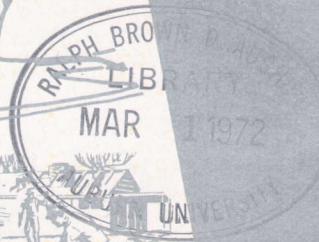


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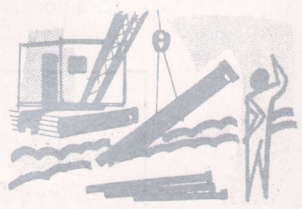
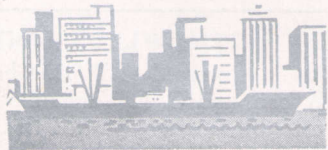
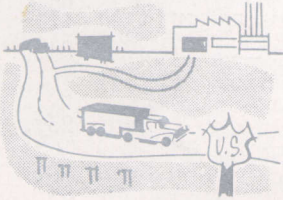
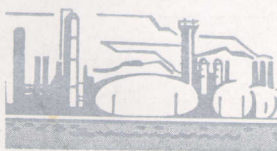
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THE STRUCTURE of the ALABAMA ECONOMY: *An Input-Output Analysis*



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The Structure of the Alabama Economy: An Input-Output Analysis*

WAYNE C. CURTIS**

IMPROVING INCOME and employment opportunities in Alabama is of increasing concern to both public and private groups at various levels. Often, however, these attempts to alleviate low income, underemployment, and unemployment problems have been hampered by insufficient information concerning economic structure of the State.

For orderly economic development, some means of assessing the impact of alternative developmental approaches should be devised. One device that may be used to estimate the total effects of a given change in economic activity is the input-output model.¹ This type of analysis could be useful to groups interested in promoting growth and development at various levels within the State. For example, it could be used to estimate total effects on income and employment from a new plant in a particular community. At a higher level, the effect that a regional marketing facility might have on the area it serves could be approximated. The comparative impact of various types of development could be evaluated through input-output techniques, and this could be especially helpful to planners at the state level. The same procedure could be used to estimate the negative effect on income and employment of the closing of a firm or industrial complex.

* This report represents partial results of Alabama's contribution to S-79, a study of rural development and the quality of life in the rural South.

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¹ Input-output analysis refers to a systematic method of analyzing the interrelationships between an industry's output of goods and services and the volume of goods and services needed to achieve a given level of production.

OBJECTIVES

The overall objective of this study was to estimate and evaluate the structural relationship of the various sectors of the Alabama economy. Particular emphasis was placed on agricultural and related sectors because of their economic importance to the State.

Specific objectives were:

(1) To delineate sectoral flows of goods and services within the Alabama economy;

(2) To evaluate the direct, indirect, and induced effects on income and employment from changes in various economic activities;

(3) To develop and interpret income and employment multipliers for the economy; and

(4) To estimate the future income and employment impacts of various changes in sectoral output.

PROCEDURE

An input-output model for the Alabama economy was developed through the use of the adjusted national model and secondary data.² The model was constructed for the year 1967 because latest detailed data on output, income, and employment were available for that year. Most of the data used in the study came from various census and other government publications.

The Alabama economy was divided into 17 endogenous and 4 exogenous sectors.³ The endogenous, or processing, sectors contain industries that are producing goods and services within Alabama. The exogenous portion of the model, on the other hand, comprises the final demand and final payments sectors. Final demand is composed of household consumption expenditures; State, local, and Federal government purchases; and exports. Final payments include imports of goods and services from outside Alabama, wages and salaries paid to households, rental income, proprietor income, and payments to the government sectors.

Delineation of the above sectors was done basically according to the industry classification used by the Bureau of Labor Sta-

² For a detailed discussion of the theoretical aspects of Leontief input-output analysis, methods and procedures used in developing the model, and interpretation and computational procedures used in deriving the coefficients, see references 2, 4, 5, 6, 7, 8, 9, 11, and 12 in the Literature Cited section.

³ For purposes of this study, a sector of the economy is assumed to be a unit composed of a group of similar industries.

tistics. This aggregation procedure reflects the structural relationships of these sectors to the Alabama economy.

Composition of each sector of the model is presented in the Appendix.

THE STATE MODEL

The Flow Table

In the transactions or interindustry flow table for Alabama, Table 1, the upper left quadrant comprises the sectors that produce goods and services within the State—the endogenous or processing sectors. State and local government, Federal government, household, and export columns represent the final demand sectors. Final payment sectors are comprised of State and local government, Federal government, household, and import rows.

Each row entry in the table represents sales by the specified producing sector to the purchasing sector represented by each column. For example, firms in the livestock sector grossed \$67,740,000 in sales of goods and services to firms within that sector; \$18,574,000 to the crops sector; \$1,427,000 in sales to the farm forestry sector; \$107,614,000 to the agricultural processing sector; and \$581,000 in sales to the services sector. A total of \$205,996,000 in sales of goods and services was made by this sector to the endogenous or processing sectors. The livestock sector also sold goods worth \$63,778,000 to the Federal government, \$28,318,000 to households, and \$192,064,000 to businesses outside the State. Entries for the remaining rows in the table can be interpreted in a similar manner.

Each column entry in Table 1 represents a purchase by the sector named at the top of each column from the specified producing sector. Column entries represent the input structure—the mix of goods and services used in producing the final product—of each purchasing sector. For example, the livestock sector purchased \$67,470,000 worth of goods and services from firms within the sector, \$41,788,000 worth from the crops sector, \$94,951,000 worth from the agricultural processing sector, \$31,655,000 worth from the wholesale and retail trade sector, and a total of \$263,324,000 worth of goods and services from the endogenous sectors of the State economy.

Export figures were computed by estimating total demand of each sector (total gross output) and demand for final consump-

TABLE 1. INTERINDUSTRY FLOWS OF GOODS AND SERVICES, ALABAMA ECONOMY, 1967

Industry producing	Livestock	Crops	Farm forestry	Agricultural processing	Mining	Construction	Textiles and apparel	Lumber and wood
	<i>Thou. dol.</i>	<i>Thou. dol.</i>	<i>Thou. dol.</i>	<i>Thou. dol.</i>	<i>Thou. dol.</i>	<i>Thou. dol.</i>	<i>Thou. dol.</i>	<i>Thou. dol.</i>
Livestock.....	67,740	18,574	1,427	107,614	0	0	6,487	0
Crops.....	41,788	2,909	534	14,922	0	449	4,956	1,451
Farm forestry.....	0	0	25	54	0	0	21	568
Agricultural processing.....	94,951	43	1,013	159,344	15	248	1,910	101
Mining.....	10	110	0	29	3,437	427	16	6
Construction.....	4,424	5,804	0	1,519	6,495	239	1,284	1,922
Textiles and apparel.....	241	540	487	675	50	576	132,635	529
Lumber and wood products.....	12	329	0	206	397	7,206	106	56,017
Furniture and fixtures.....	0	0	0	0	0	152	16	110
Paper and allied products.....	121	33	14	8,737	355	1,084	4,288	1,623
Chemical and allied products.....	608	10,892	24	1,710	7,340	1,070	27,032	2,013
Manufacturing.....	990	2,724	302	4,885	8,810	24,751	3,075	6,678
Transportation.....	10,834	3,948	676	20,349	22,580	17,641	7,755	24,691
Communications and utilities.....	947	1,312	6	2,028	6,300	1,577	1,963	2,468
Wholesale and retail trade.....	31,655	21,942	1,744	43,759	23,846	105,871	53,304	33,226
Finance, insurance, and real estate.....	6,724	25,275	53	5,257	36,074	6,695	6,304	7,720
Services.....	2,279	4,115	124	7,266	3,795	7,900	2,984	3,811
TOTAL ENDOGENOUS.....	263,324	98,550	6,429	378,354	119,494	175,886	254,136	142,934
State and local government.....	29	44	249	498	931	682	183	242
Federal government.....	122	122	146	561	749	276	1,213	565
Households.....	226,681	83,151	6,390	165,021	69,728	386,225	428,428	100,296
Imports.....	0	0	0	373,766	60,489	956,275	553,740	73,463
TOTAL GROSS OUTLAY.....	490,156	181,867	13,214	918,200	251,391	1,519,344	1,237,700	317,500

Continued

TABLE 1 (Continued). INTERINDUSTRY FLOWS OF GOODS AND SERVICES, ALABAMA ECONOMY, 1967

Industry producing	Furniture and fixtures	Paper and allied	Chemical and allied	Manufacturing	Transportation	Communications and utilities	Wholesale and retail trade
	Thou. dol.	Thou. dol.	Thou. dol.	Thou. dol.	Thou. dol.	Thou. dol.	Thou. dol.
Livestock.....	0	0	0	744	25	0	0
Crops.....	0	0	94	726	409	0	0
Farm forestry.....	0	0	11	0	0	0	0
Agricultural processing.....	13	4,334	8,011	7,932	3,085	18	5,573
Mining.....	5	234	1,037	771	33	1,219	5
Construction.....	349	2,309	3,270	1,739	22,456	14,831	2,499
Textiles and apparel.....	5,017	1,725	350	2,045	251	62	467
Lumber and wood.....	5,524	4,943	280	1	25,294	4	183
Furniture and fixtures.....	395	2	0	45	0	0	13
Paper and allied.....	1,600	99,973	9,093	4,822	162	164	3,593
Chemical and allied.....	236	13,612	106,250	10,364	371	251	595
Manufacturing.....	7,128	4,386	8,370	32,919	6,909	1,145	2,977
Transportation.....	3,975	20,957	14,240	9,357	49,602	4,288	4,618
Communications and utilities.....	831	3,770	5,857	2,931	3,472	19,549	6,075
Wholesale and retail trade.....	15,762	33,357	35,723	38,508	33,327	10,995	22,403
Finance, insurance, and real estate.....	4,732	6,490	6,167	8,224	20,473	12,640	35,845
Services.....	1,706	4,441	6,020	6,765	7,445	24,288	13,059
TOTAL ENDOGENOUS.....	47,273	200,533	204,773	127,893	173,314	89,454	97,905
State and local government.....	154	352	520	245	37,115	6,342	5,453
Federal government.....	1,178	678	942	1,268	1,885	6,391	7,994
Households.....	25,295	151,477	116,023	1,142,839	254,066	186,364	964,770
Imports.....	0	282,860	411,742	2,253,455	147,664	369,888	520,313
TOTAL GROSS OUTLAY.....	73,900	635,900	734,000	3,525,700	614,044	658,439	1,596,435

Continued

TABLE 1 (Continued). INTERINDUSTRY FLOWS OF GOODS AND SERVICES, ALABAMA ECONOMY, 1967

Industry producing	Finance, insurance, and real estate	Services	Total endogenous	State and local govern- ment	Federal government	House- holds	Exports	Total gross output
	<i>Thou. dol.</i>	<i>Thou. dol.</i>	<i>Thou. dol.</i>	<i>Thou. dol.</i>	<i>Thou. dol.</i>	<i>Thou. dol.</i>	<i>Thou. dol.</i>	<i>Thou. dol.</i>
Livestock.....	2,804	581	205,996	0	63,778	28,318	192,064	490,156
Crops.....	1,716	451	70,405	40	23,638	47,693	40,091	181,867
Farm forestry.....	0	2	681	0	1,784	3,726	7,023	13,214
Agricultural processing.....	583	52,049	329,223	0	0	454,578	134,399	918,200
Mining.....	31	4	7,374	704	478	2,981	239,854	251,391
Construction.....	33,938	5,500	108,578	137,258	5,439	583,450	684,619	1,519,344
Textiles and apparel.....	108	818	146,576	105	678	443,400	646,941	1,237,700
Lumber and wood.....	29	11	100,542	0	0	2,981	213,977	317,500
Furniture and fixtures.....	2	0	735	0	0	71,540	1,625	73,900
Paper and allied.....	987	533	137,182	986	795	17,885	479,052	635,900
Chemical and allied.....	598	1,040	184,006	4,030	294	274,237	271,433	734,000
Manufacturing.....	1,219	10,256	127,524	1,757	976	703,478	2,691,965	3,525,700
Transportation.....	1,520	44,105	261,136	6,945	67,889	129,666	148,408	614,044
Communications and utilities.....	5,174	7,075	71,335	22,229	2,752	283,925	278,198	658,439
Wholesale and retail trade.....	16,611	53,678	575,711	8,589	10,824	903,194	98,117	1,596,435
Finance, insurance, and real estate.....	75,995	30,528	255,196	11,014	13,463	353,975	366,387	1,040,035
Services.....	12,202	20,745	128,945	7,359	6,088	403,904	590,564	1,136,860
TOTAL ENDOGENOUS.....	153,517	217,376	2,751,145					
State and local government.....	7,571	3,948		1,349	513	588,716	810,706	1,465,842
Federal government.....	9,461	4,483		309	309	677,396	96,397	812,445
Households.....	271,860	761,165		686,441	1,286,891	0	0	7,313,111
Imports.....	597,626	149,888		595,655	0	1,477,059	0	8,823,883
TOTAL GROSS OUTLAY.....	1,040,035	1,136,860		1,484,770	1,486,589	7,452,102	7,991,820	33,359,966

tion within the area, in the manner followed by Moore and Peterson (12) and Little and Doeksen (9). The amount produced above these demands was the net exports for each sector. From an examination of the export column, it becomes obvious that many sectors of the Alabama economy are large exporters. In terms of gross dollars of sales, the manufacturing sector had the greatest volume of exports (approximately \$2.7 billion) and the furniture and fixtures sector had the smallest volume, \$1.6 million. If exports are expressed as a proportion of total output, then the mining sector had approximately 95 per cent of its total product shipped to points outside Alabama. Both manufacturing and paper and allied products sectors exported more than 75 per cent of total output.

Like amount exported, the amount imported is also a net figure. Demands in excess of endogenous production were considered to be imported. On this basis, the manufacturing sector was the largest importer, accounting for about \$2.2 billion worth of goods and services. Other endogenous sectors importing large quantities of goods and services were the finance, insurance, and real estate; textiles and apparel; and wholesale and retail trade sectors.

Total gross output of the Alabama economy approximated \$33.4 billion.

ESTIMATED EXPORT BALANCE. The position of the endogenous sectors of the economy with respect to import-export balance can be estimated as in Table 2. This information not only provides insight into the relative position of each sector within the State economy, but it also serves as an approximation of the Alabama economy's competitive position with the rest of the Nation. As noted in Table 2, the producing sectors in the State's economy had a net export balance of approximately \$333 million in 1967. This resulted primarily from net export balances in the services, manufacturing, paper and allied products, and livestock sectors. Net exports of the three primary agricultural sectors totaled about \$239 million, second only to those of the manufacturing sector. As might be expected, largest deficit occurred in the wholesale and retail trade sector since much of this sector's output is imported from other areas for resale in the State. Other large deficits occurred in the construction, agricultural processing, and finance, insurance, and real estate sectors.

Data in Table 2 do not take into consideration imports and exports of the exogenous sectors. With these data included, particu-

TABLE 2. ESTIMATED IMPORTS, EXPORTS, AND NET EXPORT BALANCE, ENDOGENOUS SECTORS, ALABAMA ECONOMY, 1967

Sector	Net imports	Net exports	Net export balance ¹
	<i>Thou. dol.</i>	<i>Thou. dol.</i>	<i>Thou. dol.</i>
Livestock.....	-----	192,064	192,064
Crops.....	-----	40,091	40,091
Farm forestry.....	-----	7,023	7,023
Agricultural processing.....	373,766	134,399	-239,367
Mining.....	60,489	239,854	179,365
Construction.....	956,275	684,619	-271,656
Textiles and apparel.....	553,740	646,941	93,201
Lumber and wood.....	73,463	213,977	140,514
Furniture and fixtures.....	-----	1,625	1,625
Paper and allied.....	282,860	479,052	196,192
Chemical and allied.....	411,742	271,433	-140,309
Manufacturing.....	2,253,455	2,691,965	438,510
Transportation.....	147,664	148,408	744
Communications and utilities.....	369,888	278,198	- 91,690
Wholesale and retail trade.....	520,313	98,117	-422,196
Finance, insurance, and real estate.....	597,626	366,387	-231,239
Services.....	149,888	590,564	440,676
TOTAL.....	6,751,169	7,084,717	333,548

¹ Net exports less net imports.

larly the household sector, Alabama was a net importer by about \$832 million.

STRUCTURAL INTERDEPENDENCE OF THE ECONOMY. Structural interdependence among endogenous sectors of the Alabama economy can be estimated by the relative size of the endogenous transactions of each sector in the interindustry flow table, Table 3. The livestock sector, for example, purchased 54 per cent of its inputs from other endogenous sectors and sold 42 per cent of its output to these sectors. In contrast, the manufacturing sector purchased only 4 per cent of its inputs endogenously and sold only 4 per cent of its output to other endogenous sectors. Manufacturing firms in Alabama import most of their raw material purchases and export the greatest proportion of their finished products. In a like manner, the wholesale and retail trade sector purchased only 6 per cent of its non-labor inputs from in-State firms. Furniture manufacturers, on the other hand, purchased 64 per cent of their inputs — mostly wood products — from other firms within Alabama but sold only 1 per cent of output to these firms. Most of the output of this sector was sold to households.

For those sectors where endogenous transactions constitute a large per cent of output, an increase in final demand will have a much greater impact on the state economy than would an equal

TABLE 3. ENDOGENOUS SALES AND PURCHASES OF EACH SECTOR
AS A PER CENT OF GROSS SECTORAL OUTPUT,
ALABAMA ECONOMY, 1967

Sector	Sales	Rank	Purchases	Rank
	<i>Pct.</i> ¹		<i>Pct.</i> ¹	
Livestock.....	42	1	54	3
Crops.....	39	3	54	2
Farm forestry.....	5	14	49	4
Agricultural processing.....	36	5	41	7
Mining.....	3	16	48	5
Construction.....	7	13	12	15
Textiles and apparel.....	12	10	20	11
Lumber and wood products.....	32	6	45	6
Furniture and fixtures.....	1	17	64	1
Paper and allied products.....	22	9	32	8
Chemical and allied products.....	25	7	28	10
Manufacturing.....	4	15	4	17
Transportation.....	42	2	28	9
Communications and utilities.....	11	12	14	14
Wholesale and retail trade.....	36	4	6	16
Finance, insurance, and real estate.....	24	8	15	13
Services.....	11	11	19	12

¹ Rounded to nearest whole per cent.

demand increase in sectors where endogenous transactions constitute a small per cent of gross output. Increasing output in a sector brings forth increased input purchases by that sector. If these purchases are made from firms within the State, this will have a greater effect on the economy than if the inputs are purchased from sources outside Alabama. The same holds true for sales.

Technical Coefficients

Technical coefficients for the Alabama economy are presented in Table 4. Each column entry represents an estimate of direct requirements of that purchasing sector from each producing sector (row entry) per dollar of output. In other words, technical coefficients indicate direct purchases of each processing sector from every other processing sector per dollar of output. These coefficients estimate only the first-round effects of a change in output of one sector on the other sectors from which it purchases goods and services. For example, the livestock sector required the following purchases per \$1 of output: 13.8¢ from the livestock sector; 8.5¢ from crops; 19.4¢ from agricultural processing firms; 0.9¢ from construction; 2.2¢ from transportation; 6.5¢ from wholesale and retail trade establishments; 1.3¢ from the finance, insur-

TABLE 4. TECHNICAL COEFFICIENTS, ALABAMA ECONOMY, 1967

	Live- stock	Crops	Farm forestry	Agri- cultural processing	Mining	Con- struction	Textiles and apparel	Lumber and wood	Furniture and fixtures
Livestock.....	0.13820	0.10213	0.10799	0.11720	0.00000	0.00000	0.00524	0.00000	0.00000
Crops.....	0.08525	0.01600	0.04041	0.01625	0.00000	0.00030	0.00400	0.00457	0.00000
Farm forestry.....	0.00000	0.00000	0.00189	0.00006	0.00000	0.00000	0.00002	0.00179	0.00000
Agricultural processing.....	0.19372	0.00024	0.07666	0.17354	0.00006	0.00016	0.00154	0.00032	0.00018
Mining.....	0.00002	0.00060	0.00000	0.00003	0.01367	0.00028	0.00001	0.00002	0.00007
Construction.....	0.00903	0.03191	0.00000	0.00165	0.02584	0.00016	0.00104	0.00605	0.00472
Textiles and apparel.....	0.00049	0.00297	0.03685	0.00074	0.00020	0.00038	0.10716	0.00167	0.06789
Lumber and wood products.....	0.00002	0.00181	0.00000	0.00022	0.00158	0.00474	0.00009	0.17643	0.07475
Furniture and fixtures.....	0.00000	0.00000	0.00000	0.00000	0.00000	0.00010	0.00001	0.00035	0.00535
Paper and allied products.....	0.00025	0.00018	0.00106	0.00952	0.00141	0.00071	0.00346	0.00511	0.02165
Chemical and allied products.....	0.00124	0.05989	0.00182	0.00186	0.02920	0.00070	0.02184	0.00634	0.00319
Manufacturing.....	0.00202	0.01498	0.02285	0.00532	0.03505	0.01629	0.00248	0.02103	0.09645
Transportation.....	0.02210	0.02171	0.05116	0.02216	0.08982	0.01161	0.00627	0.07777	0.05379
Communications and utilities.....	0.00193	0.00721	0.00045	0.00221	0.02506	0.00104	0.00159	0.00777	0.01124
Wholesale and retail trade.....	0.06458	0.12065	0.13198	0.04766	0.09486	0.06968	0.04307	0.10465	0.21329
Finance, insurance and real estate.....	0.01372	0.13898	0.00401	0.00573	0.14350	0.00441	0.00509	0.02431	0.06403
Services.....	0.00465	0.02263	0.00938	0.00791	0.01510	0.00520	0.00241	0.01200	0.02309
State and local government.....	0.00006	0.00024	0.01884	0.00054	0.00370	0.00045	0.00015	0.00076	0.00208
Federal government.....	0.00025	0.00067	0.01105	0.00061	0.00298	0.00018	0.00098	0.00178	0.01594
Households.....	0.46247	0.45721	0.48358	0.17972	0.27737	0.25421	0.34615	0.31589	0.34229
Imports.....	0.00000	0.00000	0.00000	0.40706	0.24062	0.62940	0.44739	0.23138	0.00000
TOTAL.....	1.00000	1.00001	0.99998	0.99999	1.00002	1.00000	0.99999	0.99999	1.00000

Continued

TABLE 4 (Continued). TECHNICAL COEFFICIENTS, ALABAMA ECONOMY, 1967

	Paper and allied	Chemical and allied	Manu- facturing	Trans- portation	Communi- cations and utilities	Whole- sale and retail trade	Finance, insurance, and real estate	Services
Livestock.....	0.00000	0.00000	0.00021	0.00004	0.00000	0.00000	0.00270	0.00051
Crops.....	0.00000	0.00013	0.00021	0.00067	0.00000	0.00000	0.00165	0.00040
Farm forestry.....	0.00000	0.00001	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Agricultural processing.....	0.00682	0.01091	0.00225	0.00502	0.00003	0.00349	0.00056	0.03699
Mining.....	0.00037	0.00141	0.00022	0.00005	0.00185	0.00000	0.00003	0.00000
Construction.....	0.00363	0.00446	0.00049	0.03657	0.02252	0.00157	0.03263	0.00484
Textiles and apparel.....	0.00271	0.00048	0.00058	0.00041	0.00009	0.00029	0.00010	0.00072
Lumber and wood products.....	0.00777	0.00038	0.00000	0.04119	0.00001	0.00011	0.00003	0.00001
Furniture and fixtures.....	0.00000	0.00000	0.00001	0.00000	0.00000	0.00001	0.00000	0.00000
Paper and allied products.....	0.15721	0.01239	0.00137	0.00026	0.00025	0.00225	0.00095	0.00047
Chemical and allied products.....	0.02141	0.14475	0.00294	0.00060	0.00038	0.00037	0.00057	0.00091
Manufacturing.....	0.00690	0.01140	0.00934	0.01125	0.00174	0.00186	0.00117	0.00902
Transportation.....	0.03296	0.01940	0.00265	0.08078	0.00651	0.00289	0.00146	0.03880
Communications and utilities.....	0.00593	0.00798	0.00083	0.00565	0.02969	0.00381	0.00497	0.00622
Wholesale and retail trade.....	0.05246	0.04867	0.01092	0.05427	0.01670	0.01403	0.01597	0.04722
Finance, insurance, and real estate.....	0.01021	0.00840	0.00233	0.03334	0.01920	0.02245	0.07307	0.02685
Services.....	0.00698	0.00820	0.00192	0.01212	0.03689	0.00818	0.01173	0.01825
State and local government.....	0.00055	0.00071	0.00007	0.06044	0.00963	0.00342	0.00728	0.00347
Federal government.....	0.00107	0.00128	0.00036	0.00307	0.00971	0.00501	0.00910	0.00394
Households.....	0.23821	0.15807	0.32415	0.41376	0.28302	0.60433	0.26140	0.66953
Imports.....	0.44482	0.56096	0.63915	0.24048	0.56177	0.32592	0.57462	0.13184
TOTAL.....	1.00001	0.99999	1.00000	0.99997	0.99999	0.99999	0.99999	0.99999

ance, and real estate sector; and 46.2¢ in services, such as wages and salaries, from the household sector.

Input requirements per dollar of output can be similarly interpreted for other sectors of the economy. These data provide an indication of the degree of direct dependency among the various sectors of the Alabama economy.

Interdependence Coefficients

Interdependence coefficients for the Alabama economy, shown in Table 5, indicate the total output — both direct and indirect — required from each sector in the economy per 1-unit increase in output of a particular sector. For example, a \$1 increase in output of the livestock sector would cause direct purchases of this sector from itself to increase by 21¢. However, increased output by the livestock sector necessitates increased purchases from other endogenous sectors in the economy. As purchases by the livestock sector from other sectors increase, each sector will be forced to alter its output to meet the resulting new demand for its products. Final result in this case will be for the crops sector to change its output by 11.0¢, agricultural processing sector by 28.6¢, wholesale and retail sector by 11.3¢, and finance, insurance, and real estate by 4.1¢. Total direct and indirect change in output generated by \$1 change in output of the livestock sector will be \$1.86.

Column totals in the interdependence coefficients matrix represent output multipliers for each sector of the Alabama economy. They estimate the total output generated in the economy per dollar change in output of each sector. Highest output multipliers in the economy were those of the three primary agriculture sectors and the furniture and fixtures industry. Agricultural processing also exhibited a high output multiplier. Lowest multipliers were in manufacturing and wholesale and retail trade, where a \$1 change in output would generate only a \$1.04 and \$1.08 change in the economy, respectively.

These multipliers point out that there is a higher degree of interdependency between each agricultural sector and the rest of the economy than is true for manufacturing and some of the service industries.

INCOME AND EMPLOYMENT MULTIPLIERS

In addition to describing the flow of goods and services within the economy and assessing the degree of interdependence among

TABLE 5. INTERDEPENDENCE COEFFICIENTS, ALABAMA ECONOMY, 1967

	Live- stock	Crops	Farm forestry	Agri- cultural processing	Mining	Con- struction	Textiles and apparel	Lumber and wood	Furniture and fixtures
Livestock.....	1.21240	0.12694	0.15032	0.17466	0.00104	0.00022	0.00815	0.00164	0.00151
Crops.....	0.10989	1.02817	0.05661	0.03591	0.00056	0.00040	0.00538	0.00612	0.00119
Farm forestry.....	0.00002	0.00001	1.00191	0.00008	0.00001	0.00001	0.00002	0.00219	0.00017
Agricultural processing.....	0.28574	0.03336	0.13029	1.25235	0.00311	0.00101	0.00491	0.00345	0.00424
Mining.....	0.00014	0.00078	0.00007	0.00010	1.01400	0.00030	0.00007	0.00008	0.00016
Construction.....	0.01819	0.04156	0.00709	0.00720	0.03657	1.00118	0.00238	0.01348	0.01184
Textiles and apparel.....	0.00138	0.00371	0.04188	0.00137	0.00044	0.00050	1.12012	0.00259	0.07695
Lumber and wood products.....	0.00255	0.00424	0.00358	0.00248	0.00737	0.00649	0.00068	1.21975	0.09521
Furniture and fixtures.....	0.00000	0.00001	0.00000	0.00000	0.00001	0.00010	0.00002	0.00043	1.00541
Paper and allied products.....	0.00417	0.00243	0.00365	0.01459	0.00294	0.00116	0.00526	0.00814	0.02785
Chemical and allied products.....	0.01040	0.07280	0.00803	0.00604	0.03524	0.00107	0.02920	0.01006	0.00783
Manufacturing.....	0.00703	0.01878	0.02663	0.00870	0.03891	0.01702	0.00362	0.02821	0.10230
Transportation.....	0.04050	0.03285	0.06615	0.03713	0.10298	0.01391	0.00936	0.10577	0.07148
Communications and utilities.....	0.00502	0.01051	0.00296	0.00437	0.02867	0.00162	0.00252	0.00151	0.01489
Wholesale and retail trade.....	0.11272	0.14934	0.16560	0.08148	0.11343	0.07316	0.05327	0.14077	0.24226
Finance, insurance, and real estate.....	0.04119	0.16330	0.02330	0.01985	0.16559	0.00761	0.00928	0.04134	0.08294
Services.....	0.01296	0.02952	0.01556	0.01353	0.02158	0.00639	0.00403	0.01880	0.03005
TOTAL.....	1.86429	1.71832	1.70365	1.65984	1.57243	1.13215	1.25828	1.61435	1.77627

Continued

TABLE 5 (Continued). INTERDEPENDENCE COEFFICIENTS, ALABAMA ECONOMY, 1967

	Paper and allied	Chemical and allied	Manu- facturing	Trans- portation	Communi- cations and utilities	Whole- sale and retail trade	Finance, insurance, and real estate	Services
Livestock.....	0.00174	0.00249	0.00073	0.00149	0.00040	0.00079	0.00398	0.00749
Crops.....	0.00050	0.00072	0.00034	0.00136	0.00014	0.00020	0.00222	0.00196
Farm forestry.....	0.00003	0.00002	0.00000	0.00010	0.00000	0.00000	0.00000	0.00001
Agricultural processing.....	0.01171	0.01719	0.00316	0.00816	0.00210	0.00496	0.00243	0.04804
Mining.....	0.00051	0.00171	0.00023	0.00010	0.00195	0.00002	0.00006	0.00003
Construction.....	0.00721	0.00727	0.00083	0.04224	0.02467	0.00274	0.03574	0.00819
Textiles and apparel.....	0.00373	0.00076	0.00068	0.00070	0.00017	0.00036	0.00018	0.00094
Lumber and wood.....	0.01356	0.00212	0.00020	0.05502	0.00065	0.00039	0.00042	0.00236
Furniture and fixtures.....	0.00001	0.00000	0.00001	0.00002	0.00000	0.00001	0.00001	0.00000
Paper and allied.....	1.18747	0.01765	0.00177	0.00111	0.00048	0.00282	0.00137	0.00138
Chemical and allied.....	0.03013	1.17001	0.00359	0.00151	0.00067	0.00059	0.00100	0.00155
Manufacturing.....	0.00991	0.01449	1.00962	0.01474	0.00287	0.00219	0.00217	0.01049
Transportation.....	0.04566	0.02709	0.00336	1.09449	0.00975	0.00399	0.00318	0.04518
Communications and utilities.....	0.00839	0.01042	0.00102	0.00754	1.03122	0.00424	0.00582	0.00740
Wholesale and retail trade.....	0.07114	0.06333	0.01220	0.07169	0.02253	1.01614	0.02181	0.05624
Finance, insurance, and real estate.....	0.01789	0.01451	0.00323	0.04373	0.02389	0.02525	1.08062	0.03358
Services.....	0.01074	0.01162	0.00229	0.01597	0.03955	0.00908	0.01366	1.02088
TOTAL.....	1.42032	1.36140	1.04325	1.35997	1.16103	1.07377	1.17468	1.24572

its sectors, the input-output model may be used for analytical purposes. This is especially true with respect to income and employment multipliers. If household income changes in one sector, the income multiplier indicates the magnitude of total income change in the economy. The employment multiplier, on the other hand, provides a measure of the total change in employment resulting from a 1-unit employment change in a particular sector.

Income Multipliers

Income multipliers estimate total change in income throughout the economy resulting from a \$1 change in income in a sector. The basis for the income multiplier is that a certain amount of income is generated with each change in output. Total change in income per unit change in output can be separated into three components: direct, indirect, and induced effects.

Direct income effect represents an estimate of the initial impact on household income per dollar change in output. It is the proportion of each dollar of output that goes to households in the form of wages and salaries, proprietor income, dividend income, or rental income. Direct income effect for each sector is shown in the household row of the technical coefficients matrix, Table 4.

Direct and indirect income effects estimate the total change in income in the economy resulting from a \$1 income change in a particular sector. Calculation of these effects requires that local consumption expenditures remain at the same level despite changes in household income generated by this output change.

A third type of income effect — the induced effect — results from changes in household purchases of locally produced goods and services as household income changes. This recognizes that a change in household receipts initiates a change in the level of household expenditures, which results in adjustments in output in the endogenous sectors and further changes in payments to local households. Hence, "induced" changes in household income result from sectoral adjustments to an initial change in the level of local household expenditures.

From the above income effects, two types of income multipliers were computed, Table 6. The Type I multiplier is an estimate of the total direct and indirect change in household income in the economy per dollar change in direct income payments to households by sector. Similarly, it may be viewed as the total amount of income generated in the economy assuming that local

TABLE 6. TYPE I AND TYPE II INCOME MULTIPLIERS, BY SECTOR, ALABAMA ECONOMY, 1967

Sector	Type I multiplier	Type II multiplier
Livestock.....	1.68	2.39
Crops.....	1.61	2.29
Farm forestry.....	1.60	2.28
Agricultural processing.....	2.30	3.26
Mining.....	1.77	2.51
Construction.....	1.26	1.79
Textiles and apparel.....	1.28	1.83
Lumber and wood products.....	1.78	2.54
Furniture and fixtures.....	1.95	2.78
Paper and allied products.....	1.58	2.25
Chemical and allied products.....	1.68	2.39
Manufacturing.....	1.05	1.50
Transportation.....	1.35	1.91
Communications and utilities.....	1.24	1.76
Wholesale and retail trade.....	1.05	1.49
Finance, insurance, and real estate.....	1.23	1.75
Services.....	1.14	1.63
ECONOMY.....	1.50	2.14

consumption expenditures do not change. As can be seen from Table 6, the agricultural processing, furniture and fixtures, lumber and wood products, and mining sectors had large Type I income multipliers. Lowest multipliers occurred in manufacturing and wholesale and retail sectors. Average Type I multiplier for the Alabama economy was 1.50.

Type II income multipliers indicate the amount of household income generated throughout the economy with each additional \$1 increase in income in a particular sector. They also reflect income effects of changes in local consumption as income increases. Average income multiplier for the economy was 2.14. In each case, the Type II multiplier was greater than its Type I counterpart because new rounds of household expenditures are generated within the local economy as a result of changes in output of the endogenous sectors.

Care is necessary in interpreting and using the income multipliers described previously. These multipliers reflect the total impact on household income of changes in sectoral income, not of changes in sectoral output. They merely indicate how income will change in the economy if personal income is increased in a given sector; they do not consider how much change in output would be required to provide the increase in income. Perhaps this can best be illustrated by assuming a \$1 million increase in output in each sector, Table 7. If the \$1 million increase were realized in

the livestock sector, the direct change in household income would be \$462,470. This analysis assumed that final demand remains constant in other sectors. Additional output of the livestock sector might be increased sales of calves, pigs, feeder cattle, dairy products, eggs, or any combination of these products. Additional output indirectly required from other sectors of the economy to support this increased output of the livestock sector would raise the household income of this sector by the amount of the Type I income multiplier. Thus, direct and indirect household income generated by the initial increase in income resulting from expanded output of the livestock sector would approximate \$776,950. When output adjustments resulting from additional rounds of induced household expenditures are included, the direct change of \$462,470 will generate \$1,105,303 in household income — by the amount of the Type II income multiplier.

The other two primary agricultural sectors exhibit like patterns of personal income generation primarily because of a high degree of interdependence with the rest of the economy. If sales of the

TABLE 7. CHANGE IN TOTAL HOUSEHOLD INCOME RESULTING FROM A \$1 MILLION CHANGE IN OUTPUT, BY SECTOR, ALABAMA ECONOMY, 1967

Sector	Per \$1 million change in output				
	Direct change in income ¹	Type I multiplier	Direct and indirect change ³	Type II multiplier	Direct, indirect, induced change ⁴
	<i>Dol.</i>		<i>Dol.</i>		<i>Dol.</i>
Livestock.....	462,470	1.68 ²	776,950	2.39 ²	1,105,303
Crops.....	457,210	1.61	736,108	2.29	1,047,011
Farm forestry.....	483,580	1.60	773,728	2.28	1,102,562
Agricultural processing.....	179,720	2.30	413,356	3.26	585,887
Mining.....	277,370	1.77	490,945	2.51	696,199
Construction.....	254,210	1.26	320,305	1.19	455,036
Textiles and apparel.....	346,150	1.28	443,072	1.83	633,454
Lumber and wood products.....	315,890	1.78	562,284	2.54	802,360
Furniture and fixtures.....	342,290	1.95	667,466	2.78	951,566
Paper and allied products.....	238,210	1.58	376,372	2.25	535,972
Chemical and allied products.....	158,070	1.68	265,558	2.39	377,787
Manufacturing.....	324,150	1.05	340,358	1.50	486,225
Transportation.....	413,760	1.35	558,576	1.91	790,282
Communications and utilities.....	283,020	1.24	350,945	1.76	498,115
Wholesale and retail trade.....	604,330	1.05	634,546	1.49	900,452
Finance, insurance, and real estate.....	261,400	1.23	321,522	1.75	457,450
Services.....	669,530	1.14	763,264	1.63	1,091,334

¹ \$1 million times direct household coefficient.

² From Table 3.

³ Direct income change times Type I multiplier.

⁴ Direct income change times Type II multiplier.

crops sector were increased by the same \$1 million, total personal income generated in the economy would change by \$1,047,011. Likewise, a similar increase in output of the farm forestry sector would generate about \$1.1 million in personal income.

The agricultural processing and chemical and allied products sectors have relatively small direct household coefficients. That is, they are both capital-intensive rather than labor-intensive sectors. A \$1 million increase in output would add only \$179,720 and \$158,070 in direct household payments, respectively. However, the structural relationships of each with other endogenous sectors are strong enough that an increase in sectoral output directly and indirectly increases household income by \$413,356 and \$265,558. When induced consumption changes are included, estimates of total household income generated increase to \$585,887 and \$377,787. In the case of agricultural processing, strong structural ties with other sectors would generate an amount of income over three times as large as the initial or direct change, as compared with 2.4 times as large for the chemical and allied products sector.

In contrast to the above sectors, the manufacturing and finance, insurance, and real estate sectors would add much smaller amounts to household income through increased output. Both have relatively weak structural ties to the economy. Thus, both magnitude of the direct change in household income by sector and the degree of structural interdependency are important in evaluating the impact of increased or decreased sectoral output on the level of household income in the economy.

Since the Type II income multiplier is always larger than its Type I counterpart, policymakers or others using these multipliers must decide which type of multiplier provides the most realistic estimate of income effects in the Alabama economy. For planning purposes, income multipliers may more nearly approximate a simple average of the two estimates.

Employment Multipliers

Employment multipliers estimate how total employment is affected by a change in final demand for the output of each endogenous sector. Changes in employment resulting from changes in final demand depend on the employment function of each endogenous sector. The basic assumption was made that employment in each endogenous sector increases at the same rate as output in that sector. This relationship may not hold for all sectors. For in-

dustries where employment has not increased at the same rate as output, employment multipliers may be too high. Agriculture is also a special case because technology is changing so fast that capital has been and still continues to be substituted for labor at a rapid rate. There are also many underemployed resources in agriculture that may be put to other uses as the opportunity presents itself. For these reasons, employment multipliers were not computed for the three primary agricultural sectors.

Total effect of a change in final demand on employment within the economy has three components: direct employment changes that result from a specific sector's response to a change in final demand; indirect employment changes resulting from endogenous output adjustments required to directly and indirectly support a change in output; and induced employment changes arising out of sectoral responses to a change in level of local household consumption expenditures.

Direct employment effects were computed as a ratio expressing employment per \$1,000 of gross output in the manner developed by Bills and Barr (2). Estimated nonagricultural employment for the endogenous sectors is shown in Table 8. To obtain direct employment effects for each sector, sectoral employment was divided by sectoral output. The wholesale and retail and services sectors had the largest direct employment per \$1,000 of gross output, whereas the chemical and allied products, paper and allied products, and agricultural processing sectors had the smallest. This is

TABLE 8. ENDOGENOUS EMPLOYMENT, NONAGRICULTURAL SECTORS, ALABAMA ECONOMY, 1967

Sector	Employment
	No.
Agricultural processing	23,600
Mining	9,920
Construction	50,700
Textiles and apparel	82,700
Lumber and wood products	19,600
Furniture and fixtures	4,400
Paper and allied products	15,000
Chemical and allied products	11,700
Manufacturing	131,800
Transportation	31,600
Communications and public utilities	21,700
Wholesale and retail trade	179,600
Finance, insurance, and real estate	39,800
Services	125,200

Source: United States Department of Labor, *Employment and Earnings Statistics for States and Areas 1939-67*.

because the first group of sectors utilizes much more labor than the latter sectors per \$1,000 of output.

Two types of employment multipliers, analogous to the two types of income multipliers, were computed, Table 9. The Type I employment multiplier is the ratio of the direct and indirect effect to the direct effect; it estimates the total employment generated in the economy by a 1-unit change in employment in a particular sector. For example, a 1-unit change in employment in the agricultural processing sector was estimated to create directly and indirectly 2.72 units of employment in the economy. Likewise, a 1-unit change in employment in the wholesale and retail sector would generate directly and indirectly only 1.04 units of employment. Type I employment multiplier for the aggregate economy was estimated to be 1.56.

The Type II employment multiplier introduces the induced effects of household consumption expenditures on employment. As employment increases throughout the economy as a result of a 1-unit change in a given sector, additional employment is created as consumption expenditures increase. Average Type II employment multiplier for the Alabama economy was 2.31.

The effect of employment multipliers may be expressed in more meaningful terms by assuming a given increase in output of a particular sector and illustrating the direct, indirect, and induced effects of this output increase on total employment in the economy. Direct, indirect, and induced employment effects of an assumed \$1 million increase in output are shown in Table 10. It

TABLE 9. EMPLOYMENT MULTIPLIERS, NONAGRICULTURAL SECTORS, ALABAMA ECONOMY, 1967

Sector	Type I multiplier	Type II multiplier
Agricultural processing	2.72	3.82
Mining	1.82	3.01
Construction	1.34	1.99
Textiles and apparel	1.27	1.72
Lumber and wood products	1.68	2.30
Furniture and fixtures	1.92	2.68
Paper and allied products	1.83	2.92
Chemical and allied products	1.98	3.12
Manufacturing	1.07	1.69
Transportation	1.44	2.18
Communications and utilities	1.32	2.04
Wholesale and retail trade	1.04	1.42
Finance, insurance and real estate	1.25	1.82
Services	1.14	1.62
ECONOMY	1.56	2.31

TABLE 10. CHANGES IN EMPLOYMENT RESULTING FROM A \$1 MILLION CHANGE IN OUTPUT, NONAGRICULTURAL SECTORS, ALABAMA ECONOMY, 1967

Sector	Per \$1 million change in output				
	Direct change in employment ²	Type I multiplier	Direct and indirect change ¹	Type II employment multiplier	Direct, indirect, induced change ¹
	No.		No.		No.
Agricultural processing.....	26	2.72	70	3.82	99
Mining.....	39	1.82	71	3.01	117
Construction.....	33	1.34	44	1.99	66
Textiles and apparel.....	67	1.27	85	1.72	115
Lumber and wood products.....	62	1.68	104	2.30	143
Furniture and fixtures.....	60	1.92	115	2.68	161
Paper and allied products.....	24	1.83	44	2.92	70
Chemical and allied products.....	16	1.98	32	3.12	50
Manufacturing.....	37	1.07	40	1.69	63
Transportation.....	51	1.44	73	2.18	111
Communications and utilities.....	33	1.32	44	2.04	67
Wholesale and retail trade.....	112	1.04	116	1.42	159
Finance, insurance, and real estate.....	38	1.25	48	1.82	69
Services.....	110	1.14	125	1.62	178

¹ Rounded to nearest whole number.

was assumed that the increase in output occurred within one sector at a time, output of all other sectors remaining constant.

As was pointed out in the discussion of income multipliers, care also must be exercised in interpreting and using employment multipliers. Employment multipliers are nothing more than ratios of changes. They indicate the generative effect that a 1-unit change in employment in a particular sector will have on total employment in the economy.

As can be seen from Table 10, greatest total employment impact on the economy would occur in the services sector. However, neither Type I nor Type II employment multipliers for this sector are nearly as high as those of the agricultural processing sector. The main difference is in the direct employment requirement — high in the services sector and relatively low in the agricultural processing sector. Again this illustrates that Alabama's service industries are highly labor-intensive, whereas agricultural processing has a low labor-output ratio. Nevertheless, the services sector does not have the job-generating capacity throughout the economy as is found in the agricultural processing industries. Another example might be the contrast between the finance, insurance, and real estate sector and the mining sector. These two sec-

tors have approximately the same direct requirement, but the total employment created by an output change in mining is almost twice as great as that created by a like output change in finance, insurance, and real estate. A similar contrast exists between the textiles and apparel and lumber and wood products sectors. A \$1 million sectoral output change will bring forth a total of 115 jobs in the latter sector and 66 in the former, even though the direct employment requirement is approximately the same. In both mining and lumber and wood products, a high degree of structural interdependence caused a greater generative capacity. As was noted in the discussion of sectoral income changes, however, both direct employment requirement and degree of structural interdependence must be considered in evaluating employment effects.

Combined Effects

Total impact of a change in sectoral output on both income and employment can be estimated by combining the income and employment data from Tables 7 and 10. Estimated direct, indirect, and induced changes in both income and employment resulting from an assumed \$1 million change in final demand for each non-agricultural sector in the Alabama economy are summarized in Table 11. Only income changes are presented for the primary agricultural sectors. Taking agricultural processing as an example, a \$1 million increase in sectoral output will directly create an annual income flow in the amount of \$179,720 and sustained employment for 26 people. Direct and indirect effects — changes that occur in other sectors as a result of direct changes in agricultural processing — will be the creation of \$413,356 in household income and 70 new jobs. When increased consumption resulting from greater income and employment is considered, total effect on the economy will be \$585,887 of income and 99 new jobs.

Greatest total combined income and employment effects occur in the services sector because of high direct labor requirements in its industries. Direct, indirect, and induced changes resulting from a \$1 million change in output would be for the creation of 178 new jobs and a sustained annual income flow of approximately \$1.1 million. Income and employment multipliers are low within this sector, but it had the highest direct requirements of both. Further, there is relatively little capital outlay associated with expanding the services sector, as with agricultural processing, paper and allied products, or chemical and allied products.

TABLE 11. ESTIMATED CHANGES IN INCOME AND EMPLOYMENT RESULTING FROM A \$1 MILLION CHANGE IN OUTPUT, BY SECTOR, ALABAMA ECONOMY, 1967

Sector	Per \$1 million change in output					
	Direct change		Direct and indirect change		Direct, indirect, and induced change	
	Income	Employment	Income	Employment	Income	Employment
	<i>Dol.</i>	<i>No.</i>	<i>Dol.</i>	<i>No.</i>	<i>Dol.</i>	<i>No.</i>
Livestock.....	462,470	---	776,950	---	1,105,303	---
Crops.....	457,210	---	736,108	---	1,047,011	---
Farm forestry.....	483,580	---	773,728	---	1,102,562	---
Agricultural processing.....	179,720	26	413,356	70	585,887	99
Mining.....	277,370	39	490,945	71	696,199	117
Construction.....	254,210	33	320,305	44	455,036	66
Textiles and apparel.....	346,150	67	443,072	85	633,454	115
Lumber and wood products.....	315,890	62	562,284	104	802,360	143
Furniture and fixtures.....	342,290	60	667,466	115	951,566	161
Paper and allied products.....	238,210	24	376,372	44	535,972	70
Chemical and allied products.....	158,070	16	265,558	32	377,787	50
Manufacturing.....	324,150	37	340,358	40	486,225	63
Transportation.....	413,760	51	558,576	73	790,282	111
Communications and utilities.....	283,020	33	350,945	44	498,115	67
Wholesale and retail trade.....	604,330	112	634,546	116	900,452	159
Finance, insurance, and real estate.....	261,400	38	321,522	48	457,450	69
Services.....	669,530	110	763,264	125	1,091,334	178

¹ Employment multipliers were not computed for the three primary agriculture sectors.

Information such as that presented in Table 11 provides some valuable quantitative estimate of the comparative impact of various types of development activities on the Alabama economy. Too often expenditure decisions for development are made without adequate knowledge of probable effects on the remainder of the economy. If there are choices as to types of industries that might be attracted to the State, then wide use could be made of information such as the above in planning for economic development. Of course, development planning must also consider the level and state of technology and available resources in the area — including human, natural, and capital resources.

SUMMARY AND CONCLUSIONS

The purpose of this study was to estimate and evaluate the structural relationship of the various sectors of the Alabama econ-

omy. Emphasis was placed on the agricultural and related sectors because of their economic importance.

An input-output model consisting of 17 endogenous and 4 exogenous sectors was developed for the State. Two types of economic multipliers resulted from the model and should be of use to those interested in economic development at various levels of planning. Income multipliers, indicating the extent to which personal income would be expanded as a result of a \$1 income change in a particular sector, were highest in the agricultural processing, furniture and fixtures, lumber and wood products, and mining sectors. Lowest multipliers were in the manufacturing and wholesale and retail trade sectors. Employment multipliers, on the other hand, estimate total employment created throughout the economy as employment changes one unit in a given sector. These values were large for agricultural processing, chemical and allied products, and mining sectors, but low for the wholesale and retail trade sector.

To provide some quantitative assessment of the impact of a change in sectoral output on income and employment, a \$1 million change in final demand was assumed for each sector. Greatest income effect would occur in the three primary agricultural sectors, but greatest total combined income and employment impact would show up in the services sector because of the high direct labor requirements of its industries.

One obvious conclusion from this study concerns the benefits that can accrue to the Alabama economy if greater interdependence between industrial sectors can be established. Stronger linkages between sectors could increase the total generative effect of a change in final demand for locally produced goods and services.

As pointed out in a similar study (5), there exists in Alabama a tremendous need for additional research in the broad area of interindustry economics. Much more work is needed on State and local levels to ascertain the actual flows of goods and services between industrial sectors. This would provide more precise data so that researchers would not have to rely so heavily on national models. Surveys should be taken to establish the nature and origin of certain critical sectoral flows, and this information should be updated periodically, say every 3 to 5 years. If this were accomplished, individual researchers in the field could concentrate their time and efforts on much needed analysis and interpretation.

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APPENDIX

Composition of Sectors of the Alabama Model

Model Sector 1 – livestock and livestock products

- | | |
|---------------------|-----------------|
| a. Dairy products | c. Meat animals |
| b. Poultry and eggs | |

Model Sector 2 – crops

- | | |
|-------------------------|----------------------|
| a. Cotton | e. Vegetables |
| b. Food grains | f. Oil bearing crops |
| c. Feed grains | g. Greenhouse crops |
| d. Fruits and tree nuts | |

Model Sector 3 – farm forestry

- | | |
|--------------------|--------------|
| a. Posts and poles | c. Sawtimber |
| b. Pulpwood | d. Crossties |

Model Sector 4 – agricultural processing

- | | |
|--|-------------------------------------|
| a. Processed meat products | g. Animal and fowl feeds |
| b. Processed dairy products | h. Milling products |
| c. Seafood products | i. Bakery products |
| d. Processed fruits and vegetables | j. Other processed foods and drinks |
| e. Pickles, sauces, and salad dressing | k. Cottonseed and soybean mills |
| f. Flour and cereal | l. Vegetable oil mills |
| | m. Other processing services |

Model Sector 5 – mining

- | | |
|--------------------|------------------------------------|
| a. Iron ore mining | d. Crude petroleum and natural gas |
| b. Nonferrous ores | e. Chemicals and fertilizer mining |
| c. Coal mining | |

Model Sector 6 – construction

- | | |
|---------------------|--|
| a. New construction | b. Maintenance and repair construction |
|---------------------|--|

Model Sector 7 – textiles and apparel

- | | |
|---|--|
| a. Broad and narrow fabrics | c. Apparel |
| b. Miscellaneous fabricated textile goods | d. Miscellaneous fabricated textile products |

Model Sector 8 – lumber and wood products

- | | |
|------------------|----------------------------------|
| a. Logging camps | c. Veneer and plywood |
| b. Sawmills | d. Prefabricated wood structures |

Model Sector 9 – furniture and fixtures

- | | |
|------------------------------------|-------------------------------|
| a. Wood household furniture | e. Office furniture |
| b. Metal household furniture | f. Public building furniture |
| c. Upholstered household furniture | g. Partitions and fixtures |
| d. Mattresses and bedsprings | h. Venetian blinds and shades |

Model Sector 10 – paper and allied products

- | | |
|---------------------|------------------------------------|
| a. Pulp mills | d. Sanitary paper products |
| b. Paper mills | e. Converted paper products |
| c. Paperboard mills | f. Paperboard containers and boxes |

Model Sector 11 – chemicals and allied products

- | | |
|---------------------------|---------------------------------|
| a. Industrial chemicals | d. Other chemical products |
| b. Fertilizers | e. Plastic and plastic products |
| c. Agricultural chemicals | |

Model Sector 12 – other manufacturing

- | | |
|---|--|
| a. Ordnance | m. Metal containers |
| b. Tobacco products | n. Screw machine products |
| c. Printing and publishing | o. Fabricated metal products |
| d. Drug and toilet preparations | p. Engines and turbines |
| e. Paints and allied products | q. Construction, mining, oil field machinery and equipment |
| f. Rubber and miscellaneous plastics products | r. Other industrial machinery and equipment |
| g. Leather products | s. Household appliances |
| h. Footwear | t. Electric lighting and wiring |
| i. Glass and glass products | u. Electronic components |
| j. Stone and clay products | v. Transportation equipment |
| k. Primary iron and steel manufacturing | w. Professional instruments |
| l. Primary nonferrous metals manufacturing | x. Miscellaneous manufacturing |

Model Sector 13 – transportation

- | | |
|---------------------------------|--|
| a. Railroads | e. Pipeline transportation |
| b. Motor freight transportation | f. Transportation services and warehousing |
| c. Water transportation | |
| d. Air transportation | |

Model Sector 14 – communications and utilities

- | | |
|-------------------------|--------------------------------|
| a. Radio and television | d. Gas utilities |
| b. Other communication | e. Water and sanitary services |
| c. Electric utilities | |

Model Sector 15 – wholesale and retail trade

- | | |
|--------------------|-----------------|
| a. Wholesale trade | b. Retail trade |
|--------------------|-----------------|

Model Sector 16 – finance, insurance, and real estate

- | | |
|--------------------|---------------------------------|
| a. Banking | c. Security commodity broker |
| b. Credit agencies | d. Insurance agents and brokers |

Model Sector 17 – services

- | | |
|----------------------------------|---|
| a. Hotels and lodging places | e. Amusements |
| b. Personal repair services | f. Medical, educational services, and nonprofit organizations |
| c. Business services | |
| d. Automotive repair and service | |

Model Sector 18 — state and local government

- a. County governments
- b. Municipal governments
- c. Separate school districts
- d. State government

Model Sector 19 — federal government

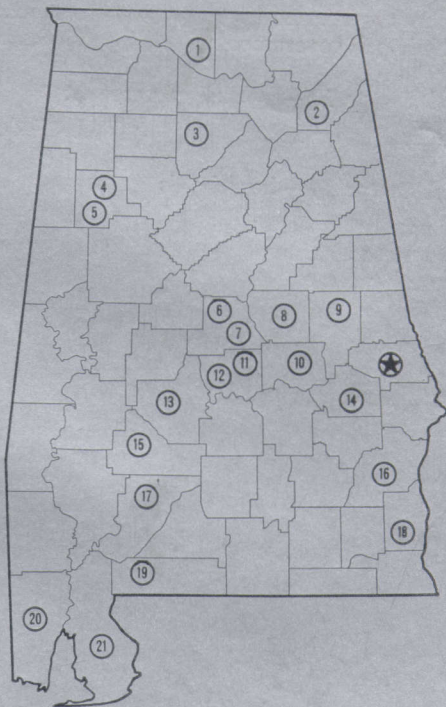
- a. Federal expenditures
- b. Federal receipts

Model Sector 20 — households

- a. Wages and salaries
- b. Proprietor income
- c. Rental income
- d. Household consumption expenditures

AGRICULTURAL EXPERIMENT STATION SYSTEM OF ALABAMA'S LAND-GRANT UNIVERSITY

With an agricultural research unit in every major soil area, Auburn University serves the needs of field crop, live-stock, forestry, and horticultural producers in each region in Alabama. Every citizen of the State has a stake in this research program, since any advantage from new and more economical ways of producing and handling farm products directly benefits the consuming public.



Research Unit Identification

★ Main Agricultural Experiment Station, Auburn.

1. Tennessee Valley Substation, Belle Mina.
2. Sand Mountain Substation, Crossville.
3. North Alabama Horticulture Substation, Cullman.
4. Upper Coastal Plain Substation, Winfield.
5. Forestry Unit, Fayette County.
6. Thorsby Foundation Seed Stocks Farm, Thorsby.
7. Chilton Area Horticulture Substation, Clanton.
8. Forestry Unit, Coosa County.
9. Piedmont Substation, Camp Hill.
10. Plant Breeding Unit, Tallassee.
11. Forestry Unit, Autauga County.
12. Prattville Experiment Field, Prattville.
13. Black Belt Substation, Marion Junction.
14. Tuskegee Experiment Field, Tuskegee.
15. Lower Coastal Plain Substation, Camden.
16. Forestry Unit, Barbour County.
17. Monroeville Experiment Field, Monroeville.
18. Wiregrass Substation, Headland.
19. Brewton Experiment Field, Brewton.
20. Ornamental Horticulture Field Station, Spring Hill.
21. Gulf Coast Substation, Fairhope.