
Imports	8,307	4,980	4,269	11,445	10,051	5,000	12,641	17,775	11,152	15,419	41,978	23,226	13,334	208,696		388,273
Total	76,310	28,589	19,151	53,144	70,584	27,365	44,161	98,290	46,302	30,928	84,129	80,242	73,169	618,514	87,942	

[1] Dash indicates zero or negligible quantity.

Table 4—Interindustry Flows of Goods and Services, District II, Oklahoma Economy, 1959.

(Thousands of Dollars)

	Lvsk. & Lvsk. Products	Crops	Agric. Proc.	Manf.	Trans., Comm. & Pub. Ut.	Real Est. Fin. & Ins.	Service	Wholesale and Retail	Mining	Construction Maintn.	Construction New	Government Federal	Government State & Local	Household	Export	Total
Livestock and Livestock Products	45,132	-[1]	107,338	506	-	2,923	399	-	-	-	-	-	95	13,233	47,996	217,622
Crops	54,623	9,859	58,975	10,045	269	4,567	797	1,508	-	-	2,183	25,921	-	16,962	1,688	187,397
Agricultural Processing	18,906	-	69,048	2,414	807	213	19,536	5,281	-	-	146	5,048	2,813	287,157	23,961	435,330
Manufacturing	3,801	24,511	36,189	424,699	39,514	31,273	160,560	86,209	82,239	61,617	159,960	164,159	43,643	525,343	-	1,843,717
Transportation, Communication and Public Utilities	7,705	6,282	18,059	107,368	54,768	7,153	61,589	36,026	30,270	5,934	19,116	44,837	20,071	142,696	5,790	567,664
Real Estate, Finance and Insurance	2,001	5,395	3,161	28,559	7,665	27,098	10,335	16,680	12,528	857	4,025	167	14,051	120,775	55,612	308,909
Services	1,446	4,861	16,737	63,681	21,239	12,485	70,012	78,366	71,478	2,497	29,498	29,868	19,913	302,149	73,167	797,397
Wholesale and Retail	7,983	11,462	15,878	175,989	13,956	10,982	26,472	29,070	35,299	24,204	45,944	68,029	18,103	443,363	43,553	970,287
Mining	54	757	340	461,898	14,284	548	399	94	42,003	2,291	5,773	4,240	1,641	1,805	204,445	740,572
Construction																
Maintenance	871	1,420	1,070	2,665	19,763	6,618	2,340	2,130	5,213	-	48	2,596	28,231	97,353		170,318
New	1,980	3,234	1,794	25,783	27,101	18,091	865	5,822	23,398	-	-	6,392	69,491	279,355		463,306
Government																
Federal	452	1,183	9,383	36,510	72,551	27,212	7,418	26,369	12,058	1,967	5,353	4,915	4,483	436,736		646,590
State and Local	6,684	8,915	6,760	39,613	28,406	4,304	3,023	20,253	34,677	2,212	6,016	73,658	-	196,047		430,568
Households																
Wages and Salaries	12,211	10,516	70,240	297,511	221,340	92,861	211,804	413,161	253,069	38,517	104,776	348,388	180,515	5,456		2,260,365
Proprietor Income	50,801	80,999	9,103	34,067	22,930	41,575	144,582	172,623	17,216	13,021	35,417	-	-	12,436		634,770
Rent Income	1,868	11,299	1,458	17,408	11,416	12,090	33,984	53,284	98,381	612	1,943	2,406	10,664	147,424		404,237
Imports	1,104	6,704	9,797	115,001	11,655	8,916	43,282	23,411	22,743	16,589	43,108	44,391	13,849	149,496		
Total	217,622	187,397	435,330	1,843,717	567,664	308,909	797,397	970,287	740,572	170,318	463,306	825,015	427,563	3,177,786	456,212	

[1] Dash indicates zero or negligible quantity.

Table 5—Interindustry Flows of Goods and Services, District III, Oklahoma Economy, 1959.

(Thousands of Dollars)

	Lvsk. & Lvsk. Products	Crops	Agric. Proc.	Manf.	Trans., Comm. & Pub. Ut.	Real Est. Fin. & Ins.	Service	Wholesale and Retail	Mining	Construction Maintn.	Construction New	Government Federal	Government State & Local	Household	Export	Total
Livestock and Livestock Products	20,672	-[1]	3,425	6	-	158	12	-	-	-	-	-	11	1,170	+71,879	97,333
Crops	25,019	7,225	1,881	120	26	246	24	129	-	-	232	1,619	-	1,499	96,072	134,092
Agricultural Processing	2,869	-	729	9	26	4	199	149	-	-	6	105	105	8,410		12,611
Manufacturing	277	2,779	181	784	598	261	756	1,136	1,764	1,004	2,633	1,585	758	7,163		21,679
Transportation, Communication and Public Utilities	3,257	4,249	532	1,191	4,927	356	1,734	2,847	3,894	582	1,875	2,585	2,080	11,643		41,752
Real Estate, Finance and Insurance	578	2,492	64	216	471	922	199	900	1,100	58	269	7	995	6,729		15,000
Services	263	1,414	213	303	821	267	847	2,664	3,955	107	1,244	742	887	10,605		24,332
Wholesale and Retail	3,184	7,312	442	1,842	1,184	517	703	2,168	4,284	2,241	4,253	3,700	1,770	34,123		67,723
Mining	25	554	11	5,553	1,392	29	12	9	5,857	243	614	265	184	160	58,848	73,756
Construction																
Maintenance	373	978	32	30	1,807	335	25	171	683	-	4	152	2,974	8,073		15,637
New	877	2,291	55	300	2,554	944	69	482	3,155	-	-	386	7,544	23,880		42,537
Government																
Federal	207	867	299	439	7,072	1,468	226	2,258	1,680	210	569	307	503	38,608		54,713
State and Local	3,062	6,532	215	476	2,769	232	92	1,733	4,834	235	640	4,601	-	17,331		42,752
Households																
Wages and Salaries	3,249	4,475	963	3,090	7,996	3,339	6,462	20,018	5,788	1,623	4,416	17,972	16,749	482		96,622
Proprietor Income	23,268	59,355	290	410	2,234	2,246	4,412	14,782	2,400	1,384	3,766	-	-	1,099		115,646
Rent Income	855	8,280	46	209	1,112	653	1,037	4,562	13,717	65	207	150	1,198	13,032		45,123
Imports	9,298	25,289	3,233	6,701	6,763	3,023	7,523	13,715	20,645	7,885	21,809	13,569	8,732	96,913		245,098
Total	97,333	134,092	12,611	21,679	41,752	15,000	24,332	67,723	73,756	15,637	42,537	47,745	44,490	280,920	226,799	

[1] Dash indicates zero or negligible quantity.

ucts. Thus, the structure supports the findings of the model as derived by the adjustment process for District III.

The ability of the predictive devices to represent the economy of each district depends on the reliability of the data and the adjustment technique. All checks on the models demonstrate that the input-output tables obtained reasonably reflect the economic structure of the districts. For each district model, three tables were constructed: an inter-industry flow table, a table of technical coefficients and a table of interdependence coefficients. The inter-industry flow table provides the base of the input-output model as the technical and interdependence coefficients are derived directly from it. From the interdependence coefficients are derived the empirical predictive devices.

The Inter-Industry Flow Table

The inter-industry flow of goods and services for each district is presented in Tables 3, 4, and 5. The inter-industry flow table for each district presents the dispersion of each sector's output among the purchasing and final demand sectors as well as the purchases made by each sector from the other sectors. By reading across a row, the amount of goods and services sold by a producing sector to a purchasing sector is indicated. For example, reading across the first row of Table 3, the livestock and livestock products sector in District I sold 15.56 million dollars worth of goods to farmers within the sector, 4.36 million dollars worth of goods and services to the agricultural processing firms, and .01 million dollars worth of goods to the manufacturing sector.

The livestock and livestock products sector also sold .29 million dollars worth of goods and services to the real estate, finance, and insurance sector; .02 million dollars to the service sector, .19 million dollars to the state and local government sector, and 2.58 million dollars worth of goods and services to the household sector. The export entry indicates that 53.47 million dollars worth of goods and services from the livestock sector left District I.

By reading down a column, the amount purchased by a sector from all the other sectors is determined. As an illustration, consider column three of Table III. The agricultural processing sector purchased 4.36 million dollars worth of goods and services from the livestock and livestock products sector and 2.26 million dollars worth of goods from the crop sector. The main items purchased from the livestock sector were slaughter animals, while wheat made up the bulk of the purchases from the crop sector. The agricultural processing sector purchased .79 million dollars worth of goods and services from industries within that sector. The purchases by the agricultural processing sector from the manufacturing sector were mainly packaging materials and equipment which equaled .33 million dollars. Purchases from the transportation, communication, and public utilities totaled .73 million dollars and from the real estate, finance, and insurance equaled .10 million dollars. The remaining entries of this column can be interpreted similarly. Also the remaining columns and rows can be interpreted as the column and row illustrated.

The flow pattern differs in each district. The total volume of goods and services sold is much greater in District II than in either District I or III. The relative flow of goods and services can best be seen by examining the technical coefficients for the districts.

Technical Coefficients

Technical coefficients indicate the amount of inputs purchased from each sector to produce one dollar's worth of output for a given sector. The technical coefficients are relevant only for the processing sectors, and thus are not computed for the final demand sectors. Presented in Tables 6, 7, and 8 are the technical coefficients for the three districts in Oklahoma. By considering the livestock and livestock products sector of District I (Table 6), the column of technical coefficients for the sector can be interpreted as follows. If production increases by one dollar, the livestock and livestock products sector will purchase 20 cents from industries within that sector, 23 cents from the crop sector, and 2 cents from the agricultural processing sector.

Also needed by the livestock and livestock products sector for a one dollar increase in output would be 3 cents worth of transportation, communication, and public utilities; 1 cents worth of goods and services from the real estate, finance, and insurance sector; and 3 cents worth of wholesale and retail services. Purchases necessary for the one dollar increase in output from the exogenous sectors total 46 cents.[4] Included in this total is the amount spent on construction, paid to the government, paid to households and spent on imports.

The technical coefficients for the three districts indicate the direct dependence of each sector on the other sectors and on imports. In general, the endogenous sectors in District II, with its great industrial and urban structure, have larger technical coefficients than does District I. Thus District II has a better base for economic development. It is difficult to generalize about the size of the technical coefficients when comparing Ditsricts II and III. However, on the average the coefficients in District II must be larger due to the smaller import requirements of that District.

[4] These figures were rounded to the nearest cent and need not total 1.00 because of the rounding technique.

Table 6—Technical Coefficients, District I, Oklahoma Economy, 1959.

	Lvsk. & Lvsk. Products	Crops	Agric. Proc.	Manf.	Trans., Comm. & Pub. Ut.	Real Est., Fin. & Ins.	Service	Whole-sale & Retail	Mining
Livestock and Livestock Products	.20391	--	.22772	.00021	--	.01067	.00050	--	--
Crops	.23292	.04883	.11801	.00384	.00060	.01571	.00095	.00173	--
Agricultural Processing	.02394	--	.04104	.00024	.00051	.00022	.00686	.00181	--
Manufacturing	.00396	.02963	.01739	.04029	.02178	.02657	.04706	.02440	.03337
Transportation, Communication, and Public Utilities	.03481	.03295	.03827	.04349	.12962	.02609	.07701	.04374	.05250
Real Estate, Finance and Insurance	.00667	.02088	.00496	.00852	.01337	.07287	.00951	.01492	.01602
Services	.00288	.01126	.01572	.01138	.02223	.02006	.03868	.04204	.05477
Wholesale and Retail	.02673	.04456	.02491	.05282	.02448	.02967	.02457	.02617	.04540
Mining	.00025	.00399	.00068	.18700	.03380	.00197	.00050	.00011	.07285
Construction									
Maintenance	.00912	.01731	.00392	.00111	.06541	.06728	.00301	.00721	.00929
New	.00379	.00721	.00219	.01003	.04522	.02335	.00104	.00250	.03905
Government									
Federal	.00204	.00623	.01995	.01477	.17171	.09918	.00928	.03200	.02091
State and Local	.03019	.04677	.01436	.01603	.06722	.01571	.00376	.02459	.06017
Households									
Wages and Salaries	.07198	.07195	.22553	.37404	.18035	.21217	.26770	.32373	.15427
Proprietor Income	.22950	.42495	.01932	.01381	.05426	.15169	.18082	.20953	.02987
Rent Income	.00845	.05929	.00313	.00706	.02703	.04407	.04250	.06468	.17068
Total	.30993	.55619	.24798	.39491	.26164	.40793	.49102	.59794	.35482
Imports	.10886	.17419	.22291	.21536	.14240	.18272	.28625	.18084	.24085
Total	1.00000	1 00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

Table 7—Technical Coefficients, District II, Oklahoma Economy, 1959.

	Lvsk. & Lvsk. Products	Crops	Agric. Proc.	Manf.	Trans., Comm. & Pub. Ut.	Real Est., Fin. & Ins.	Service	Whole-sale & Retail	Mining
Livestock and Livestock Products	.20739	--	.24658	.00028	--	.00946	.00050	--	--
Crops	.25100	.05261	.13547	.00545	.00047	.01479	.00100	.00155	--
Agricultural Processing	.08688	--	.15861	.00131	.00142	.00069	.02450	.00544	--
Manufacturing	.01747	.13080	.08313	.23035	.06961	.10124	.20136	.08885	.11105
Transportation, Communication, and Public Utilities	.03541	.03352	.04148	.05823	.09648	.02316	.07724	.03713	.04087
Real Estate, Finance and Insurance	.00919	.02879	.00726	.01549	.01350	.08772	.01296	.01719	.01692
Services	.00664	.02594	.03845	.03454	.03741	.04042	.08780	.08077	.09652
Wholesale and Retail	.03668	.06116	.03647	.09454	.02458	.03555	.03320	.02996	.04766
Mining	.00025	.00404	.00078	.25053	.02516	.00177	.00050	.00010	.05672
Construction									
Maintenance	.00400	.00758	.00246	.00145	.03484	.02142	.00293	.00220	.00704
New	.00910	.01726	.00412	.01398	.04774	.05856	.00108	.00600	.03159
Government									
Federal	.00208	.00631	.02155	.01980	.12781	.08809	.00931	.02718	.01628
State and Local	.03071	.04757	.01553	.02149	.05004	.01393	.00379	.02087	.04682
Households									
Wages and Salaries	.05611	.05612	.16135	.16136	.38991	.30061	.26561	.42580	.34173
Proprietor Income	.23344	.43224	.02091	.01848	.04039	.13459	.18132	.17791	.02325
Rent Income	.00858	.06029	.00335	.00944	.02011	.03914	.04262	.05492	.13284
Imports	.29813	.54865	.16679	.18928	.45041	.47434	.48955	.65863	.49782
Total	.00507	.03577	.02250	.06237	.02053	.02886	.05428	.02413	.03071
	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

Table 8—Technical Coefficients, District III, Oklahoma Economy, 1959.

	Lvsk. & Lvsk. Products	Crops	Agric. Proc.	Manf.	Trans., Comm. & Pub. Ut.	Real Est., Fin. & Ins.	Service	Whole-sale & Retail	Mining
Livestock and Livestock Products	.21238	--	.27158	.00028	--	.01053	.00049	--	--
Crops	.25705	.05388	.14916	.00554	.00062	.01640	.00099	.00190	--
Agricultural Processing	.02948	--	.05781	.00042	.00062	.00027	.00818	.00220	--
Manufacturing	.00284	.02073	.01435	.03616	.01432	.01740	.03107	.01677	.02392
Transportation, Communication, and Public Utilities	.03346	.03169	.04219	.05494	.11801	.02373	.07126	.04204	.05280
Real Estate, Finance and Insurance	.00594	.01858	.00507	.00996	.01128	.06147	.00818	.01329	.01491
Services	.00270	.01054	.01689	.01398	.01966	.01780	.03481	.03934	.05362
Wholesale and Retail	.03271	.05453	.03505	.08497	.02836	.03447	.02889	.03201	.05808
Mining	.00026	.00413	.00087	.25615	.03334	.00193	.00049	.00013	.07941
Construction									
Maintenance	.00383	.00729	.00254	.00138	.04328	.02233	.00103	.00253	.00926
New	.00901	.01709	.00436	.01384	.06117	.06293	.00284	.00712	.04278
Government									
Federal	.00213	.00647	.02371	.02025	.16938	.09787	.00929	.03334	.02278
State and Local	.03146	.04871	.01705	.02196	.06632	.01547	.00378	.02559	.06554
Households									
Wages and Salaries	.03338	.03337	07636	.14253	.19152	.22261	.26558	.29559	.07847
Proprietor Income	.23906	.44264	.02300	.01891	.05351	.14973	.18133	.21827	.03254
Rent Income	.00878	.06175	.00365	.00964	.02663	.04353	.04262	.06736	.18598
Total	.28127	.53776	.10301	.17108	.27166	.41587	.48953	.58122	.29699
Imports	.09553	.18860	.25636	.30909	.16198	.20153	.30917	.20252	.27991
Total	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

The direct import coefficients (from the imports row of Tables 6, 7, and 8) are much smaller in District II than in both I and III. The demand for imports is less in District II than in I or III. Most of the goods imported by any of the districts are manufactured products. There are many more manufacturing firms located in District II which can supply much of the demand in the district which explains in part the larger coefficients in the manufacturing row for District II than for District I and III.

An indication of the level of technology in each district can be gained from an examination of the coefficients of the row in Tables 6, 7, and 8 which is labeled wages and salaries. The wages and salaries coefficients for the two basic agricultural sectors in District III are smaller than the coefficients in I and II. This indicates the low requirement for hired labor and the associated high degree of mechanization in the basic agricultural sectors in III. The wages and salaries coefficients for the agricultural processing and manufacturing sectors are larger in District I than in the other two districts. The manufacturing firms employ a greater percent of labor than do similar firms in Districts II and III, indicating the firms are more labor intensive and less capital intensive.

District II has the largest wages and salaries coefficients for the service-type sectors. There are more jobs in service-type firms in District II and the labor is generally more skilled. As a result, the percent paid by these firms to the household sector is highest in District II. Similarly, the more skilled labor in the mining sector explains to a great extent, the larger technical coefficient in II than in I or III.

Interdependence Coefficient

The interdependence coefficients indicate the total change in input requirements as a result of a one dollar change in final demand for a particular sector. The total change includes the direct effect as represented by the technical coefficient as well as all indirect effects resulting from the initial one dollar change but does not include induced effects. The indirect effect is the difference between the interdependence coefficient and the technical coefficient. The interdpeendnce coefficients for Districts I, II and III are presented in Tables 9, 10 and 11. To illustrate the interdependence coefficient, consider a one dollar change in the agricultural processing sector in District III. The direct effects of such a change are listed in the column for agricultural processing in Table 8.

The agricultural processing sector directly requires 27 cents worth of goods and services from the livestock and livestock products sector. However, as the livestock and livestock products sector in turn changes its output to meet this new demand for its products, its purchases

Table 9—Interdependence Coefficients, District I, Oklahoma Economy, 1959.

	Lvsk. & Lvsk. Products	Crops	Agric. Proc.	Manf.	Trans., Comm. & Pub. Ut.	Real Est., Fin. & Ins.	Service	Whole-sale & Retail	Mining
Livestock and Livestock Products	1.2655	.0004	.3008	.0007	.0005	.0148	.0031	.0010	.0005
Crops	.3144	1.0522	.2045	.0050	.0015	.0218	.0033	.0029	.0010
Agricultural Processing	.0318	.0003	1.0506	.007	.0009	.0009	.0077	.0023	.0007
Manufacturing	.0199	.0370	.0316	1.0550	.0310	.0343	.0555	.0309	.0451
Transportation, Communication and Public Utilities	.0698	.0476	.0734	.0726	1.1586	.0405	.0989	.0590	.0776
Real Estate, Finance, and Insurance	.0187	.0260	.0150	.0160	.0188	1.0812	.0136	.0185	.0220
Services	.0131	.0175	.0256	.0300	.0319	.0265	1.0460	.0478	.0675
Wholesale and Retail	.0541	.0532	.0497	.0706	.0346	.0384	.0335	1.0324	.0577
Mining	.0083	.0138	.0108	.2155	.0486	.0108	.0154	.0086	1.0906
Output Multipliers	1.7956	1.2480	1.7620	1.4661	1.3264	1.2692	1.2770	1.2034	1.3627

Table 10—Interdependence Coefficients, District II, Oklahoma Economy, 1959.

	Lvsk. & Lvsk. Products	Agric. Crops	Proc.	Manf.	Trans., Comm. & Pub. Ut.	Real Est., Fin. & Ins.	Service	Whole-sales & Retail	Mining
Livestock and Livestock Products	1.3048	.0016	.3839	.0033	.0018	.0150	.0123	.0038	.0022
Crops	.3670	1.0586	.2802	.0112	.0030	.0233	.0121	.0058	.0034
Agricultural Processing	.1373	1.0030	1.2323	.0073	.0045	.0053	.0356	.0108	.0053
Manufacturing	.1506	.2284	.2532	1.4238	.1380	.1891	.3421	.1693	.2206
Transportation, Communication and Public Utilities	.0920	.0674	.1154	.1278	1.1271	.0535	.1301	.0674	.0816
Real Estate, Finance, and Insurance	.0332	.0432	.0334	.0384	.222	1.1044	.0280	.0265	.0295
Services	.0502	.0593	.0963	.1168	.0641	.0710	1.1352	.1096	.1395
Wholesale and Retail	.0999	.0980	.1145	.1686	.0488	.0677	.0841	1.0573	.0852
Mining	.0446	.0671	.0728	.3818	.0668	.0539	.0951	.0470	1.1210
Output Multipliers	2.2796	1.6257	2.5820	2.2790	1.4763	1.5832	1.8746	1.4975	1.6883

Table 11—Interdependence Coefficients, District III, Oklahoma Economy, 1959.

	Lvsk. & Lvsk. Products	Crops	Agric. Proc.	Manf.	Trans., Comm. & Pub. Ut.	Real Est., Fin. & Ins.	Service	Whole-sale & Retail	Mining
Livestock and Livestock Products	1.2839	.0004	.3704	.0010	.0006	.0147	.0040	.0012	.0006
Crops	.3558	1.0579	.2705	.0073	.0016	.0230	.0042	.0034	.0011
Agricultural Processing	.0405	.0003	1.0734	.0012	.0011	.0011	.0093	.0029	.0008
Manufacturing	.0153	.0259	.0270	1.0500	.0201	.0221	.0364	.0210	.0322
Transportation, Communication and Public Utilities	.0698	.0455	.0839	.0926	1.1426	.0361	.0902	.0557	.0773
Real Estate, Finance, and Insurance	.0176	.0231	.0163	.0191	.0156	1.0677	.0155	.0162	.0204
Services	.0135	.0167	.0289	.0386	.0281	.0234	1.0412	.0446	.0665
Wholesale and Retail	.0698	.0654	.0737	.1149	.039	.0441	.0389	1.0393	.0738
Mining	.0088	.0137	.0129	.2956	.0470	.0098	.0140	.0081	1.0981
Output Multipliers	1.8750	1.2489	1.9570	1.6203	1.2963	1.2420	1.2497	1.1924	1.3708

from the other sector will increase. As the amount of purchases from other sectors change, each sector will change its output to meet the new demand. These sectors in turn will change their purchases from every other sector, including the livestock and livestock products sector. All these secondary repercussions are measured in the indirect effect.

The direct and indirect effects in the agricultural processing sector of District III as a result of a one dollar increase in output are listed in Table 12. A change in the agricultural processing sector had the largest direct effect on the livestock and livestock products sector and the largest indirect effect on the crops sector.

The interdependence coefficients are larger for District II than for Districts I and III. The interrelationships among the sectors in II indicate a more economically developed base in the district. The smaller coefficients in I indicate less interdependencies among the sectors and less economic activity. The immediate implication is that an investment in District I would generate less activity than would the same investment in either District II or III.

District III tends to have larger interdependence coefficients for the basic agricultural and the industrial sectors and smaller coefficients for the service-type sectors than does District I. There is more interaction of the basic agricultural sectors with the other sectors in District III reflecting the much larger basic agricultural output in District III. Similarly, there is more interaction of the two industrial sectors with the two agricultural production sectors in District III. The large coefficients for the service-type sectors in District I indicates a larger, more developed base of service-type firms in the district. This can be explained by a larger industrial output in District I than in III and in part at least by a large nonfarm population in I that would require more services than a population sparsely settled as in District III.

Table 12—Effects of One Dollar Increase in Output of the Agricultural Processing Sector of District III.

	Total Effect	Direct Effect	Indirect Effect
Livestock and Livestock Products	.37	.27	.10
Crops	.27	.15	.12
Agricultural Processing	1.07	1.06	.01
Manufacturing	.03	.01	.02
Transportation, Communication and Public Utilities	.08	.04	.04
Real Estate, Finance and Insurance	.02	.01	.01
Services	.03	.02	.01
Wholesale and Retail	.07	.04	.03
Mining	.01	.00	.01

Empirical Results

The input-output multipliers which are derived from the interdependence coefficients are used to predict the total change in sector output, income, and employment due to a change in demand for goods and services of a sector. The multipliers assume that the economic structure is as depicted by the input-output table, and they indicate nothing about the potential and extent of an increase in demand or the availability of basic resources to meet the demand. If the economic base of a district is small, the effect of an economic change within a district generally will be reduced as a result of importing goods and services into the district.

The effect that imports have on a multiplier is referred to as leakage. To compute the leakage coefficient, multipliers for each sector for each district are computed under the assumption that each district produces all of the products demanded by the producing and final demand sectors. In other words, no goods and services are imported from the other districts in the state or outside the state. The difference between each multiplier computed under the assumption and those computed from the original model with imports is the leakage coefficient associated with each multiplier.[5]

Leakage would be expected in the three models for Oklahoma as there is considerable trading among districts. It is not always feasible or even desirable to eliminate leakage by expanding industries in a district as some areas are not suited for certain economic activity. However, leakage is an important consideration for assessing the alternatives available for promoting economic growth and development.

Output Multipliers

Output multipliers measure the amount of output generated by a dollar change in final demand for products of a particular sector. They are computed directly from the interdependence coefficients (Table 9, 10, and 11) by adding down the column for each sector to obtain the output multiplier for that purchasing sector. For example, from Table 9, by adding down the column for the livestock and livestock products sector, the output multiplier for the sector is 1.80. This indicates that a one dollar change in final demand in District I for livestock and livestock products will cause a change in total output of 1.80 in District I. Output multipliers for each sector in each district are listed in Table 13. Also listed are the leakage coefficients for each multiplier of each sector in each district. Leakage is the net amount of a change in total

[5] For a detailed calculation procedure, see [8].

output as a result of the one dollar change in final demand that is not realized within the district due to imports.

The multipliers for District II are larger than those for either District I or III. The greater industrial activity, as well as the large number of urban centers in District II, account for most of the differences. The multipliers for District I and III are very similar except for three sectors: livestock and livestock products, agricultural processing, and manufacturing. For each sector, the multipliers are larger in District III. There is more interaction of these sectors with the other sectors in District III than in District I.

The agricultural processing sector has a relatively large multiplier in all three districts. If demand for products in this sector changes by one dollar, output will change by $1.76 in District I, $2.58 in District II and $1.96 in District III. These multipliers indicate the large interaction of this sector with the other sectors, especially the two basic agricultural sectors. Leakage for the agricultural processing sectors is large for districts I and III, due to the large amount of manufactured goods and services imported by industries in the sector from outside each district. The multipliers of the livestock and livestock products sector are also relatively large in all three districts. Again, leakage is greatest in Districts I and III. In spite of the leakage coefficients, an expansion of economic activity in either the agricultural processing or the livestock and livestock products sector will generate more economic activity in each district than a similar change in any other sector. Expansion, of course, depends on the availability of resources in the districts and the amount of increase in demand. The greatest potential for expansion at the present in these two sectors most likely exists in Districts II and III as they have more of the available basic resources.

The multiplier for the manufacturing sector is larger in District II than in Districts I and III. The large urban centers located in District II can provide many of the services demanded by the manufacturing sector. Thus a change in manufacturing activity in District II generates considerable activity in the service-type industries located within that district. Districts I and III have less service-type industries, and as a result, a large part of any increased demand for service outputs is met by industries outside the districts. This is shown by the smaller multipliers and the large leakage coefficients for the two districts. Future expansion in manufacturing would most likely occur in Districts II with an established industrial base.

The output multipliers of the crop and mining sectors are small. An increase in demand for products in these sectors was met by more intensive use of inputs within the sector and thus a small increase in the demand for inputs from the other sectors. The result is a small degree of interdependence between the crop and mining sectors and all the other sectors. This condition is reflected in the input-output model in terms of smaller technical coefficients and small multipliers.

The remaining service-type sectors are similar in nature. The multipliers for these sectors are generally smaller than those of the primary and industrial sectors, principally because these sectors are rather labor-intensive and purchase relatively fewer goods from the primary sectors. The amount of economic activity of these sectors in a district depends on the industrial base of the district. The large industrial base in District II accounts for the larger magnitude of the multipliers for the service-type sectors in that district as compared with Districts I and III.

The multipliers for the service-type sectors are slightly larger in District I than in District III. There is a larger base of service activities in District I. The leakage coefficients for the service-type sectors are considerably larger in District III than in District I. Due to the smaller base of service activities in District III, more service-type goods and services have to be imported into the district.

Income Multipliers

The income multiplier is defined as the total change in income throughout the economy resulting from a one dollar change in income in a sector.[6] Income multipliers for the three districts are listed in Table 14. The amount of leakage associated with each multiplier is also listed in Table 14. Leakage is defined as the net amount of new income which is not generated within the district as a result of a one dollar increase in income because of imports into the district.

The agricultural processing sector has the largest income multiplier in each district. This indicates that if income from the agricultural processing sector increases by one dollar in each district, $2.22 income will be generated in District I, $4.16 in District II, and $4.42 in District III. The smaller coefficient in District I can be explained by the fact that a greater percent of the amount spent for total inputs goes to the household sector in District I. This means that a smaller percent of expenditures goes directly to other production sectors, thus creating the small interaction among the endogenous sectors in the economy.

The leakage associated with the agricultural processing sector is small for Ditsrict II, but rather large for Districts I and III. More goods and services used by agricultural processing firms are imported into Districts I and III than into District II. The large multipliers indicate that the agricultural processing sector has the largest impact on district

[6] For a computational procedure of the income multiplier, see [5]. The income multipliers computed from this analysis assumes the household sector as an exogenous sector, thus the induced effects are not included in the mutiplier. If included the multiplier would be larger.

Table 13—Output Multipliers and Leakage of the Sectors for the Three Districts of Oklahoma.

	District I			District II			District III		
	Multiplier		Leakage	Multiplier		Leakage	Multiplier		Leakage
	Size	Rank		Size	Rank		Size	Rank	
Livestock and Livestock Products	1.80	1	.50	2.28	2	.10	1.88	2	.66
Crops	1.25	8	.45	1.63	6	.15	1.25	7	.64
Agricultural Processing	1.76	2	.76	2.58	1	.18	1.96	1	1.16
Manufacturing	1.47	3	.64	2.28	3	.29	1.62	3	1.25
Transportation, Communication and Public Utilities	1.33	5	.41	1.48	9	.09	1.30	5	.56
Real Estate, Finance, and Insurance	1.27	6	.47	1.58	7	.13	1.24	8	.64
Services	1.28	7	.71	1.87	4	.24	1.25	6	.99
Wholesale and Retail	1.20	9	.46	1.50	8	.11	1.19	9	.65
Mining	1.36	4	.65	1.69	5	.15	1.37	4	.96

Table 14—Income Multipliers and Leakages of the Sectors for the Three Districts in Oklahoma.

	District I			District II			District III		
	Income Multiplier		Leakage Coefficient	Income Multiplier		Leakage Coefficient	Multiplier		Leakage Coefficient
	Size	Rank		Size	Rank		Size	Rank	
Livestock and Livestock Products	2.10	2	.63	2.73	3	.11	2.26	3	.64
Crops	1.20	8	.34	1.46	7	.09	1.20	7	.33
Agricultural Processing	2.22	1	1.17	4.16	1	.29	4.42	1	3.03
Manufacturing	1.47	3	.67	3.76	2	.49	2.28	2	2.02
Transportation, Communication and Public Utilities	1.44	4	.65	1.43	8	.07	1.37	5	.60
Real Estate, Finance and Insurance	1.28	6	.47	1.49	6	.09	1.24	6	.44
Services	1.22	7	.59	1.66	4	.15	1.18	8	.56
Retail and Wholesale	1.14	9	.32	1.30	9	.05	1.13	9	.32
Mining	1.42	5	.75	1.56	5	.10	1.47	4	.95

incomes. This is especially true in Districts II and III. Some effort might be expended to reduce leakage in Districts I and III, if the demand in the districts is sufficient to support new or expanded industries.

The sector with the second largest income multiplier for District I is the livestock and livestock products sector. The magnitude of the multiplier indicates that this sector has an impact on income almost equal to those of the agricultural processing sector and definitely better than the manufacturing sector. In Ditsricts II and III, the manufacturing sector has the second largest income multiplier. The multiplier for the manufacturing sector of District II is larger than that of the livestock sector. However, for District III, the multipliers for the livestock sector and the manufacturing sector are about the same, reflecting similar income impacts. Leakage due to imports is particularly large for the manufacturing sector in District III.

The income multipliers for the mining sector are similar in all three districts. The leakage coefficients are larger for Districts I and III, indicating that many of the goods and services needed by the mining sector in these districts are imported. Again the multipliers for the service-type industries are slightly larger in I than those in III. Multipliers for these sectors in District II are larger than either I or III, again reflecting concentration of service industries in the urban centers in District II.

It is important that any expanded economic activities depend on the available resources as well as the demand for more goods and services. These conditions have to be assessed in each district before new investment for expansion can be effectively utilized.

Employment Multipliers

The employment multiplier defines the change in employment due to a one unit change in the labor force of a particular sector.[7] The basic assumption in computing the employment multipliers for Oklahoma is that there is a linear relationship between employment and output in a sector. The relationship does not strictly hold for several sectors since output has been increasing while the number of employed has been decreasing. For example, in the more capital intensive sectors, such as the agricultural and mining sectors, new technology has replaced labor. Thus for these industries, the estimated multipliers would be too high. Another condition, particularly relevant in the basic agricultural sectors, is the presence of underemployment resources and unused capacity. Mainly because of these conditions, employment multipliers for the basic

[7] For a computation procedure of the employment multiplier, see [9].

agricultural and mining sectors were not computed. The linear assumption more nearly holds for the labor intensive service-type sectors.

The employment multipliers for the three districts are presented in Table 15. Each multiplier indicates the change in employment generated throughout the district by a one unit employment change in the sector specified. For example, if employment changes by one unit in the agricultural processing sector in each district, District I would expect a change in man-year employment of 1.24, District II a 2.87 man-year change, and District III a 1.55 man-year change. Employment leakage for each sector is also listed in Table 15. It is defined as the net amount of the employment caused by a one unit change in employment in a district which is lost to that district because of imports. For example, if employment changes by one unit in the agricultural processing sector in each district, the amount of employment lost in District I is 0.77 man-years, in District II 0.32 man-years and 1.64 man-years in District III.

The largest employment multiplier for the sectors in Districts II and III exist in the agricultural processing sector. This indicates that an expansion of economic activity in this sector will generate more jobs than similar changes in any other sector in these districts. The leakage coefficient associated with the agricultural processing sector in District III is rather large. Efforts to reduce this could prove profitable by expanding the within district effects of an increase in employment in the agricultural processing sector. The second largest employment multiplier for Districts II and III is for the manufacturing sector and it is only slightly smaller than that of the agricultural processing sector.

The multipliers for the agricultural processing and manufacturing sectors for District I are smaller than the rest of the sectors in that district. This is contrary to the situations in Districts II and III. The lack of interdependencies explains the smallness of the multipliers for these two sectors.

The service-type sectors in Districts I and III have similar size multipliers. In District II the magnitude of this multiplier reflects the effect of the location of the urban centers and indicates a relatively large employment effect resulting from an initial change. The leakage coefficients for the service-type sectors are larger in Districts I and III.

Using the District Models for Prediction and Policy Implications Policy Implications

For those advocating methods to improve the income situation in a poverty district, questions are constantly arising which require prediction of future economic conditions. The policy maker has a goal, but he must first know what change can be expected with existing conditions

Table 15—Employment Multipliers and Leakages of the Sectors In the Three Districts in Oklahoma.

	District I			District II			District III		
	Employment Multiplier		Employment Multiplier	Employment Multiplier		Empoyment Multiplier	Employment Multiplier		Employment Multiplier
	Size	Rank	Leakage	Size	Rank	Leakage	Size	Rank	Leakage
Livestock and Livestock Products	[1]								
Crops	[1]								
Agricultural Processing	1.24	4	.77	2.87	1	.32	1.55	1	1.64
Manufacturing	1.19	5	.49	2.72	2	.35	1.43	2	1.11
Transportation, Communication, and Public Utilities	1.41	2	.88	1.41	5	.07	1.30	3	.60
Finance, Real Estate and Insurance	1.35	3	.97	1.48	4	.09	1.24	5	.67
Services	1.43	1	1.54	1.70	3	.17	1.28	4	1.04
Wholesale and Retail	1.12	6	.38	1.26	6	.05	1.11	6	.34
Mining	[1]								

[1] Employment multipier not computed for sector.

and how these can be altered to obtain his goal. The usefulness of the district input-output models for prediction purposes can be illustrated by considering the low income situation in District I relative to District II. The main question is whether the relative income levels for District I will improve in the future, say by 1975.

To use the input-output model for prediction problems of this nature, coefficients for the resources from the exogenous sectors are needed. These coefficients for Districts I, and II and III are presented in Tables 16, 17, and 18. For the three models the exogenous sectors were aggregated into four sectors: construction, government, households and imports. The coefficients are calculated by multiplying the direct coefficients of the exogenous sectors by the matrices of interdependence coefficients.[8] Each coefficient indicates the amount of exogenous resources needed directly and indirectly for each dollar's worth of final demand for products of the sector represented by the column. For example, for each dollar of final demand for the livestock and livestock products sector in District I, 3 cents worth of construction is needed, 8 cents worth of government services, 65 cents worth of household services and 23 cents worth of imports. The tables can be used to answer questions concerning the amount of exogenous inputs required to meet any specified final demand for a particular sector or for all sectors.

Comparing Tables 16, 17, and 18, the coefficients reflect the differences in the economic bases of each district. The coefficients are somewhat higher in District II, except for the imports sector. As noted, Districts I and III import more manufactured products per unit of production than District II. The coefficients for the households sector are much larger in District II due to the greater degree of interdependence in the district. The requirement for construction and government services is also generally higher in District II.

To project the exogenous input requirements, final demand by sectors in 1975 were estimated for each district. The district final demand estimates are shown in Table 19. Total final demand in 1975 for each district was first estimated; these estimates were then used to allocate among districts the projected state final demand by sectors in 1975 [7, pp. 21-22]. The proportion of the district total to the state total was taken to be the same for all the sectors in a district. The result is an approximation of final demand by sectors barring significant structural changes or errors in estimating final demand.

Multiplying the matrix of exogenous resource coefficients times the estimated final demand vectors, yields estimates of the amount of inputs from the construction, government, households, and imports sectors needed to meet the final demand. These estimates are shown in Table

[8] For a caculation procedure, see [4, pp. 68-70].

Table 16—Primary Resources Coefficients, District I, Oklahoma Economy, 1959.

	Lvsk. & Lvsk. Products	Crops	Agric. Proc.	Manf.	Trans., Comm. & Pub. Ut.	Real Est., Fin. & Ins.	Service	Whole-sale & Retail	Mining
Construction	.034859	.035096	.026257	.032595	.133088	.104585	.018266	.019280	.064670
Government	.081885	.075647	.080835	.073849	.286380	.140010	.044225	.077183	.115122
Household	.650444	.668393	.551418	.578732	.377856	.521936	.597149	.681515	.502585
Imports	.232791	.220844	.341471	.314828	.202706	.233451	.340334	.222017	.317595

Table 17—Primary Resources Coefficients, District II, Oklahoma Economy, 1959.

	Lvsk. & Lvsk. Products	Crops	Agric. Proc.	Manf.	Trans., Comm. & Pub. Ut.	Real Est., Fin. & Ins.	Service	Whole-sale & Retail	Mining
Construction	.042432	.049095	.040343	.052563	.100346	.099398	.027873	.021488	.057212
Government	.101889	.129826	.119122	.120141	.216205	.139522	.067408	.077723	.103739
Households	.811522	.969629	.748263	.711912	.644017	.708070	.811347	.854511	.778371
Imports	.041577	.084962	.069047	.115249	.039313	.052937	.092680	.046083	.060591

Table 18—Primary Resources Coefficients, District III, Oklahoma Economy, 1959.

	Lvsk. & Lvsk. Products	Crops	Agric. Proc.	Manf.	Trans., Comm. & Pub. Ut.	Real Est., Fin. & Ins.	Service	Whole-sale & Retail	Mining
Construction	.035647	.034324	.030816	.044122	.123972	.096922	.016307	.018260	.068458
Government	.088569	.078119	.099742	.102179	.278933	.136033	.041983	.078741	.124207
Household	.635319	.645694	.455222	.390532	.372198	.514226	.576321	.656226	.437407
Imports	.240493	.241909	.414270	.463118	.224939	.252785	.365442	.246813	.369930

20. For the households sector, the estimates can also be interpreted as the level of income generated by the expected final demand. With the projected final demand, households in Districts I could expect $582, 956,000 worth of income, and households in District II could expect $4,379,680,000 worth of income in 1975. This includes wages and salaries, proprietor income, and rent income. Dividing this by the population estimate[9] for 1975 yielded per capita incomes of $1,352 and $2,081 for Districts I and II, respectively. Multiplying the per capita income amounts times the family size[10] yielded family incomes of $4,732 and $7,283 for Districts I and II, respectively.

At first glance, these income projections seem large. However, past data on income trends, which show that median family income almost doubled from 1950 to 1960 for Districts I and II, support the projected estimates [6, p. 34]. The important consideration is not the magnitude of these estimates, but the relative size of the family income of District I

[9] The population estimates were calculated bv deriving the annual change in population from 1960 to 1966 for these two districts. This percentage change was assumed to be the percentage change in population from 1966 to 1975.

[10] For illustration purposes, a family size of 3.5 was assumed. This was the family size in both districts in 1960 [6, p. 17].

Table 19—Estimated Final Demand for the Three Districts in Oklahoma for 1975.

	District I	District II	District III
	(Thousands of Dollars)		
Livestock and Livestock Products	36,606	207,253	24,708
Crops	25,047	141,809	16,906
Agricultural Processing	61,917	350,562	41,793
Manufacturing	295,566	1,673,428	199,502
Transportation, Communication and Public Utilities	83,669	473,714	56,475
Real Estate, Finance and Insurance	61,653	349,062	41,614
Services	133,980	758,564	90,434
Wholesale and Retail	213,807	1,210,526	144,316

Table 20—Estimated Requirements of Primary Inputs for the Three Districts in Oklahoma for 1975.

	District I	District II	District III
	(Thousands of Dollars)		
Construction	43,705	277,987	31,081
Government	97,671	634,415	72,593
Households	582,956	4,379,680	340,812
Imports	282,809	433,478	235,326
Mining	94,903	537,321	64,058

as compared with a designated minimum income level. If the aim is to improve the income situation in District I compared to District II, then regional comparisons are valid. In 1960, the median family income of District I was 62 percent of District II [6, p. 34]. The predictions for 1975 show the family income in District I as 65 percent of District II, indicating only a slight change in the income situation in District I compared with District II.

The results indicate that the projected conditions will not eliminate the depressed income situation in District I. Different policies have to be advocated. Two alternatives are available: (1) increase income by increasing final demand in District I, relative to District II, and (2) change the structure of the economy in District I.

The first alternative could include either an equal increase in demand in all sectors or an increase in one or several sectors. Suppose an equal increase in final demand in all sectors is suggested to make family income in District I equal to that in District II. Total income in District I would have to be $896,911,000 in 1975. To obtain this income, final sector demands would have to be 54 percent larger than the estimated 1975 demands. If demand is increased in only a few of the sectors, the percentage increases would be even larger.

The second alternative is to change the structure of the economy. This is probably the more realistic alternative, particularly if considered in conjunction with an increase in final demand. Structural changes are reflected by changes in the interdependence coefficients and the primary technical coefficients. The new coefficients can be used to determine future input requirements and expected income.

The projection of family income illustrates only one application of the district input-output models. In addition, an estimate of required government expenditures for 1975 can be obtained as well as an estimate of future import and construction needs for a district. For example, if family incomes in 1975 in District I were raised to the level of District II with no structural changes, government expenditures would have to be $150,413,000, construction demands would be $67,306,000, and $435,526,000 of goods and services would have to be imported. To those concerned with area development, the questions are: Will this level of government expenditures be available? Can the import and construction demands be met? Estimates of this nature are useful in determining future tax structures and needed public investments. They can also be used to determine the capacity in the construction industry which would be needed for expansion. In addition, they provide information about possible bottlenecks to economic development in meeting the import requirements.

The district input-output model used along with information about the availability of resources and estimates of final demand can be used for analyzing economic changes and suggesting policy alternatives. Of course, its practical value, like all quantitative methods, depends upon the degree to which the real world approximates the assumptions of the model, the reliability of data, and the adjustments made to derive the models.

The input-output model is based upon two fundamental assumptions. The most restrictive assumption is that the direct input-output coefficients are fixed. The assumption of fixed coefficients implies that technology remains constant, no external economies or diseconomies exist, and substitution possibilities due to changes in relative prices or availability of new material are not considered. This assumption places limits on the use of the input-output model as a long-range forecasting technique. The other assumption of the basic input-output model is that there are no errors of aggregation in combining industries into sectors. Industries within a sector are homogeneous and different from industries in other sectors. This implies that a given product is supplied by only one sector and there are no joint products. Conclusions drawn from the analysis indicate the average conditions of the industries within the sector. The more sectors included in the model, the less chance that errors of aggregation will arise.

Data often limits the application of the input-output model. In this analysis, primary data were used to obtain the state input-output model. Data limitations forced the necessity of using adjustment techniques to arrive at the district models. Of course, if the district models derived by the adjustment procedure do not reflect the structure of the economy, the predictive devices will be in error. Some possible data errors could arise in the technology adjustment, final demand estimates or total output figures. The import adjustment could also introduce some error. However, there does not appear to be any major inconsistencies between the district models and the observed structure of the economy of the districts. Thus, the technique used was able to derive meaningful and reasonable district models. In turn, the analysis provides useful and interesting estimates of how the district economy would respond to increases in aggregate demand, or how demand would have to change to accomplish a desired response.

Summary and Implications

The general objective of the study was to examine the economic structure of Oklahoma by dividing the state into three districts. Each district model consisted of nine endogenous and seven exogenous sectors.

The basic agricultural and mining sectors provide the raw materials for the agricultural processing and manufacturing sectors. The remaining producing sectors consist of service-type industries whose output depends on the demands of the agricultural, mining, and industrial sectors as well as the exogenous sectors.

Summary

The agricultural processing sector has the largest output multiplier of all sectors in Districts II and III, and is second largest in District I. In District I, it is exceeded only slightly by the multiplier for the livestock and livestock product sector. Thus, a change in output in the agricultural processing sector would generate more output throughout the economy of Districts II and III than an identical change in any other sector. The livestock and livestock products sector multiplier is the second largest in District III and tied for second in District II. The large multiplier for the manufacturing sector in District II indicates that expanding this sector will greatly affect economic growth.

The agricultural processing sector in all districts has the largest income multiplier. The second largest income multiplier for District I is that of the livestock and livestock products sector, whereas for District II and III, it is manufacturing sector. The sector with the third largest income multiplier for Districts II and III is the livestock and livestock products sector.

The agricultural processing sector had the largest employment multiplier for Districts II and III. This sector was followed closely in rank by the manufacturing sector in Districts II and III. The service-type industries had the largest multipliers in District I, but none of these multipliers were very large.

Output, income and employment leakage effects were computed for each sector. In all cases, the leakage coefficients for Districts I and III were the largest, mainly because the concentration of economic activity in the large urban centers reduced leakage due to imports in District II. In District II, the manufacturing sector had the largest leakage for all multipliers. District I had the most output and income leakage in the agricultural processing sector, whereas District III had the most output leakage in the manufacturing sector and the most income leakage in the agricultural processing sector.

The usual projections derived from an input-output analysis can be calculated for these sectors. This procedure assumes no structural changes over time. Estimates are made for final demand for some future period and then the amount of output required for the estimate is determined. Another application of the input-output analysis arises with regard to determining the required input from the household sector for a specified level of final demand. Since the inputs from the household sector are measured in money flow units, the procedure can be reversed to answer the following question: What level of final demand is needed to generate a specified level of returns to the households, for example, a median family income equal to $3,000?

Having specified an income goal for the district, the immediate problem is how to generate the required final demand in each sector. After estimating the final demand, it is an easy step to find the necessary level of endogenous outputs to satisfy the final demand. From this analysis, questions concerning whether a district is sufficiently developed to guarantee the level of final demand and to satisfy the output requirements can be asked. If these conditions are not met, then what actions are necessary to induce economic growth and development in the district? The input-output analysis can be used to provide answers to these and similar questions and information can be easily obtained to answer questions about the amount of government expenditures and the amount of imports needed to obtain a desired level of income.

Implications

Multipliers and leakage coefficients reveal that an increase in final demand in the agricultural processing, livestock and livestock products and manufacturing sectors would generate more economic activity throughout the Oklahoma economy than similar changes in the other sectors. The agricultural processing and livestock and livestock products sectors were dominant in Districts I and III, whereas these sectors along with the manufacturing sector were dominant in District II. An expansion of economic activity in these sectors would encourage the development of industries which use the resources found in the state.

Expanding the economic activity in these sectors would mean (1) the livestock sector would demand more products from the crop sector produced, (2) the agricultural processing sector would demand more raw materials from the crop and livestock sectors, and (3) the manufacturing sector would process more raw material products from the mining sector. If industries were encouraged to develop which depended very little on resources found in the district, then the amount of leakage would be large and less economic activity would be generated within the district.

In general the multipliers for District I were smaller than for Districts II and III. Thus any induced change would have less impact in District I than in II and III. In this case, the necessary expansion for a specified level of development would be greater in District I, provided there were no changes in the economic structure of the district. This is an important consideration, and economic development in the district may be obtained by changing the structure. Induced expansion in III could build substantially upon the established economic base in the district, since livestock production and agricultural processing are presently important sectors of the economy. Any induced expansion in II would also depend upon the existing base. Indications are that this is the district that would benefit most from industrial expansion. At the present it has the greater industrial base and the associated base of service industries.

Finally, the approach to development would certainly differ by districts. Any effective recommendation for induced economic expansion must be based on an examination of the particular district of interest.

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