Structure of the Texas Economy

Emphasis on Agriculture

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Summary

An input-output economic model was designed to provide public and private decision makers with empirical guidelines to assist the development and growth of the Texas economy. The model is utilized to quantify and portray the intricate flow of goods and services that bind sectors of the economy together and to estimate the economic impact that changes in particular sectors have on other sectors of the economy. Of primary interest are interrelationships among agricultural and agribusiness sectors and other sectors of the general economy.

Gross Texas Product (GTP) was estimated at $43.8 billion in 1967 or 5.52 percent of United States gross national product of $793.5 billion. This percentage was slightly higher than Texas's share of U.S. population of 5.49 percent. The labor intensive wholesale and retail trade sector was the largest contributor to GTP with $6.6 billion or 15.1 percent of the total for the State.

Agricultural and agricultural processing sectors are closely interrelated with other sectors of the general economy. Their impact on the economy is significant. Output, income and employment multipliers of these sectors were among the largest of the 31-sector multipliers computed in this study. The meat products output multiplier of 2.82 was the largest, followed by the poultry and eggs sector and meat animals sector with multipliers of 2.46 and 2.36, respectively. These output multipliers indicate the total change in output in the economy required to meet a $1 increase in final demand for each of the given sectors. These multipliers are large, relative to those of other sectors, because of closer linkages with sources of input supplies and resources within the State.

Income and employment multipliers were also large for agricultural sectors. Meat products, poultry and eggs and fats and oil mills sectors had the largest income multipliers of all sectors. It was estimated, for example, that if the meat products sector expanded its sales to final demand sufficiently that one additional dollar was paid to wages, salaries and other income, the total effect on the Texas economy would be to raise total income by $5.29. Other agricultural and agricultural processing sectors had relatively large income multipliers, as did certain manufacturing sectors. The largest manufacturing income multiplier was 3.40 in the petroleum refining sector.

Employment multipliers were highest in the meat products, petroleum refining and fats and oil mills sectors of the Texas economy in 1967. The creation of one new man-year of employment in any of these sectors, resulting from increased output, would have a significant impact on total employment in the general economy. This again reflects the relatively close relationship and high demand for resources located within the State.

Total production is projected to increase substantially to 1975 and 1980 for each of the 31 economic sectors considered in this study. This projection is based on an assumption of continued increases in population and per capita income, similar in magnitude to those of the recent past. Total value of output for the 10 agricultural sectors identified for study is projected to increase to $4.9 billion by 1975 and to $5.4 billion by 1980.

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Emphasis on Agriculture

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and

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THE ECONOMY OF TEXAS is complex. Economic activity within the State ranges from small, individually owned and operated farms and businesses to industrial and manufacturing establishments that are among the largest in the nation. Much of the state's economy is linked closely to that in other parts of the country and in foreign countries. An understanding of the economy's complexity and its interrelationships is critical in designing effective economic development programs.

The Texas input-output model presented in this report was developed to estimate the relationship of sales and purchases of goods and services among Texas industries and major sectors of the economy. Of specific interest was the relationship between major agricultural sectors of the economy and other agribusiness and related sectors. These relationships depict the interdependent structure of the Texas economy by indicating the dependence of industries upon one another and upon industries outside the State for markets and supplies. The study may be used to predict the effects of a change in one sector upon others in the State. By quantifying and portraying the intricate flows of goods and services that bind sectors in the economy together, this study provides public and private decision makers with empirical guidelines for assisting the development and future growth of the Texas economy.

The chief advantage of the input-output technique utilized in this study over other methods is that it provides estimates of indirect as well as direct effects of changes in the economy.[1] For example, if a meat processing plant locates in Texas, its direct economic effects are its purchases of inputs directly from other Texas industries and its employment, wages and other payments to the local economy. The economic impact of the new plant does not stop with this initial effect, however. As local suppliers sell products to the new plant, they, in turn, must increase their purchases and employment. Livestock producers may have to increase their output and, in turn, hire more labor and purchase more feed and livestock. Feed producers must then purchase more

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[1]For a complete description of the input-output technique see Gholam Mustafa and L. L. Jones, "Regional Input-Output Model Using Location Quotients," Departmental Program and Model Documentation 71–4, Department of Agricultural Economics, Texas A&M University, 1971.

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inputs in order to meet the increased sales. These are the possible indirect effects of the new plant on the State's economy. Such indirect effects may be expected to continue until virtually all sectors of the economy are affected by the initial change. This study provides tables which trace these repercussions and show the accumulated direct and indirect demands placed upon suppliers in the State on a sector-by-sector basis.

Purpose

The primary purpose of this report is to present the results of an input-output analysis of the interdependent structure of the Texas economy so as to identify interaction among different sectors of the economy, giving emphasis to agriculture. The report presents estimates of the value of transactions among economic sectors, technical and interdependent coefficients among sectors and output, income and employment multipliers for individual sectors. These findings are then used to make projections of 1975 and 1980 output requirements for each sector of the economy.

The specific objectives of the study were

1. To develop an input-output transaction matrix for the Texas economy.

2. To estimate direct and indirect interdependence among the different sectors of the economy.

3. To estimate output, income and employment multipliers for the different sectors of the economy and to make a comparative analysis of these multipliers.

4. To use the input-output model to project output requirements of each sector to 1975 and 1980.

The Texas Model

The interindustry model of the Texas economy presented in this report was based on secondary data[2] for 1967—the most recent year in which data from most census and other reports were complete and available. Sector output data published specifically for the State, such as that from the Texas Crop and Livestock Reporting Service and other state agencies, were utilized wherever possible. When state data were not available, national data, primarily from census reports, were used in the model after adjustment to reflect Texas demographic and economic

[2]An interindustry analysis based on survey data and similar to that reported herein is presently being completed by the Office of the Governor that gives more emphasis to the industrial sectors of the Texas economy. The analysis presented herein was developed independently. Secondary data were considered adequate since emphasis was given to agriculture and more secondary information is available for agricultural sectors than for the rest of the economy. Nevertheless, some differences may exist in estimated coefficients and multipliers of the two studies as a result of differences in data, analytical methods and basic assumptions.

conditions.[3] The basic source of data for estimating transactions among sectors of the Texas economy was the 1963 national input-output model[4] (6).

Economic sectors may be grouped into two categories, differentiated on the basis of their demand characteristics. These are the processing (also known as endogenous) sectors and the final demand (exogenous) sectors. Processing sectors actively engage in the production of goods and services, and the demand for products of a particular processing sector is functionally related to output of other processing sectors and/or final demand sectors. Included in the endogenous group are such sectors as dairy farm products, cotton, grain mill products, mining, construction and wholesale and retail trade.

The final demand sectors are known as exogenous sectors because changes in demand for products in these sectors occur autonomously and their repercussions are transmitted throughout the rest of the economy. Sectors such as government, households and exports to other regions are considered final demand sectors. Changes in the final demand sectors are determined by political decisions and consumer preference. Tracing the direct and indirect effects of a change in the exogenous sectors on the endogenous sectors is the primary objective of an input-output model.

The final payment sectors account for direct payments for wages, salaries, other labor income, proprietor income, including profits, and payments made outside the State for goods and services imported. For this study, final payments were divided into two sectors—imports and value added.

For purposes of this study, the Texas economy was disaggregated into 31 endogenous and five exogenous sectors. To emphasize the structure of Texas agriculture and the relationship between agriculture and the rest of the economy, the sectors were classified with as much detail as possible for agricultural production and agricultural product processing activities.[5] Other sectors of the model were relatively aggregative.

This study included the following sectors:

A. Agricultural Product Producing Sectors
    1. Dairy farm products
    2. Poultry and eggs
    3. Meat animals and other livestock products
    4. Cotton
    5. Food, feed grains and grass seeds
    6. Fruit and tree nuts
    7. Vegetables and other crops

[3]For detailed procedures of obtaining total Texas output, see reference 4, p. 155.

[4]For estimation procedure of the Texas flow table, see references 8 and 5, p. 14.

[5]For detail sector classification, see reference 4, p. 150.

8. Oil bearing crops

9. Farm forest, greenhouse and nursery products

10. Forestry and fishery products

B. Agricultural Product Processing Sectors

11. Meat products

12. Dairy products

13. Canning, freezing and dehydrating

14. Grain mill products

15. Fats and oil mills

16. Textiles, apparel and fabrics

17. Agricultural, forestry and fishery services

18. Other agricultural processing

C. Other Industrial Sectors

19. Mining

20. Construction

21. Lumber and wood products

22. Chemicals and fertilizer

23. Petroleum refining and related industries

24. Farm machinery

25. Other manufacturing

26. Transportation and warehousing services

27. Communications (radio, television and such) and utility (electric, gas and sanitary) services

28. Wholesale and retail trade

29. Finance, insurance and real estate

30. Other services

31. Government enterprises

D. Final Demand Sectors

32. Households

33. Gross private capital formation

34. Net inventory change

35. Government

36. Exports

E. Final Payments

Imports

Value added

Limitations

The limitations of the input-output study are related primarily to the basic assumption of constant input ratios or coefficients. The assumption of constant input ratios is that each industry operates on a production function where all inputs vary proportionately with the industry's output. This is a simplification of conventional theory regarding production functions. Nonproportional inputs, changes in product-mix, input substitutions and technological changes all constitute departures from the assumption used in this study. Yet, the assumption of constant input ratios is a first approximation to the more complex production functions of the real world. The accuracy of the model in depicting interrelation of the Texas economy depends on whether the errors

involved in using this first approximation are satisfactorily small. The issue is subject to empirical verification, and previous research has shown that the assumption of constant input ratios is not unreasonable although it is only the first approximation to reality (1).

The second limiting assumption is that there are no errors in the aggregation process of combining industries into sectors. This implies that industries within a sector are homogeneous and different from industries in other sectors and that each industry produces only one product.

Both these major assumptions limit the interpretation of the results of the input-output analysis. For instance, economic multipliers are developed for relatively broad sectors of the economy rather than for individual industries. Hence, each sector multiplier approximates that for the industries included in that sector. The limitations do not, however, negate the usefulness of the analysis for purposes of economic policy decision making for either public planning agencies or private enterprises.

Intersector Flow of Goods and Services

The intersector flow table (Table 1) is the basis of the input-output model. It summarizes the 1967 Texas intersector transactions of goods and services (in producer prices) by sector of origin and destination, with the single exception that the intersector transactions do not include capital goods sales in the intersector portion of the table. Capital goods affecting future production capability are, however, shown separately as sales to capital formation.

Each row entry represents the value of goods or services in millions of dollars sold by the producing sector to the purchasing sector represented by each column entry. For example (reading across the first row), in 1967 the dairy farm products sector sold $4.40 million worth of goods to the meat animals and other livestock products sector; $3.60 million worth of goods to the cotton sector; $7.71 million worth of goods to the food, feed grains and grass seed sector; $109 million worth of goods to the dairy products sector; and so on. The dairy farm product sector sold a total of $76.40 million of output to final demand sectors, of which $62.79 million worth of goods were sold to regions outside of Texas,[6] and $13.61 million worth were sold directly to Texas households. The amount of dairy products used on farms by producers is included in the households sector. Most of the output of dairy farm product and other agricultural product producing sectors was sold as intermediate products for further processing rather than as final products directly to households (Table 1).

[6]The export and import of goods and services by each sector were estimated on a *net* or *residual* basis. Consequently, these estimates may understate the actual quantity of goods and services exported and imported by individual sectors.

TABLE 1. INTERSECTOR FLOW OF GOODS AND SERVICES, TEXAS ECONOMY, 1967 (MILLIONS OF DOLLARS)

No.	Name[1]	1 Dairy	2 Poultry	3 Meat animals	4 Cotton	5 Grains	6 Fruit	7 Vege- tables	8 Oil crops	9 Farm forest	10 Forestry
1.	Dairy			4.40	3.60	7.71	.10	1.99	.52	.17	
2.	Poultry				1.99	2.67	.16	.66	.26	.10	
3.	Meat animals			396.60	30.84	44.81	.28	8.23	5.87	.32	11.80
4.	Cotton				4.42	27.15					
5.	Grains	69.15	28.81	349.05							
6.	Fruit						.01				
7.	Vegetables			1.41				2.42			
8.	Oil crops			.92					.85		
9.	Farm forest						.06			.31	2.93
10.	Forestry										3.52
11.	Meat products										
12.	Dairy products										
13.	Canning										
14.	Grain mill	18.95	71.33	73.65							
15.	Fats and oil	2.13	8.03	21.89							
16.	Textiles	.01		.04	.02	.07		.05			.20
17.	Agricultural services	1.98	22.38		80.78	23.21	1.73	5.38	1.63	.25	7.49
18.	Other agricultural processing	.68	.09	1.03				.05			2.26
19.	Mining		.37	.06	2.46	4.90	.10	.70	.12	.07	
20.	Construction	2.17	1.53	9.75	9.86	12.65	.37	2.34	.72	.24	
21.	Lumber	.01	.01	.04	.02	.02	.22	.83			
22.	Chemicals	.78	2.51	6.35	42.53	52.39	1.57	8.71	1.79	.18	.60
23.	Petroleum refining	1.79	1.89	7.48	18.95	37.53	.47	4.67	2.40	.68	3.46
24.	Farm machinery			.02	.26	.62		.03	.04	.01	
25.	Other manufacturing	.90	.49	1.87	2.20	3.88	.08	.53	.21	.27	4.36
26.	Transportation services	8.07	4.33	26.53	6.48	11.27	.38	1.79	.42	.33	4.45
27.	Communications services	1.79	1.74	5.90	8.72	9.82	.26	1.81	.33	.39	.02
28.	Trade	6.32	10.95	43.14	19.13	27.87	1.15	5.72	1.37	1.01	5.68
29.	Finance	4.08	2.22	20.36	85.06	74.26	.40	10.91	4.30	.30	.29
30.	Other services	5.06	.73	18.90	18.73	37.00	.64	3.48	2.34	.88	2.27
31.	Government enterprises	.03	.03	.18	.10	.12		.03	.01	.01	.05
	Import	20.79	18.39	101.13	25.01	38.15	1.12	10.58	4.40	1.77	23.70
	Value added	68.09	36.47	372.98	336.78	446.30	21.46	130.71	29.36	21.52	103.43
	Total	212.78	212.30	1,463.69	697.94	862.40	30.56	201.62	56.93	28.79	176.50

[1]For complete sector titles see pages 4 and 5.

TABLE 1. (Continued)

No.	Name[1]	11 Meat products	12 Dairy products	13 Canning	14 Grain mill	15 Fats and oil	16 Textiles	17 Agricultural services	18 Other agricultural processing	19 Mining	20 Construction
1.	Dairy		109.00								
2.	Poultry	86.96	.32					15.75			
3.	Meat animals	596.55					1.95		2.38		
4.	Cotton					32.31	11.62	7.00	.01		
5.	Grains	.25			98.53			21.70	6.45		1.05
6.	Fruit		.10	.98		.01		.65	.74		
7.	Vegetables			4.93	.23	1.07	.01	4.26	36.53		.38
8.	Oil crops					41.28		1.30	1.31		
9.	Farm forest							.17			8.10
10.	Forestry			6.18	.11	1.94	.99				
11.	Meat products	107.37	.69	4.28	1.99	28.39			4.73		
12.	Dairy products	.48	51.90	.25	1.04	.01			4.17		
13.	Canning	.47	.02	2.09	.41	.69			1.47		
14.	Grain mill	.81	.57	1.62	59.81	5.23	.24	3.01	53.32	.02	
15.	Fats and oil	1.67		3.50	38.58	121.70	.18		12.36		3.00
16.	Textiles	.05	.01		.17	.01	4.73	.13	.02	.02	.59
17.	Agricultural Services										.31
18.	Other agricultural processing	.29	3.32	4.08	6.46	.59			117.35	.01	.06
19.	Mining	.42	.24	.07	.82	.55	.14		.72	299.99	27.53
20.	Construction	1.35	.94	.41	.93	.70	.49		2.98	109.29	2.65
21.	Lumber	.29	.18	.05	.14	.17	.03	.51	.92	2.75	176.63
22.	Chemicals	.91	.37	.46	11.63	5.24	21.09	.09	14.70	72.32	152.47
23.	Petroleum refining	1.12	2.49	.32	.62	.83	.42	.35	4.27	42.54	178.46
24.	Farm machinery										.01
25.	Other manufacturing	16.12	12.29	12.99	9.65	9.48	5.02	9.32	44.52	132.65	1,075.28
26.	Transportation services	37.22	3.32	7.29	27.64	23.75	3.61	2.59	32.20	146.03	281.44
27.	Communications services	6.15	5.16	1.39	3.53	5.26	3.02	.08	12.72	102.23	58.99
28.	Trade	23.35	10.92	9.10	28.34	15.03	12.31	4.28	40.13	84.14	764.77
29.	Finance	4.72	6.16	1.52	2.81	2.74	3.70	4.16	13.98	624.07	93.79
30.	Other services	12.53	11.59	7.65	15.76	11.33	4.82	1.55	71.97	93.60	384.98
31.	Government enterprises	.59	.47	.13	.28	.19	.46	.02	1.55	4.12	4.30
	Import	77.45	164.72	56.97	62.38	135.02	156.87	43.82	268.49	294.98	1,946.51
	Value added	171.90	94.74	44.22	82.06	72.20	108.11	59.16	736.44	3,397.60	3,957.00
	Total	1,149.06	479.50	170.47	453.92	515.70	339.82	179.90	1,486.41	5,406.37	9,118.30

[1]For complete sector titles see pages 4 and 5.

TABLE 1. (Continued)

No. Name[1]	21 Lumber	22 Chemicals	23 Petroleum refining	24 Farm machinery	25 Other manu- facturing	26 Transpor- tation services	27 Communi- cations services	28 Trade	29 Finance	30 Other services	31 Govern- ment enterprises
1. Dairy									8.89		
2. Poultry						.13			7.21	2.43	
3. Meat animals		.29			2.08				41.59	1.27	
4. Cotton					.40				15.31		14.87
5. Grains		.17				5.46			49.39		16.22
6. Fruit						.01			.40	.33	
7. Vegetables		1.37			1.05	.18			7.68	.84	.03
8. Oil crops						.02			2.52		.23
9. Farm forest	1.20								.89	.19	.02
10. Forestry	25.93	3.58			.14					.54	
11. Meat products		7.35	.03		7.63	2.91	.01	5.80	.42	43.76	
12. Dairy products		.11			.07	.74		5.67	.49	8.82	2.82
13. Canning		.13				.16		.67	.10	1.38	
14. Grain mill	.01	9.80			3.80	.29	.01	4.73	.56	3.83	3.95
15. Fats and oil		46.51	8.96		1.31	.16		1.94	.31	2.18	1.12
16. Textiles	.18	.14	.04		2.84	.08	.03	.42	.14	.54	.05
17. Agricultural Services								12.70	1.17	.01	.03
18. Other agricultural processing		7.81	.02		.47	1.94	.06	11.62	2.04	46.12	.06
19. Mining	.12	98.99	3,592.49	.03	158.07	2.53	188.88	1.13	8.36	.76	10.46
20. Construction	1.16	16.56	126.80	.05	24.06	94.84	93.05	29.72	503.17	68.30	74.86
21. Lumber	47.20	2.88	.58	.05	27.69	.15	.06	4.23	.83	.08	
22. Chemicals	3.57	1,139.10	242.10	.38	250.10	3.93	4.29	33.11	22.89	100.18	5.13
23. Petroleum refining	5.67	162.82	593.90	.11	33.48	126.28	22.65	101.73	39.40	39.02	4.01
24. Farm machinery				.14	.70			.08	.03	.38	
25. Other manufacturing	12.18	159.31	68.59	9.18	1,807.80	51.63	13.46	123.88	53.19	398.27	4.08
26. Transportation services	12.64	94.04	350.43	.86	190.37	278.85	42.86	67.92	23.84	256.44	76.11
27. Communications services	6.57	103.24	150.56	.46	149.43	50.66	436.66	249.58	123.84	395.52	44.66
28. Trade	12.01	133.84	144.47	1.88	284.67	85.45	23.11	161.70	112.96	255.93	5.70
29. Finance	7.08	48.36	200.60	.50	129.66	110.45	52.59	544.46	793.98	429.58	14.80
30. Other services	8.23	252.19	176.96	1.55	279.30	113.48	122.99	561.00	354.36	675.23	23.46
31. Government enterprises	.29	6.27	4.58	.06	15.23	68.22	249.09	94.22	90.31	66.17	.58
Import	114.43	285.50	149.18	15.60	2,771.88	130.93	116.01	390.45	305.82	825.09	20.22
Value added	174.28	1,783.91	2,117.40	18.24	4,232.68	2,098.32	1,952.27	6,626.92	5,513.23	4,393.21	403.27
Total	432.76	4,364.27	7,927.67	49.10	10,374.92	3,227.80	3,318.10	9,033.69	8,085.29	8,016.39	726.75

[1]For complete sector titles see pages 4 and 5.

TABLE 1. (Continued)

No.	Name[1]	House-holds	Capital formation	Inventory change	Govern-ment	Export	Final demand	Intermediate demand	Total
1.	Dairy	13.61				62.79	76.40	136.38	212.78
2.	Poultry	92.85		.08	.73		93.66	118.64	212.30
3.	Meat animals	8.11		26.80	1.09	282.81	318.81	1,144.88	1,463.69
4.	Cotton			−26.71	355.48	256.08	584.85	113.09	697.94
5.	Grains	.19		15.16	71.29	129.51	216.16	646.24	862.40
6.	Fruit	25.40		1.51	.42		27.34	3.23	30.57
7.	Vegetables	111.27		15.62	12.36		139.24	62.38	201.62
8.	Oil crops	.76		12.53	−5.44	.66	8.51	48.42	56.93
9.	Farm forest	14.60			.33	−0.00	14.92	13.87	28.79
10.	Forestry	30.13		3.19	−33.54	133.80	133.58	42.92	176.50
11.	Meat products	906.64		10.27	16.80		933.70	215.36	1,149.06
12.	Dairy products	389.65		.51	12.77		402.93	76.57	479.50
13.	Canning	160.15		.77	1.97	−0.00	162.89	7.58	170.47
14.	Grain mill	128.54		4.43	5.39	−0.00	138.36	315.56	453.92
15.	Fats and oil	47.86		3.85	1.25	187.20	240.16	275.54	515.70
16.	Textiles	318.59	1.18	4.20	5.28		329.25	10.57	339.82
17.	Agricultural Services	1.09			−1.33	21.10	20.85	159.05	179.90
18.	Other agricultural processing	1,259.06		15.13	5.80		1,279.99	206.42	1,486.41
19.	Mining	13.04		−3.71	21.36	974.61	1,005.31	4,401.06	5,406.37
20.	Construction		3,315.10		1,744.78	2,866.49	7,926.37	1,191.93	9,118.30
21.	Lumber	125.84	30.49	6.34	3.54	−0.00	166.21	266.55	432.76
22.	Chemicals	420.78		22.44	123.43	1,596.13	2,162.78	2,201.49	4,364.27
23.	Petroleum refining	591.33		12.73	72.72	5,811.07	6,487.84	1,439.83	7,927.66
24.	Farm machinery	.25	44.83	1.09	.61		46.77	2.33	49.10
25.	Other manufacturing	2,694.46	1,692.64	199.16	1,744.99		6,331.24	4,043.68	10,374.92
26.	Transportation services	642.59	41.26	10.93	143.82	365.70	1,204.31	2,023.49	3,227.80
27.	Communications services	1,211.90	34.79		130.92		1,377.60	1,940.50	3,318.10
28.	Trade	5,803.32	348.93	23.33	60.53	461.18	6,697.28	2,336.42	9,033.70
29.	Finance	4,650.74	80.50		62.17		4,793.41	3,291.89	8,085.30
30.	Other services	4,006.91		.43	415.17	319.31	4,741.82	3,274.58	8,016.39
31.	Government enterprises	88.97			30.11	−0.00	119.08	607.67	726.75
	Import	431.28	11.90	1.51	190.52	−9,212.54	−8,577.33		
	Value added	274.68			3,952.82		4,227.50		43,831.77
	Total	24,464.59	5,601.62	361.59	9,148.14	4,255.90	43,831.79	30,619.12	

[1]For complete sector titles see pages 4 and 5.

Each column of the endogenous sectors of Table 1 depicts a sector's input structure. As an illustration, consider column 2. The poultry and eggs sector purchased $28.81 million worth of food, feed grains and grass seed; $71.33 million of Texas grain mill products; $8.03 million from fats and oil mills; and so on. In total, the poultry and eggs sector purchased $157.44 million of inputs from producers in the State. Poultry and egg producers also purchased $18.39 million of supplies and services from sectors outside the State as shown in the import sector row (Table 1).

These outlays account for $175.83 million, leaving $36.47 million as the portion of the output created by the poultry and egg sector itself (Table 1). This portion is called *value added,* and it represents what is available from the revenue of the sector for wages and salaries, interest, taxes, depreciation and returns on owner investment.

The term value added is analogous with gross national product originating in each sector. Strictly speaking, value added is not the same as gross income earned by Texas residents because it includes property income on nonresident-owned investment and wages and salaries paid to the workers outside the State.

The final demand sectors are types of sectors that do not purchase goods and services for resale within the State. However, some productive activities conducted within these sectors result in income. The value added in the household column indicates the value of the services of domestic employees. This income is shown in the value added row of the final demand columns of Table 1. The value added in the government column reflects wage and salary costs associated with government.

Gross Texas Product (GTP)

Gross Texas Product is the total value added by the production of goods and services within the State in 1 year. The term GTP is similar to Gross National Product (GNP) which represents the annual value of goods and services produced in the United States as a whole. Total GTP was $43.8 billion in 1967. This compares with a GNP in 1967 of $793.5 billion for the United States. Thus, Texas, which had about 5.49 percent of the nation's population, produced about 5.52 percent of the nation's gross national product.

GTP by sector of origin shows how much of the total GTP was created in each of the economic sectors of the State (Table 2). This is a useful measure of the incomes earned by the resources engaged in each activity (2).

The largest value adding sector in Texas was wholesale and retail trade, contributing $6.6 billion or 15.1 percent of the total gross income of the State (Table 2). This sector includes the gross margins (operating expenses plus profits) from selling activities

TABLE 2. 1967 GROSS TEXAS PRODUCT (VALUE ADDED) BY SECTOR OF ORIGIN

No.	Name	GTP (million $)	Percent of total	Rank
28.	Wholesale and retail trade	6,626.92	15.125	1
29.	Finance, insurance and real estate	5,513.23	12.580	2
30.	Other services	4,393.21	10.026	3
25.	Other manufacturing	4,232.68	9.651	4
20.	Construction	3,957.00	9.034	5
35.	Government	3,952.82	9.012	6
19.	Mining	3,397.60	7.758	7
23.	Petroleum refining and related industries	2,117.40	4.828	8
26.	Transportation and warehousing services	2,098.32	4.785	9
27.	Communications and utility services	1,952.27	4.451	10
22.	Chemicals and fertilizer	1,783.91	4.068	11
18.	Other agricultural processing	736.44	1.680	12
5.	Food, feed grains and grass seed	446.30	1.018	13
31.	Government enterprises	403.27	.919	14
3.	Meat animals and other livestock products	372.98	.851	15
4.	Cotton	336.78	.768	16
32.	Households	274.68	.626	17
21.	Lumber and wood products	174.28	.397	18
11.	Meat products	171.90	.392	19
7.	Vegetables and other crops	130.71	.298	20
16.	Textiles, apparel and fabrics	108.11	.247	21
10.	Forestry and fishery products	103.43	.236	22
12.	Dairy products	94.74	.216	23
14.	Grain mill products	82.06	.187	24
15.	Fats and oil mills	72.20	.165	25
1.	Dairy farm products	68.09	.155	26
17.	Agricultural, forestry and fishery services	59.16	.135	27
13.	Canning, freezing and dehydrating	44.22	.101	28
2.	Poultry and eggs	36.47	.083	29
8.	Oil bearing crops	29.37	.067	30
9.	Farm forest, greenhouse and nursery	21.52	.049	31
6.	Fruit and tree nuts	21.46	.049	32
24.	Farm machinery	18.24	.042	33
	GROSS TEXAS PRODUCT	43,831.77	100.000	

of wholesale and retail trade establishments, commissions of merchandise agents and brokers, state and local sales taxes, federal excise taxes collected and remitted and tips received by employees performing a trade function (7).

The trade supporting sectors, consisting of transportation and warehousing services; communications and utility services; finance, insurance and real estate; other services; and agricultural forestry and fishery services; generated $14.01 billion or 31.98 percent of GTP in 1967.

Among the product producing sectors, the "other manufacturing" sector ranked first, followed by petroleum refining and related industries and chemicals and fertilizer. The other manufacturing sector produced a gross income value of $4.23 billion or 9.7 percent of GTP. The petroleum refining and

related industries produced incomes of $2.12 billion or 4.83 percent of GTP, while the chemicals and fertilizer sector produced incomes of $1.78 billion or 4.07 percent of GTP.

The agricultural processing sectors generated $1.37 billion income and accounted for 3.13 percent of total GTP.

The resource sectors of the State, including agriculture, fisheries, forestry and mining, contributed $4.73 billion to the incomes of people who work in Texas, or 10.79 percent of GTP. However, these resource sectors play a more important role than is signified by the direct incomes they generate. These sectors are the suppliers to many manufacturing sectors whose output and incomes depend directly on the processing of basic resource materials produced by these sectors. Income multipliers (presented in a later section) take into consideration all such interdependence of incomes. These multipliers are more appropriate measures of total income generated by a given economic sector than is direct income.

Intersector Relations of the Texas Economy

A major portion of the output of Texas industries is sold to other Texas industries as an input into their production process. This type of transaction is referred to as *intermediate* since the sales are of goods and services to be used in further production. In the Texas economy, $30.6 billion of goods and services were sold to meet intermediate demand, and $43.8 billion of goods and services were sold to meet final demand in 1967.

Intersector Purchases

The percentage of total inputs that constitute intersector purchases within the State varied widely among sectors in 1967 (Table 3). The percentage of interindustry purchases ranged from as high as 97.43 percent in the case of the petroleum refining and related industries sector to a low of 32.30 percent in the case of the textiles, apparel and fabrics sector. Of the 16 sectors with the highest percentage of inputs purchased from within Texas, eight sectors were related to the agricultural products producing sectors. The relatively high dependence of agricultural products producing sectors on other sectors within the State resulted from the fact that farming was one of the earlier forms of economic development within the State and continues to be a significant segment of the economy. Consequently, input supplying industries had sufficient time to develop in response

TABLE 3. INTERSECTOR PURCHASES WITHIN TEXAS[1]

No.	Name	Total purchase from other Texas sectors (million $)	Percent of total purchase from other Texas sectors to total purchase	Rank
23.	Petroleum refining and related industries	5,661.09	97.43	1
31.	Government enterprises	303.26	93.75	2
4.	Cotton	336.15	93.08	3
11.	Meat products	899.71	92.07	4
27.	Communications and utility services	1,250.82	91.51	5
5.	Food, feed grains and grass seed	377.95	90.83	6
3.	Meat animals and other livestock products	989.58	90.73	7
2.	Poultry and eggs	157.44	89.54	8
22.	Chemicals and fertilizer	2,294.86	88.94	9
26.	Transportation and warehousing services	998.55	88.41	10
29.	Finance, insurance and real estate	2,266.24	88.11	11
6.	Fruit and tree nuts	7.99	87.71	12
1.	Dairy farm products	123.90	85.57	13
19.	Mining	1,713.79	85.32	14
7.	Vegetables and other crops	60.33	85.08	15
8.	Oil bearing crops	23.16	84.03	16
28.	Wholesale and retail trade	2,016.32	83.78	17
14.	Grain mill products	309.48	83.22	18
30.	Other services	2,798.09	77.23	19
9.	Farm forest, greenhouse and nursery	5.50	75.65	20
15.	Fats and oil mills	308.48	69.56	21
10.	Forestry and fishery products	49.37	67.57	22
18.	Other agricultural processing	481.48	64.20	23
17.	Agricultural, forestry and fishery services	76.92	63.71	24
20.	Construction	3,214.79	62.29	25
12.	Dairy products	220.04	57.19	26
21.	Lumber and wood products	144.05	55.73	27
13.	Canning, freezing and dehydrating	69.28	54.88	28
25.	Other manufacturing	3,370.36	54.87	29
24.	Farm machinery	15.26	49.45	30
16.	Textiles, apparel and fabrics	74.84	32.30	31

[1]In this table, the value added figure is not included.

to these markets. The two agricultural products producing sectors that purchased a relatively low percentage of inputs from industries within the State were the farm forest, greenhouse and nursery sector and the forestry and fishery products sector.

Petroleum refining and related industries, government enterprises and meat products sectors ranked high with respect to the percentage of total purchases from other Texas industries.

Intersector Sales

Sales by Texas sectors to other Texas sectors are shown in Table 4. The agricultural, forestry and fishery services sector sold the highest percentage of its total output to other Texas sectors, followed by the oil bearing crops sector, government enterprises sector, mining sector (including petroleum) and the meat animals and other livestock products sector. The mining sector made the largest dollar volume of sales by a sector to other Texas sectors. The difference in the volume of sales by Texas sectors to other Texas sectors occurred chiefly for two reasons—one reason is that many sectors sold a large part of their output outside the State for further processing; another reason is that, due to the different stages of production of different outputs, some products may be sold to the final demand sectors while some may need further processing. For example,

virtually all mining output must be further processed before consumption, and in numerous instances mining and manufacturing are combined into single, continuous operations at the same location.

Technical Coefficients

The technical coefficients of Table 5 represent the direct purchases per dollar of output of each sector from every other sector. Each column shows the value of inputs required directly from each of the sectors per dollar change in output in a specific sector. For example, to produce 1 dollar's worth of output, the meat products sector (sector 11) required 8 cents of output from poultry and eggs (sector 2), 52 cents worth of meat animals and other livestock products (sector 3), 9 cents of purchases among meat processors within the sector, 3 cents worth of transportation and warehousing services (sector 26) and so forth. Hence, these coefficients show the direct effect on each sector of a 1-dollar change in output in a particular sector.

As expected, the agricultural product processing sectors depended directly and heavily upon the agricultural producing sectors within the State for products. The agricultural sectors, in turn, were closely related to agricultural services, farm machinery, chemical and fertilizer sectors (Table 5). These sectors have a lesser effect on other industrial sectors of the economy.

TABLE 4. INTERSECTOR SALES WITHIN TEXAS, 1967

No.	Name	Sales to Texas sectors (million $)	Percentage of sales to Texas sectors to total sales	Rank
17.	Agricultural, forestry and fishery services	159.05	88.41	1
8.	Oil bearing crops	48.42	85.05	2
31.	Government enterprises	607.67	83.61	3
19.	Mining	4,401.06	81.41	4
3.	Meat animals and other livestock products	1,144.88	78.22	5
5.	Food, feed grains and grass seed	646.24	74.94	6
14.	Grain mill products	315.56	69.52	7
1.	Dairy farm products	136.38	64.09	8
26.	Transportation and warehousing services	2,023.49	62.69	9
21.	Lumber and wood products	266.55	61.59	10
27.	Communications and utility services	1,941.50	58.49	11
2.	Poultry and eggs	118.64	55.88	12
15.	Fats and oil mills	275.54	53.43	13
22.	Chemicals and fertilizer	2,201.49	50.44	14
9.	Farm forest, greenhouse and nursery	13.87	48.18	15
30.	Other services	3,274.58	40.84	16
29.	Finance, insurance and real estate	3,291.89	40.71	17
25.	Other manufacturing	4,043.68	38.98	18
7.	Vegetables and other crops	62.38	30.94	19
28.	Wholesale and retail trade	2,336.42	25.86	20
10.	Forestry and fishery products	42.92	24.32	21
11.	Meat products	215.36	18.74	22
23.	Petroleum refining and related industries	1,439.83	18.16	23
4.	Cotton	113.09	16.20	24
12.	Dairy products	76.57	15.97	25
18.	Other agricultural processing	206.42	13.89	26
20.	Construction	1,191.93	13.07	27
6.	Fruit and tree nuts	3.23	10.57	28
24.	Farm machinery	2.33	4.75	29
13.	Canning, freezing and dehydrating	7.58	4.45	30
16.	Textiles, apparel and fabrics	10.57	3.11	31

TABLE 5. DIRECT PURCHASES PER DOLLAR OF OUTPUT, TEXAS ECONOMY, 1967

| | | 1 | 2 | 3 Meat | 4 | 5 | 6 | 7 Vege- | 8 Oil | 9 Farm | 10 |
No.	Name[1]	Dairy	Poultry	animals	Cotton	Grains	Fruit	tables	crops	forest	Forestry
1.	Dairy			.00301	.00516	.00894	.00327	.00988	.00911	.00593	
2.	Poultry				.00285	.00310	.00516	.00328	.00462	.00341	
3.	Meat animals			.27096	.04419	.05196	.00929	.04083	.10307	.01098	.06688
4.	Cotton				.00634	.03148					
5.	Grains	.32501	.13572	.23847							
6.	Fruit						.00016				
7.	Vegetables	.00002		.00096				.01200			
8.	Oil crops			.00063					.01489		
9.	Farm forest						.00209	.00001		.01066	.01661
10.	Forestry										.01993
11.	Meat products										
12.	Dairy products										
13.	Canning										
14.	Grain mill	.08907	.33597	.05032							
15.	Fats and oil	.01002	.03783	.01496							
16.	Textiles	.00006	.00001	.00003	.00002	.00008	.00006	.00024	.00002	.00007	.00113
17.	Agricultural services	.00930	.10543		.11574	.02692	.05674	.02668	.02868	.00852	.04243
18.	Other agricultural processing	.00317	.00044	.00070				.00024			.01281
19.	Mining	.00002	.00173	.00004	.00352	.00568	.00319	.00348	.00210	.00229	
20.	Construction	.01018	.00720	.00666	.01413	.01467	.01205	.01160	.01266	.00844	
21.	Lumber	.00003	.00003	.00003	.00002	.00003	.00717	.00410	.00003	.00003	
22.	Chemicals	.00366	.01181	.00434	.06094	.06075	.05126	.04320	.03143	.00633	.00343
23.	Petroleum refining	.00843	.00893	.00511	.02716	.04352	.01539	.02318	.04208	.02372	.01959
24.	Farm machinery	.00001	.00001	.00001	.00037	.00072	.00013	.00017	.00068	.00002	
25.	Other manufacturing	.00424	.00229	.00128	.00316	.00450	.00264	.00261	.00365	.00934	.02470
26.	Transportation services	.03791	.02041	.01812	.00928	.01307	.01243	.00890	.00733	.01134	.02519
27.	Communications services	.00840	.00818	.00403	.01249	.01139	.00866	.00899	.00575	.01360	.00011
28.	Trade	.02970	.05158	.02947	.02742	.03232	.03759	.02835	.02414	.03515	.03215
29.	Finance	.01916	.01045	.01391	.12187	.08612	.01316	.05409	.07547	.01030	.00165
30.	Other services	.02380	.00345	.01291	.02683	.04290	.02082	.01728	.04103	.03048	.01287
31.	Government enterprises	.00013	.00015	.00013	.00015	.00014	.00015	.00013	.00013	.00020	.00026

[1]For complete sector titles see pages 4 and 5.

TABLE 5. (continued)

No.	Name[1]	11 Meat products	12 Dairy products	13 Canning	14 Grain mill	15 Fats and oil	16 Textiles	17 Agricultural services	18 Other agricultural processing	19 Mining	20 Construction
1.	Dairy		.22731								
2.	Poultry	.07568	.00067					.08752			
3.	Meat animals	.51917					.00575		.00160		
4.	Cotton					.06266	.03421	.03889	.00001		
5.	Grains	.00022			.21707			.12064	.00434		.00012
6.	Fruit		.00021	.00573		.00003		.00363	.00050		
7.	Vegetables			.02890	.00050	.00208	.00002	.02368	.02458		.00004
8.	Oil crops					.08004		.00720	.00088		
9.	Farm forest							.00094			.00089
10.	Forestry			.03623	.00025	.00376	.00291				
11.	Meat products	.09344	.00145	.02511	.00438	.05505			.00318		
12.	Dairy products	.00042	.10824	.00148	.00228	.00001			.00280		
13.	Canning	.00041	.00004	.01226	.00091	.00133			.00099		
14.	Grain mill	.00071	.00119	.00952	.13176	.01014	.00070	.01675	.03587		
15.	Fats and oil	.00145		.02053	.08500	.23599	.00054		.00831		.00033
16.	Textiles	.00004	.00002	.00003	.00038	.00002	.01413	.00072	.00001		.00007
17.	Agricultural services										.00003
18.	Other agricultural processing	.00025	.00692	.02392	.01424	.00115			.07895		.00001
19.	Mining	.00037	.00051	.00041	.00181	.00107	.00041		.00049	.05549	.00302
20.	Construction	.00117	.00195	.00242	.00205	.00136	.00145		.00200	.02022	.00029
21.	Lumber	.00026	.00037	.00027	.00031	.00033	.00009	.00283	.00062	.00051	.01937
22.	Chemicals	.00079	.00077	.00269	.02563	.01017	.06206	.00051	.00989	.01338	.01672
23.	Petroleum refining	.00098	.00519	.00188	.00137	.00160	.00124	.00192	.00287	.00787	.01957
24.	Farm machinery										
25.	Other manufacturing	.01403	.02562	.07618	.02127	.01839	.01477	.05181	.02995	.02454	.11793
26.	Transportation services	.03239	.00692	.04279	.06089	.04606	.01065	.01439	.02166	.02701	.03087
27.	Communications services	.00536	.01077	.00818	.00777	.01019	.00888	.00045	.00856	.01891	.00647
28.	Trade	.02032	.02277	.05339	.06244	.02914	.03624	.02382	.02700	.01556	.08387
29.	Finance	.00411	.01285	.00889	.00619	.00531	.01088	.02315	.00941	.11543	.01029
30.	Other services	.01095	.02417	.04490	.03471	.02197	.01419	.00859	.04842	.01731	.04222
31.	Government enterprises	.00051	.00097	.00073	.00062	.00036	.00135	.00013	.00104	.00076	.00047

[1]For complete sector titles see pages 4 and 5.

TABLE 5. (continued)

No.	Name[1]	21 Lumber	22 Chemicals	23 Petroleum refining	24 Farm machinery	25 Other manufacturing	26 Transportation services	27 Communications services	28 Trade	29 Finance	30 Other services	31 Government enterprises
1.	Dairy									.00110		
2.	Poultry						.00004			.00090	.00030	
3.	Meat animals		.00007			.00020				.00514	.00016	
4.	Cotton					.00004				.00189		.02047
5.	Grains		.00004				.00169			.00611		.02232
6.	Fruit									.00005	.00004	
7.	Vegetables		.00031			.00010	.00006			.00095	.00011	.00005
8.	Oil crops						.00001			.00031		.00031
9.	Farm forest	.00277								.00011	.00002	.00002
10.	Forestry	.05991	.00082			.00001					.00007	
11.	Meat products		.00168			.00074	.00090		.00064	.00005	.00546	
12.	Dairy products		.00003			.00001	.00023		.00063	.00006	.00110	.00388
13.	Canning		.00003				.00005		.00008	.00001	.00017	
14.	Grain mill	.00002	.00225			.00037	.00009		.00052	.00007	.00048	.00544
15.	Fats and oil	.00001	.01066	.00113		.00013	.00005		.00022	.00004	.00027	.00154
16.	Textiles	.00043	.00003	.00001	.00003	.00028	.00003	.00001	.00005	.00002	.00007	.00007
17.	Agricultural services								.00141	.00015		.00004
18.	Other agricultural processing		.00179			.00005	.00060	.00002	.00129	.00025	.00575	.00008
19.	Mining	.00028	.02268	.45316	.00065	.01524	.00078	.05691	.00013	.00103	.00010	.01439
20.	Construction	.00268	.00379	.01599	.00107	.00232	.02938	.02804	.00329	.06223	.00852	.10301
21.	Lumber	.10906	.00066	.00007	.00104	.00267	.00005	.00002	.00047	.00010	.00001	
22.	Chemicals	.00826	.26101	.03054	.00776	.02411	.00122	.00129	.00367	.00283	.01250	.00705
23.	Petroleum refining	.01310	.03731	.07492	.00224	.00323	.03912	.00683	.01126	.00487	.00487	.00552
24.	Farm machinery	.00001			.00291	.00007			.00001		.00005	
25.	Other manufacturing	.02814	.03650	.00865	.18687	.17425	.01600	.00406	.01371	.00658	.04968	.00562
26.	Transportation services	.02922	.02154	.04420	.01760	.01835	.08639	.01291	.00752	.00295	.03199	.10473
27.	Communications services	.01518	.02366	.01899	.00934	.01440	.01569	.13186	.02763	.01532	.04934	.06146
28.	Trade	.02775	.03067	.01822	.03822	.02744	.02647	.00697	.01790	.01397	.03193	.00785
29.	Finance	.01637	.01108	.02530	.01028	.01250	.03422	.01585	.06027	.09820	.05359	.02037
30.	Other services	.01902	.05779	.02232	.03163	.02692	.03516	.03706	.06210	.04383	.08423	.03228
31.	Government enterprises	.00067	.00144	.00058	.00115	.00147	.02114	.07505	.01043	.01117	.00825	.00080

[1]For complete sector titles see pages 4 and 5.

Changes in the manufacturing sectors exert a large effect on the mining, services and trades sectors.

Interdependence Coefficients

The technical coefficients in Table 5 represent only the direct or first-round effects. The interdependence coefficients (Table 6) reflect direct as well as indirect effects on the endogenous sectors of a change originating in the final demand sectors. Returning to the example of meat products, it is indicated in Table 5 that each additional dollar increase in final demand of the meat products sector directly required 8 cents output from the poultry and eggs sector and 52 cents worth of meat animals and other livestock products. If these sectors increase output by 8 and 52 cents in response to a 1-dollar increase in demand for processed meat products, they, in turn, must make additional purchases of materials and services. This is second-round, indirect effect which gives rise to a third-round, indirect effect. In this way, the indirect effects continue as in chain reaction until, ultimately, the effect of the initial change in final demand reaches almost every other industry within the State.

The interdependence coefficients presented in Table 6 represent the total direct and indirect effects on each sector resulting from a 1-dollar change in final demand for products of a particular sector. For example, the column for the meat products sector (sector 11) shows that in order to provide final consumers with an additional $1 million of meat products, a total output of $1,106,013 ($1,000,000 × 1.106013) of goods and services would ultimately be required from the meat products sector itself;[7] $805,366 ($1,000,000 × .805366) of goods and services from the meat animals and other livestock products sector; $226,074 ($1,000,000 × .226074) of goods from the food, feed grains and grass seed sector; and so on (Table 6).

The increase in output by the food, feed grains and grass seed sector in this case is an illustration of the indirect effects incorporated in the interdependence coefficients. Little of this output would be sold directly to the meat products sector to meet its increased output. Rather, the increase would be required for indirect sales made to the meat animals and other livestock products sector which would be required to increase its sales to the meat products sector. Similar indirect transactions are included in each of the interdependence coefficients.

The interdependence coefficients table is useful in examining and predicting the total impact of changes and adjustments in certain sectors of the economy on other sectors. Numerous changes, such

as that posed for the meat products sector, could be considered for any other sector presented in Table 6. The total output effects of locating a new industry, increasing or decreasing exports and/or changes in government spending may be predicted by using these coefficients.

Predictive Devices

The analysis of the interdependent structure of the Texas economy summarized in Table 6 provided the basis for developing empirical devices that may be used to predict the effects of planned or induced changes in some sector of the economy on total output, income and employment in the State. These devices are commonly referred to as *sector input-output multipliers,* and they indicate the effect that a change in output, income or employment in a particular sector will have on the rest of the economy.

Output Multipliers

The sum of a column of interdependence coefficients in Table 6 indicates the total direct and indirect requirements for output of products of all sectors within the Texas economy generated by the delivery of $1 to final demand by a sector. This sum is commonly referred to as the sector output multiplier. For example, the sum of the vertical column for the dairy farm sector (column 1, Table 6) is 2.04. This means that a $1 change in final demand for products of the dairy farm sector will cause a change in total output in the economy of $2.04. Of this total, just over $1 is produced by dairy farms, 36 cents is from increased output by the grains sector and 11 cents from grain mills (Table 6). Outputs by these sectors account for most of the multiplier.

Output multipliers for each of the 31 sectors identified in this study, ranked by magnitude, are presented in Table 7. Meat products, poultry and eggs, meat animals and other livestock products, grain mills products, fats and oil mills and petroleum refining have the highest output multipliers (Table 8). These multipliers are large, relative to those of other sectors, because of closer linkages with sources of input supplies and resources within the State. Each imports a relatively small share of its inputs. The meat products sector, for example, depends directly and heavily upon livestock and poultry producers in the State for supplies of slaughter animals. These producers, in turn, demand relatively large quantities of locally produced feed grains and other productive inputs purchased from agricultural suppliers and other sectors of the general economy. Such close interrelationship means that an increase or decrease in demand for products of these sectors will have a relatively large cumulative effect on the economy as a whole. The primary dampening influences on sector multipliers are the payments made outside the State for imports of goods and services and other payments to the final payments sectors.

[7]Of this $1,106,013, $1 million of output would have been sold to final consumers and $106,013 would have gone to intermediate demand. This latter increase in sales is the result of indirect effect on the meat products sector as other endogenous sectors increase their output in response to the initial change.

TABLE 6. DIRECT AND INDIRECT REQUIREMENTS PER DOLLAR OF DELIVERY TO FINAL DEMAND BY SECTORS, TEXAS ECONOMY, 1967

No.	Name[1]	1 Dairy	2 Poultry	3 Meat animals	4 Cotton	5 Grains	6 Fruit	7 Vege-tables	8 Oil crops	9 Farm forest	10 Forestry
1.	Dairy	1.00360	.00284	.00772	.00604	.00982	.00356	.01054	.01032	.00618	.00077
2.	Poultry	.00333	1.01173	.00256	.01377	.00637	.01047	.00607	.00785	.00439	.00421
3.	Meat animals	.02951	.02663	1.40164	.06638	.07728	.01498	.05977	.14884	.01646	.09713
4.	Cotton	.01420	.01864	.01444	1.01302	.03453	.00309	.00236	.00343	.00086	.00314
5.	Grains	.36023	.24554	.35748	.03804	1,02933	.01503	.02427	.04755	.00873	.03170
6.	Fruit	.00009	.00044	.00005	.00045	.00013	1.00038	.00011	.00013	.00004	.00017
7.	Vegetables	.00092	.00352	.00195	.00318	.00106	.00151	1.01302	.00109	.00030	.00159
8.	Oil crops	.00237	.00869	.00409	.00137	.00069	.00068	.00056	1.01596	.00020	.00070
9.	Farm forest	.00006	.00015	.00005	.00017	.00008	.00222	.00008	.00007	1.01080	.01718
10.	Forestry	.00024	.00063	.00027	.00019	.00017	.00062	.00040	.00013	.00005	1.02039
11.	Meat products	.00279	.00842	.00329	.00098	.00104	.00065	.00067	.00103	.00046	.00061
12.	Dairy Products	.00047	.00125	.00039	.00019	.00020	.00013	.00013	.00019	.00012	.00016
13.	Canning	.00016	.00053	.00015	.00004	.00004	.00003	.00003	.00004	.00002	.00004
14.	Grain mill	.10718	.39734	.08407	.01258	.00906	.00676	.00779	.01371	.00363	.00898
15.	Fats and oil	.02667	.09594	.03784	.00492	.00447	.00272	.00351	.00590	.00131	.00355
16.	Textiles	.00017	.00031	.00013	.00015	.00014	.00013	.00030	.00008	.00010	.00123
17.	Agricultural services	.02123	.11601	.01193	.12003	.03262	.05884	.02880	.03186	.00955	.04525
18.	Other agricultural processing	.00585	.00750	.00308	.00096	.00102	.00063	.00095	.00103	.00048	.01472
19.	Mining	.02252	.02391	.02115	.02835	.03917	.01838	.02301	.03248	.01889	.01522
20.	Construction	.02635	.02233	.02448	.03008	.02929	.01766	.02087	.02593	.01343	.00549
21.	Lumber	.00091	.00134	.00084	.00131	.00101	.00879	.00536	.00089	.00047	.00046
22.	Chemicals	.04558	.05951	.04747	.09399	.09539	.07516	.06642	.05525	.01351	.01297
23.	Petroleum refining	.03435	.03197	.03215	.04043	.05832	.02381	.03283	.05552	.02957	.02785
24.	Farm machinery	.00028	.00021	.00029	.00041	.00076	.00015	.00019	.00074	.00026	.00004
25.	Other manufacturing	.02628	.03873	.02133	.02842	.02585	.01833	.01694	.02187	.01984	.04035
26.	Transportation services	.06576	.07029	.04985	.02649	.03087	.02341	.02093	.02448	.01973	.03777
27.	Communications services	.02811	.03136	.02408	.02923	.02913	.01916	.02049	.02055	.02297	.00800
28.	Trade	.06285	.10518	.07138	.04917	.05262	.04995	.04245	.04453	.04343	.04569
29.	Finance	.07632	.06483	.07504	.16043	.12376	.03015	.07706	.10915	.02384	.01856
30.	Other services	.06714	.05743	.05927	.05768	.07389	.03878	.03756	.06882	.04385	.02871
31.	Government enterprises	.00600	.00683	.00539	.00597	.00581	.00346	.00392	.00468	.00353	.00275

[1]For complete sector titles see pages 4 and 5.

TABLE 6. (continued)

No.	Name[1]	11 Meat products	12 Dairy products	13 Canning	14 Grain mill	15 Fats and oil	16 Textiles	17 Agricultural services	18 Other agricultural processing	19 Mining	20 Construction
1.	Dairy	.00482	.25590	.00104	.00346	.00207	.00031	.00212	.00137	.00021	.00010
2.	Poultry	.08598	.00182	.00291	.00298	.00831	.00059	.09021	.00080	.00020	.00014
3.	Meat animals	.80537	.00942	.02882	.03234	.08074	.01143	.01780	.01002	.00152	.00108
4.	Cotton	.01008	.00384	.00263	.01728	.08461	.03553	.04572	.00193	.00050	.00029
5.	Grains	.22607	.09329	.01205	.26263	.02872	.00423	.15297	.01829	.00166	.00095
6.	Fruit	.00007	.00027	.00584	.00006	.00011	.00002	.00371	.00056	.00001	.00001
7.	Vegetables	.00147	.00050	.03056	.00175	.00342	.00022	.02464	.02724	.00018	.00014
8.	Oil crops	.00326	.00067	.00255	.01078	.10698	.00026	.00843	.00244	.00009	.00010
9.	Farm forest	.00005	.00003	.00067	.00006	.00013	.00007	.00101	.00002	.00005	.00100
10.	Forestry	.00027	.00012	.03764	.00099	.00522	.00313	.00003	.00023	.00012	.00141
11.	Meat products	1.10601	.00288	.03072	.01453	.08059	.00060	.00138	.00574	.00040	.00077
12.	Dairy products	.00092	1.12162	.00200	.00328	.00030	.00011	.00026	.00370	.00012	.00019
13.	Canning	.00060	.00011	1.01252	.00130	.00185	.00002	.00008	.00117	.00001	.00003
14.	Grain mill	.08240	.02982	.01583	1.15807	.02419	.00221	.05621	.04640	.00039	.00046
15.	Fats and oil	.03201	.00738	.03036	.13108	1.31446	.00256	.01159	.01770	.00051	.00110
16.	Textiles	.00015	.00009	.00013	.00052	.00009	1.01436	.00082	.00007	.00003	.00014
17.	Agricultural services	.01663	.00565	.00387	.00997	.01494	.00451	1.02014	.00172	.00020	.00033
18.	Other agricultural processing	.00292	.01026	.02778	.01908	.00284	.00055	.00135	1.08713	.00040	.00069
19.	Mining	.01761	.01241	.00942	.02135	.01523	.00864	.01265	.00830	1.06919	.02112
20.	Construction	.02016	.01255	.00993	.01788	.01412	.00648	.01109	.00825	.03420	1.00696
21.	Lumber	.00110	.00099	.00115	.00120	.00112	.00044	.00394	.00130	.00154	.02245
22.	Chemicals	.03520	.01608	.01517	.07221	.03843	.09122	.02774	.02397	.02386	.03163
23.	Petroleum refining	.02499	.01712	.01042	.02593	.01913	.00860	.01723	.00952	.01425	.02752
24.	Farm machinery	.00019	.00008	.00003	.00021	.00013	.00002	.00015	.00003	.00001	.00002
25.	Other manufacturing	.03784	.04661	.10725	.05242	.04502	.02749	.07496	.05045	.04275	.15386
26.	Transportation services	.07618	.02990	.06193	.10061	.08294	.01888	.03231	.03738	.03825	.04485
27.	Communications services	.02702	.02642	.02235	.03183	.02987	.01878	.01350	.02101	.03195	.02098
28.	Trade	.07598	.04677	.07172	.10220	.06133	.04596	.04909	.04272	.02690	.09701
29.	Finance	.05930	.04275	.02873	.05572	.04082	.02680	.06170	.02743	.14500	.03067
30.	Other services	.05782	.05413	.04653	.05563	.06051	.03070	.03562	.07210	.03687	.06552
31.	Government enterprises	.00650	.00532	.00574	.02731	.08966	.00441	.00360	.00503	.00636	.00522

[1]For complete sector titles see pages 4 and 5.

TABLE 6. (continued)

No.	Name[1]	21 Lumber	22 Chemicals	23 Petroleum refining	24 Farm machinery	25 Other manufacturing	26 Transportation services	27 Communications services	28 Trade	29 Finance	30 Other services	31 Government enterprises
1.	Dairy	.00014	.00018	.00019	.00007	.00008	.00022	.00020	.00032	.00144	.00049	.00146
2.	Poultry	.00038	.00048	.00021	.00010	.00017	.00027	.00014	.00035	.00120	.00099	.00059
3.	Meat animals	.00715	.00440	.00158	.00078	.00176	.00186	.00101	.00173	.00941	.00613	.00432
4.	Cotton	.00044	.00163	.00062	.00022	.00034	.00083	.00206	.00065	.00288	.00070	.02212
5.	Grains	.00276	.00283	.00162	.00063	.00105	.00357	.00287	.00189	.01056	.00319	.02667
6.	Fruit	.00002	.00001	.00001		.00001	.00001	.00001	.00002	.00006	.00006	.00002
7.	Vegetables	.00017	.00065	.00017	.00008	.00020	.00017	.00008	.00019	.00115	.00041	.00024
8.	Oil crops	.00009	.00164	.00026	.00005	.00010	.00008	.00009	.00010	.00044	.00015	.00064
9.	Farm forest	.00432	.00005	.00006	.00002	.00003	.00005	.00006	.00003	.00020	.00006	.00015
10.	Forestry	.06866	.00133	.00016	.00015	.00030	.00009	.00009	.00008	.00013	.00016	.00020
11.	Meat products	.00041	.00455	.00077	.00063	.00148	.00155	.00049	.00132	.00058	.00700	.00083
12.	Dairy products	.00012	.00028	.00017	.00013	.00014	.00051	.00049	.00091	.00025	.00153	.00455
13.	Canning	.00002	.00010	.00003	.00002	.00002	.00007	.00002	.00010	.00003	.00022	.00003
14.	Grain mill	.00087	.00457	.00055	.00037	.00093	.00068	.00082	.00120	.00150	.00197	.00725
15.	Fats and oil	.00061	.01987	.00265	.00045	.00101	.00053	.00050	.00073	.00075	.00131	.00341
16.	Textiles	.00059	.00009	.00004	.00010	.00036	.00005	.00004	.00007	.00004	.00011	.00011
17.	Agricultural services	.00319	.00053	.00023	.00014	.00017	.00030	.00038	.00163	.00102	.00038	.00348
18.	Other agricultural processing	.00134	.00354	.00064	.00047	.00054	.00118	.00051	.00201	.00082	.00716	.00080
19.	Mining	.01381	.06637	.53033	.00965	.02685	.02818	.07806	.01108	.00908	.01214	.03126
20.	Construction	.00892	.01524	.04059	.00610	.00831	.04183	.04809	.01281	.07393	.02033	.11573
21.	Lumber	1.12281	.00166	.00149	.00206	.00391	.00113	.00120	.00093	.00185	.00075	.00270
22.	Chemicals	.01733	1.36313	.05931	.02022	.04236	.00859	.00849	.00929	.01020	.02386	.02087
23.	Petroleum refining	.02179	.06039	1.09408	.00676	.00893	.05008	.01372	.01541	.01032	.01146	.01875
24.	Farm machinery	.00002	.00002	.00001	1.00293	.00009	.00001	.00001	.00002	.00002	.00006	.00003
25.	Other manufacturing	.04750	.07466	.04263	.23398	1.21971	.03414	.02121	.02612	.02545	.07459	.03382
26.	Transportation services	.04402	.04683	.07692	.02863	.03049	1.10645	.03469	.01648	.01303	.04699	.12816
27.	Communications services	.02698	.05157	.04675	.02145	.02776	.03029	1.16673	.04142	.02764	.07076	.08310
28.	Trade	.04098	.05532	.04148	.05014	.04008	.03944	.01930	1.02578	.02748	.04504	.02967
29.	Finance	.03160	.04185	.11083	.02450	.02873	.05572	.04082	.07788	1.12042	.07655	.04725
30.	Other services	.03579	.10289	.05713	.05030	.04653	.05563	.06051	.07908	.06387	1.11003	.05956
31.	Government enterprises	.00494	.00894	.00849	.00497	.00574	.02731	.08966	.01577	.01580	.01699	1.01126

[1]For complete sector titles see pages 4 and 5.

No.	Name	Output multipliers	Rank
11.	Meat products	2.82	1
2.	Poultry and eggs	2.46	2
3.	Meat animals and other livestock products	2.36	3
15.	Fats and oil mills	2.26	5
14.	Grain mill products	2.23	4
23.	Petroleum refining and related industries	2.12	6
1.	Dairy farm products	2.04	7
22.	Chemicals and fertilizer	1.94	8
12.	Dairy products	1.85	9
4.	Cotton	1.83	10
17.	Agricultural, forestry and fishery services	1.78	11
5.	Food, feed grains and grass seed	1.77	12
8.	Oil bearing crops	1.75	13
31.	Government enterprises	1.66	14
13.	Canning, freezing and dehydrating	1.64	15
27.	Communications and utility services	1.59	16
20.	Construction	1.54	17
30.	Other services	1.54	17
18.	Other agricultural processing	1.53	18
7.	Vegetables and other crops	1.53	18
21.	Lumber and wood products	1.51	19
10.	Forestry and fishery products	1.50	20
25.	Other manufacturing	1.50	20
26.	Transportation and warehousing services	1.49	21
19.	Mining	1.48	22
24.	Farm machinery	1.47	23
6.	Fruit and tree nuts	1.45	24
29.	Finance, insurance and real estate	1.43	25
16.	Textiles, apparel and fabrics	1.37	26
28.	Wholesale and retail trade	1.35	27
9.	Farm forest, greenhouse and nursery	1.34	28

Income Multipliers

Income multipliers measure the change in total income in the economy that results from a $1 change in income in a particular sector. The concept of the income multiplier is that an increase in final demand for products of a sector leads to a cumulative increase in income in the economy as higher output (both direct and indirect) generates increased payments in the form of wages, salaries and other income forms. This cumulative or total income change divided by the direct income change in the sector in which final demand initially increases, yields an estimate of the sector income multiplier.

The income multiplier was largest in the meat products sector at 5.29, followed by the poultry and egg sector at 4.36, fats and oil mills sector at 4.20 and the grain mills products sector at 4.07 (Table 8). An increase in income in any of these sectors would have a relatively large effect on income throughout the State.

The relative magnitudes of the income multipliers in Table 8 reflect differences in the linkages among sectors, use of local resources and the amounts paid as income out of total output of individual sectors.

Employment Multipliers

The employment multiplier measures the total change in man-years of employment in the economy resulting from a direct change of one man-year in the labor force in a particular sector. The concept of an employment multiplier is that the requirements for labor change in a number of sectors for each change in output and employment of an individual sector. As in the income multiplier, the cumulative employment change that occurs in all sectors is divided by the direct employment change to obtain the employment multiplier.

Employment multipliers for each of the 31 endogenous sectors are ranked and presented in Table 9. As expected, employment multipliers are highest in those capital intensive sectors that depend heavily on labor intensive sectors for inputs, such as agricultural processing. This results because the direct employment effect of the capital intensive sectors is relatively small, and a relatively large increase in output is required for an additional man-year to be

No.	Name	Income multipliers	Rank
11.	Meat products	5.29	1
2.	Poultry and eggs	4.36	2
15.	Fats and oil mills	4.20	3
14.	Grain mill products	4.07	4
23.	Petroleum refining and related industries	3.40	5
3.	Meat animals and other livestock products	3.25	6
12.	Dairy products	2.76	7
1.	Dairy farm products	2.56	8
13.	Canning, freezing and dehydrating	2.26	9
22.	Chemicals and fertilizer	2.09	10
17.	Agricultural, forestry and fishery services	2.08	11
4.	Cotton	1.83	12
5.	Food, feed grains and grass seed	1.73	13
8.	Oil bearing crops	1.67	14
20.	Construction	1.66	15
21.	Lumber and wood products	1.65	16
31.	Government enterprises	1.64	17
24.	Farm machinery	1.63	18
25.	Other manufacturing	1.61	19
16.	Textiles, apparel and fabrics	1.58	20
27.	Communications and utility services	1.57	21
30.	Other services	1.54	22
18.	Other agricultural products	1.53	23
19.	Mining	1.44	24
26.	Transportation and warehousing services	1.42	25
10.	Forestry and fishery products	1.39	26
7.	Vegetables and other crops	1.39	26
29.	Finance, insurance and real estate	1.35	27
6.	Fruit and tree nuts	1.30	28
28.	Wholesale and retail trade	1.27	29
9.	Farm forest, greenhouse and nursery	1.22	30

TABLE 9. TOTAL CHANGE IN MAN-YEARS OF EMPLOY-
MENT PER ONE MAN-YEAR DIRECT CHANGE IN EM-
PLOYMENT BY SECTORS OF THE TEXAS ECONOMY,
1967

No.	Name	Employment multipliers	Rank
11.	Meat products	8.57	1
23.	Petroleum refining and related industries	7.67	2
15.	Fats and oil mills	7.19	3
18.	Other agricultural products	6.48	4
14.	Grain mill products	4.94	5
10.	Forestry and fishery products	3.95	6
12.	Dairy products	3.77	7
22.	Chemicals and fertilizer	3.20	8
2.	Poultry and eggs	2.57	9
3.	Meat animals and other livestock products	2.37	10
27.	Communications and utility services	1.99	11
20.	Construction	1.98	12
29.	Finance, insurance and real estate	1.84	13
1.	Dairy farm products	1.80	14
19.	Mining	1.79	15
17.	Agricultural, forestry and fishery services	1.70	16
26.	Transportation and warehousing services	1.55	17
4.	Cotton	1.54	18
13.	Canning, freezing and dehydrating	1.52	19
25.	Other manufacturing	1.52	19
24.	Farm machinery	1.45	20
30.	Other services	1.40	21
21.	Lumber and wood products	1.35	22
5.	Food, feed grains and grass seed	1.27	23
8.	Oil bearing crops	1.27	23
31.	Government enterprises	1.22	24
7.	Vegetables and other crops	1.16	25
28.	Wholesale and retail trade	1.16	25
6.	Fruit and tree nuts	1.11	26
16.	Textiles, apparel and fabrics	1.09	27
9.	Farm forest, greenhouse and nursery	1.08	28

added to the labor force of such a sector. Hence, indirect employment effect per man-year increase in direct employment is relatively large.

An underlying assumption in computing employment multipliers is that a direct linear relationship exists between employment and output. Another important assumption is that the multipliers do not account for possible under-employed resources and excess capacity. Neither of these assumptions holds for a number of sectors, and in these cases, the magnitude of the estimated multipliers may be exaggerated. This appears to be a problem particularly in the capital intensive sectors such as meat products processing, fats and oil mills, other agricultural products processing and the petroleum refining sectors. Hence, some caution should be exercised in the interpretation and use of employment multipliers in those sectors. Nevertheless, the indicated relative magnitude (rank) of these multipliers appears accurate, and it is logical to conclude that the impact on the state's employment by a change in employment in these sectors is relatively large. The magnitude of employment multipliers for the more labor intensive sectors, such as

wholesale and retail trade and the various services sectors, is consistent with expectations.

Effects of Change in Final Demand on Output, Income and Employment in the Economy

The selection of economic sectors for further development may be made on the basis of which sector has the greatest direct and indirect impact on output, income or employment in the State for a given increase in final demand for its products. To illustrate this, the effect of a $1-million change in final demand, such as increased exports by a particular sector, on output, income and employment in the Texas economy is presented in Table 10. The

TABLE 10. EFFECTS OF $1-MILLION CHANGE IN FINAL DEMAND ON OUTPUT, INCOME AND EMPLOYMENT FOR EACH SECTOR OF THE TEXAS ECONOMY, 1967

No.	Name	Total change in output (million $)	Total change in income (million $)	Total change in employment (man-years)
1.	Dairy farm products	2.04	.820	151.80
2.	Poultry and eggs	2.46	.749	116.67
3.	Meat animals and other livestock products	2.36	.829	156.44
4.	Cotton	1.83	.883	106.02
5.	Food, feed grains and grass seed	1.77	.895	150.97
6.	Fruit and tree nuts	1.45	.917	205.80
7.	Vegetables and other crops	1.53	.903	174.03
8.	Oil bearing crops	1.75	.862	172.73
9.	Farm forest, greenhouse and nursery	1.32	.912	213.24
10.	Forestry and fishery products	1.50	.815	37.65
11.	Meat products	2.82	.792	122.04
12.	Dairy products	1.85	.546	67.95
13.	Canning, freezing and dehydrating	1.66	.585	91.10
14.	Grain mill products	2.25	.736	82.02
15.	Fats and oil mills	2.18	.588	61.08
16.	Textiles, apparel and fabrics	1.37	.504	199.85
17.	Agricultural, forestry and fishery services	1.78	.684	116.92
18.	Other agricultural processing	1.53	.756	26.66
19.	Mining	1.48	.907	33.77
20.	Construction	1.54	.718	48.45
21.	Lumber and wood products	1.51	.665	83.38
22.	Chemicals and fertilizer	1.94	.856	37.64
23.	Petroleum refining and related industries	2.12	.908	32.44
24.	Farm machinery	1.47	.604	62.78
25.	Other manufacturing	1.50	.656	56.12
26.	Transportation and warehousing services	1.49	.921	54.30
27.	Communications and utility services	1.59	.924	53.16
28.	Wholesale and retail trade	1.35	.929	99.62
29.	Finance, insurance and real estate	1.43	.921	37.69
30.	Other services	1.54	.846	77.30
31.	Government enterprises	1.66	.909	144.30

meat products sector had the greatest stimulating potential in terms of total output in the economy. A $1-million increase in meat processing final demand would result in an estimated $2.82 million of total output in the economy.

The wholesale and retail trade and the communications and utility services sectors had the highest potential of all the sectors to increase income as a result of an initial increase in final demand. If the output in the wholesale and retail trade sector was expanded by $1 million, then wages, salaries and other income in the economy would increase by $929,000 ($1,000,000 × .929). The comparable figure for communications and utility services was $924,000 ($1,000,000 × .924) (Table 10). These sectors are labor intensive, and a relatively high percentage of their total output is paid out as household and business income. Development of the wholesale and retail trade sector is, of course, largely dependent upon further development of basic resource and manufacturing sectors.

The creation of jobs would be greatest (213 per million dollars of final demand) by the farm forest, greenhouse and nursery sector. This sector, in comparison with all others, had the highest potential for

increasing employment with fairly large total income and relatively low total output effects. The number of jobs created per million dollars of final demand was relatively large in most of the agricultural sectors (Table 10).

The initiation of economic development strategies that maximize the total effects on output, income and employment in the state's economy would appear to be an appropriate development goal. The estimates shown in Table 10 provide a comparative analysis of the economy in this respect and may be used in conjunction with other planning factors to select those sectors that should receive emphasis in achieving this goal.

Projections of Sector Output

The input-output model may be used for projecting the future output of each sector. Such projections involve two steps. These are 1) estimating the final demands on all sectors for the projection year and 2) estimating the total production required in all sectors to meet both final demands and the intermediate demands from other sectors. The input-output model developed in this study was used to project sector outputs for 1975 and 1980 (Table 11).

TABLE 11. ESTIMATED FINAL DEMAND AND PROJECTED OUTPUT FOR 1975 AND 1980, TEXAS ECONOMY (IN MILLIONS OF DOLLARS)[1]

No.	Name	Estimated final demand, 1975	Projected output, 1975	Estimated final demand, 1980	Projected output, 1980
1.	Dairy farm products	84.52	269.26	85.55	280.53
2.	Poultry and eggs	110.80	262.25	123.07	285.13
3.	Meat animals and other livestock products	397.93	1,859.60	465.56	2,039.07
4.	Cotton	633.35	779.46	679.98	847.11
5.	Food, feed grains and grass seed	271.03	1,101.55	312.36	1,232.04
6.	Fruit and tree nuts	32.23	36.55	35.65	40.66
7.	Vegetables and other crops	162.49	246.64	178.64	276.81
8.	Oil bearing crops	9.92	75.00	10.96	86.57
9.	Farm forest, greenhouse and nursery	20.45	39.23	24.03	46.22
10.	Forestry and fishery products	179.12	237.27	219.98	288.29
11.	Meat products	1,188.60	1,472.88	1,226.88	1,542.42
12.	Dairy products	553.70	658.55	570.15	683.37
13.	Canning, freezing and dehydrating	223.32	233.60	262.42	274.38
14.	Grain mill products	189.69	599.01	222.89	681.98
15.	Fats and oil mills	327.67	695.43	384.83	801.14
16.	Textiles, apparel and fabrics	359.87	373.16	392.47	407.61
17.	Agricultural, forestry and fishery services	27.95	218.56	32.77	244.18
18.	Other agricultural processing	1,754.87	2,036.44	2,062.06	2,391.45
19.	Mining	1,349.04	7,272.06	1,581.54	8,527.18
20.	Construction	10,781.06	12,393.91	12,657.59	14,544.33
21.	Lumber and wood products	227.87	590.29	267.76	692.87
22.	Chemicals and fertilizer	2,917.29	5,867.80	3,421.99	6,866.93
23.	Petroleum refining and related industries	8,720.50	10,656.30	10,235.28	12,498.19
24.	Farm machinery	64.12	67.18	75.35	78.86
25.	Other manufacturing	8,680.13	14,182.73	10,199.63	16,648.99
26.	Transportation and warehousing services	1,640.14	4,372.38	1,925.88	5,115.06
27.	Communications and utility services	1,888.69	4,522.85	2,219.31	5,302.95
28.	Wholesale and retail trade	9,168.14	12,322.55	10,771.33	14,452.27
29.	Finance, insurance and real estate	6,571.76	11,007.94	7,722.18	12,904.23
30.	Other services	6,491.46	10,930.57	7,626.62	12,819.28
31.	Government enterprises	163.26	990.39	191.84	1,161.18

[1]The final demand and total output of each sector for the year 1967 are indicated in the intersector flow table (Table 1).

Final demand of each sector was estimated for 1975 and 1980 on the assumption that Texas exports of goods and services are determined by economic activity elsewhere in the United States while other final demand, such as Texas household consumption, is determined by economic activity within Texas. Final demand estimates for 1975 and 1980 are presented in Table 11. Detailed procedures for developing these estimates are shown in Appendix. These final demand projections were then utilized in conjunction with the interdependence matrix to estimate total output required in each sector to meet these projected final demands (see Appendix). Consequently, the projections include total sector outputs needed to meet both projected final demand and intermediate demand for the years 1975 and 1980. Such projections are based on the assumption of fixed technical coefficients within economic sectors. Over time, technology and innovations may alter these coefficients; therefore, input-output projections are more reliable for shorter time spans.

Total projected production increases substantially to 1975 and 1980 for each of the 31 economic sectors (Table 11). Total value of production for the 10 agricultural sectors identified for study is projected to increase to $4.9 billion by 1975 and to $5.4 billion by 1980. The projections indicate the quantity of output required to meet both the demands of final consumers and the intermediate demand of other sectors of the Texas economy.

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Appendix

Procedures for Projection of Final Demand (FD) and Total Output to 1975 and 1980

Procedure 1

a) The projection of per capita consumption for 1980 is available in *Agricultural Economics Research*, January 1966, Vol. XVIII, No. 1. By linear interpolation the per capita consumption in 1967 and 1975 was derived. An index was derived for 1975 and 1980 taking 1967 as base year. Let these indices be k_1 and k_2.

b) A population index was estimated for the United States and Texas separately for the years 1975 and 1980, with 1967 as base year.

Let I_{u1} = U.S. index for 1975

I_{u2} = U.S. index for 1980

I_{t1} = Texas index for 1975

I_{t2} = Texas index for 1980

c) Now let e = 1967 Texas export of a particular sector

f = 1967 Texas FD (except export) of a particular sector

Then 1975 projection of total FD of a particular sector = $k_1 I_{t1} f + k_1 I_{u1} e$

and 1980 projection of total FD of a particular sector = $k_2 I_{t2} f + k_2 I_{u2} e$

The FD of the sectors 1 to 8, 11, 12, 15 and 16 were estimated using this procedure.

Procedure 2

a) The personal consumption patterns were available (in billions of dollars) in *Statistical Abstracts of the United States* (p. 314) for the years 1950, 1955, 1960, 1965, 1966, 1967 and 1968. From each year, data on the consumption of food, beverages and tobacco were subtracted because these are covered in Procedure 1. Let these data be Y_t(t = 1950, 1955 ..... 1968)

b) Develop an index by taking Y_{1967} as base. Let these indices be y_t

$$y_t = Y_t / Y_{1967}$$

(Note that $y_{1967} = 1$)

c) Fit a regression equation

$$y_t = a + b_1 x_1 + b_2 x_2$$

where x_1 = time period (1950 = 0, 1955 = 5, and so forth)

x_2 = 0 or 1 (dummy variable)

x_2 is 0 for 1950 and 1955 and 1 elsewhere (The reason is that prior to 1960 Alaska and Hawaii are excluded)

d) From the regression line of (c), project y_{1975} and y_{1980}.

In our model

$$y_{1975} = 1.371$$
$$y_{1980} = 1.611$$

e)

Year	R	R_i/R_{1967}
1967	18.25	1.000
1975	17.85	.978
1980	17.81	.976

$$R = \frac{\text{U.S. population}}{\text{Texas population}}$$

R indicates that in comparison with 1967, the U.S. population in 1975 and 1980 relatively declined (with respect to Texas). Therefore, the export will also be relatively less in 1975 and 1980.

So, a correction is included such that

$$y_{e1975} = 1.371 \times .978 = 1.341$$
$$y_{e1980} = 1.611 \times .976 = 1.572$$

f) Let e = 1967 Texas export of a particular sector

f = 1967 Texas FD (except export) of a particular sector

Then, 1975 projection of total FD of a particular sector = 1.371f + 1.341e; 1980 projection of total FD of a particular sector = 1.611f + 1.572e.

The FD of the sectors 9, 10, 13, 14 and 17 to 31 were estimated using this procedure.

Procedure for Calculating Output Requirements to Meet the Estimated Final Demand

The basic equation of the input-output model is $X = (I-A)^{-1} Y$

where

X is a matrix of sector total outputs,

$(I-A)^{-1}$ is the interdependence coefficients matrix, and

Y is a matrix of sector final demands.

If the projected final demand matrix for 1975 and/or 1980 is $\hat{Y}$, then the future output requirement matrix $(\hat{X})$ may be obtained by the equation $\hat{X} = (I-A)^{-1} \hat{Y}$. This matrix $(\hat{X})$ contains the projected output of each sector required to meet the estimated final demand $(\hat{Y})$ for the projection year. This procedure was conducted for each of the projection years, 1975 and 1980. Estimated final demand and required output for each sector are presented in Table 11.

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