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Economic Interrelationships in a Rural East Tennessee Economy

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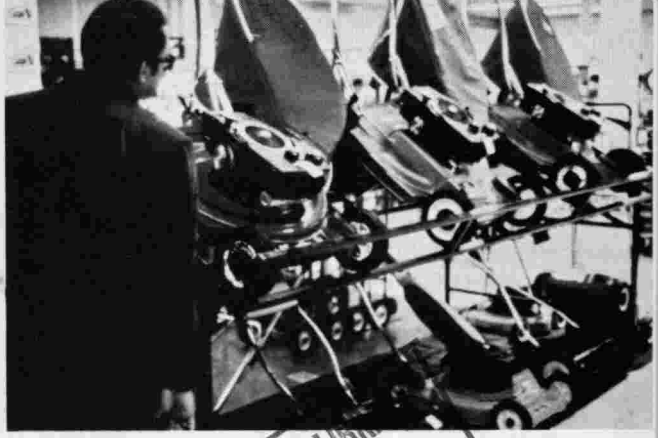

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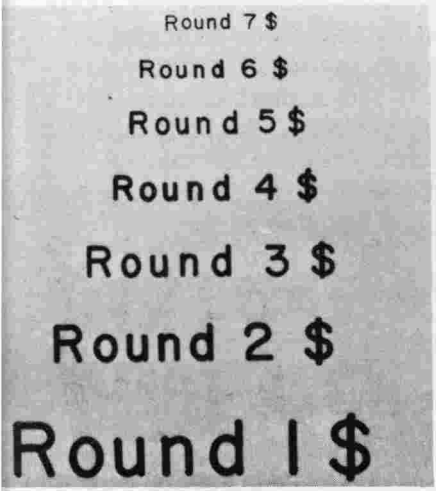

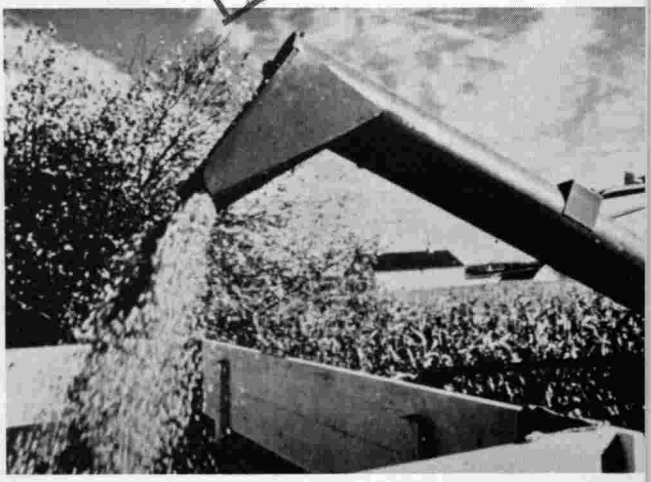

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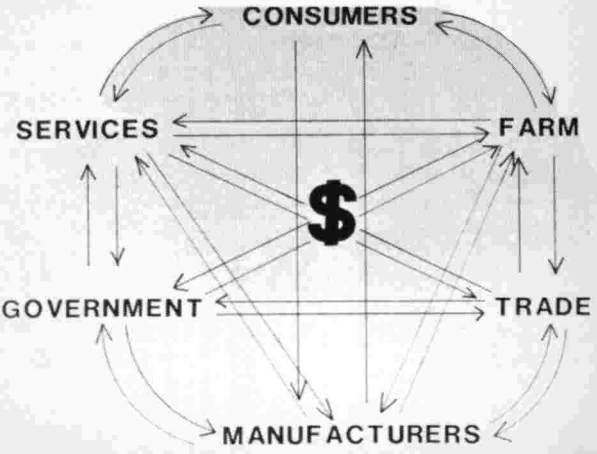

SUMMARY

The purpose of this study was to examine the economic structure of a composite rural area of Tennessee. Output, income, and employment multipliers were estimated for each of eight business sectors identified for the synthesized economy.

Output multipliers were calculated to reflect the estimated total value of output generated in the local economy by a sector making an additional sale of one dollar to final demand. The estimated final demand output multiplier was highest, 1.93, for the Agricultural Sector. Estimates ranged from 1.38 to 1.49 for the Eating, Drinking, and Lodging, Local Government, Other Services, and Finance, Insurance, and Real Estate (F.I.R.E.) sectors. Lowest output multipliers, ranging from 1.11 to 1.17, were estimated for the Automotive, Trade, and Manufacturing and Processing sectors.

Income multipliers by sectors were used to estimate the total change in local household income for every dollar increase in direct payment to the Household Sector. Estimated income multipliers were 1.78 for the Agriculture Sector and 1.45 for the Trade Sector, while the remainder ranged from 1.22 to 1.32.

Employment multipliers were calculated by sectors to estimate the total man-years of employment generated in the local economy by an employment increase of one man-year. The highest employment multipliers were 1.79 for the F.I.R.E. Sector, 1.46 for the Trade Sector, and 1.34 for the Automotive Sector. Estimated employment multipliers for other sectors ranged from 1.23 for the Agricultural Sector to 1.08 for the Eating, Drinking, and Lodging Sector.

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Economic Interrelationships in a Rural Tennessee Economy

Thomas H. Klindt and George F. Smith*

INTRODUCTION

Public and private leaders at the county level routinely make decisions which affect the economic growth of rural areas. Often, these decisions are made without adequate information. Information is needed which would allow estimation of the economic consequences of alternative courses of action. If decision-making is to be effective, it is necessary that the requisite information be at a level of aggregation which corresponds to the decision makers' area of influence.

OBJECTIVES

The purpose of this study was to examine the economic structure of a synthesized or composite area economy in rural Tennessee. Specific objectives were to identify a set of economic sectors for the synthesized economy and estimate output, income and employment multipliers for each sector through input-output analysis techniques.

THE STUDY AREA

Primary data from Claiborne, Overton, and Pickett counties[1] in Tennessee were combined to synthesize an "average" or "composite" rural economy. Responses from the three counties were pooled to create a composite area economy which reflected an "average" of the geographic size and economic structure of the three counties.[2]

Claiborne County is located in the northern portion of East Tennessee while Overton and Pickett counties are located in the

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[1]The three counties were among those selected as pilot areas for intensive research and Extension efforts under Title V of the Rural Development Act of 1972.

[2]The method used in combining responses is presented in the "Procedure" section of this report.

northeastern portion of Middle Tennessee. Although geographically separated, the three rural counties had many natural resource, population, and economic characteristics which were similar.

Natural Resources

Each county had a rough, generally forested terrain similar to much of Appalachia. In 1971, privately-owned forests comprised the largest portion of the total area in each county, ranging from 57% in Claiborne County to 62% in Overton County (Table 1). However, these forests were not utilized intensively. In addition to having similar portions of forested acres, the three counties had about the same percent of cropland area in 1969. The highest percentage of cropland to total area was 26% in Claiborne County while the lowest was 22% in Pickett County.

Table 1. Selected characteristics of the land base in Claiborne, Overton and Pickett counties, Tennessee

Characteristic	Claiborne	Overton	Pickett
	percent of total area		
Inland water area, 1960[a]	2	0	9
Land area, 1971[a]	98	100	91
Commercial forests, 1971[a]	57	62	60
Total cropland, 1969[b]	26	24	22

[a]Source [2, Tables 8.11 and 9.1].

[b]Source [9, Table 1].

Each county borders or has a large water impoundment within its boundaries. In 1960 Pickett County had approximately 9% of its area covered by inland water, primarily Dale Hollow Lake, a Corps of Engineers reservoir (Table 1). This lake also extends into Overton County. Claiborne County contains a portion of Norris Lake, a TVA reservoir, which accounted for much of the 2% of the county area covered by inland water in 1960. In addition to these man-made reservoirs, each county has several miles of clear, free-flowing streams.

While much of the resource base was similar among the three counties, differences also existed. Principal among these was the availability of minerals. During 1967, the value added in mining (primarily coal) was $3.9 million in Claiborne County whereas coal mining operations within the other two counties were negligible [2, Table 15.6]. Moreover, coal reserves in 1971 were reported as 50.5 million short tons in Claiborne County with no coal reserves being reported for Overton and Pickett counties [2, Table 15.10].

Population Characteristics

Selected population characteristics for each of the three counties are presented in Table 2. In terms of total population, a relatively wide range existed in 1973—4,014 in Pickett to 20,715 in Claiborne. However, less variation was found in other measures of population characteristics. The median age of persons in the three counties ranged from 29 years in Claiborne to 32 in Pickett. This was somewhat higher than the 28 median age for all persons in the state [2, Table 16.8]. Each of the counties lagged behind the state in the percentage of persons 25 years of age or older with a high school education. Figures ranged from 19% in Overton County to 24% in Claiborne, while the comparable figure for the state was 42% [8, Table 2]. The place of residence indicated that all of the counties were largely rural. The percentage of population living on farms ranged from 22% in Overton County to 47% in Pickett County. The remainder of the population in Claiborne and Pickett counties lived in rural nonfarm areas. In Overton County, 58% of the population lived in rural nonfarm areas while 20% lived in urban areas.

Table 2. Selected population characteristics for Claiborne, Overton and Pickett counties, Tennessee, 1970

Characteristic	Claiborne	Overton	Pickett
Total population—1973[a]	20,715	15,618	4,014
Median age[b]	29	30	30
Percent 25 years of age or older with high school education[b]	24	19	20
Percent living in urban areas[b]	0	20	0
Percent living in rural nonfarm areas[b]	62	58	53
Percent living on farms[b]	38	22	47

[a]Source: Provisional estimates by Center for Business and Economic Research in [2, Table 16.1].

[b]Source [8, Table 2].

Economic Characteristics

For the three counties, levels of family income were similar and relatively low compared with the state level. According to the 1970 Census of Population, median family income for the three counties was $4,266 in Claiborne, $4,348 in Overton, and $4,612 in Pickett [2, Table 11.6]. These median family incomes were all considerably lower than the $7,447 figure reported for the state [2, Table 11.5]. Further evidence of the relatively low levels of income

was given by the percentage of families below the poverty income level.[3] These figures for 1969 were 39% in Claiborne, 36% in Overton, and 34% in Pickett while the comparable figure for the state was 18% [2, Table 11.16].

In 1970, the total civilian labor force in the three counties was 5,885 in Claiborne, 5,421 in Overton, and 1,293 in Pickett [8, Table 2]. Of these work forces, 7.1%, 5.6%, and 6.0% were unemployed in Claiborne, Overton, and Pickett counties, respectively. These unemployment rates were all higher than the comparable figure of 4.4% for Tennessee.

In each of the three counties, a large portion of the labor force was hired by manufacturing industry. In Overton and Pickett counties, 44 and 43%, respectively, of total employment during 1970 was in manufacturing industry (Table 3). The lower figure of 25% hired by manufacturing industry in Claiborne County was still the largest single employment classification.

[3]Data were from an index adopted by a federal interagency committee in 1969. The index includes many factors such as income, family size, number of children, and place of residence. As an example, the threshold of poverty for a nonfarm family of four was $3,743 in 1969. The comparable figure for a farm family of four was $3,195 [2, Table 11.16].

Table 3. Total number of employed persons 16 years old and over and the percent in major industry groups in Claiborne, Overton, and Pickett counties, 1970[a]

Industry	Claiborne	Overton	Pickett
Total employed	5,467	5,117	1,215
Percent in agriculture, forestry, and fisheries	12	8	10
Percent in mining	4	1	1
Percent in construction	7	8	10
Percent in manufacturing	25	44	43
Percent in transportation, communication, and public utilities	5	2	3
Percent in wholesale and retail trade	16	13	13
Percent in finance, insurance, and real estate	2	2	0
Percent in services	25	20	16
Percent in public administration	3	2	4

[a]Source [2, Table 12.5]. Percentages were calculated from employment figures.

In each of the three counties, agriculture was an important base industry. The percentage of total employment in the agriculture, forestry, and fisheries industry ranged from 8.4% in Overton to 12.2% in Claiborne (Table 3). The total value of agricultural sales were $6.0 million ($3.2 million crops, $0.1 million forest products, and $2.7 million livestock) in Claiborne County, $3.9 million ($0.7 million crops, $0.1 million forest products, and $3.1 million livestock) in Overton County, and $1.9 million ($0.8 million crops, $0.1 million forest products, and $1.0 million livestock) in Pickett County [9, Table 4]. In each county, tobacco was the largest contributor to crop sales while most of the livestock receipts were from cattle sales.

PROCEDURE

Input-output analysis aids in examining interrelationships which exist among sectors of an economy and facilitates estimation of output, income and employment multipliers.[4] Input-output analysis has been conducted for rural county economies [4, 5, and 7]; however, limitations exist which diminish its usefulness for such small economies. Because of data requirements, input-output analysis has a relatively high cost. In addition, when the economy under study is small, unique sectoral interrelationships due to the economic dominance of one or two firms or special circumstances may occur. When unique economic structures are unstable, the predictive capabilities of the model for the economy under study is limited. Moreover, the presence of uniqueness in individual small economy studies limits generalizing results to other area economies.

To partially alleviate these limitations, modifications were made in the traditional input-output analysis. First, an examination was made of the economic interrelationships among sectors of a composite of three counties rather than a particular economy. It was anticipated that while this modification would preclude a completely accurate representation of each county economy, the results would be more stable and amenable for generalization to similar area economies. Second, the complete specification of a "transactions matrix" to determine total monetary flows among sectors in the study area was bypassed. This step would have required that all firms in the study area be interviewed. Instead, the monetary linkages among sectors (direct requirements) were estimated from a sample of firms. Doing so materially reduced the cost of the study.

Identification of Economic Sectors

The first step involved in identifying the economic sectors was

[4]For a description of input-output analysis techniques, see [3 or 6].

to compile a list of firms from local telephone directories for the three counties. Emphasis was given to aggregating the identified business firms[5] and other economic units (households, government, and other public institutions) into categories with similar input, output, and processing characteristics. However, it was necessary to constrain the number of sectors to reflect the composition of the small rural economies under study. It was also occasionally necessary to aggregate into a single sector combinations of firms which were more heterogenous than desirable.

From the list of firms compiled from the telephone directories, seven sectors were identified. To these, the Household and Agriculture sectors were added. The nine sectors together with brief descriptions of each are shown in Table 4.

[5]Unless otherwise noted, the term "firm" is used to denote firms and public agencies.

Table 4. Economic sectors and sector descriptions for a composite rural Tennessee economy, 1974

Sector	Description
1. Manufacturing and processing	Clothing manufacturers, furniture manufacturers and processors of stone products, bottlers, etc.
2. Agriculture	Farm enterprises which produce agricultural products
3. Trade	Wholesale and retail businesses, e.g., grocers, drug stores, department and variety stores, implement dealers, petroleum products, hardware stores, etc.
4. F.I.R.E.	Finance, insurance, and real estate firms
5. Eating, drinking, and lodging	Restaurants and other eating places, bars, motels, and campgrounds
6. Other services	Recreational service firms, repair firms, construction, professional services, etc.
7. Automotive	Automobile dealers, repair firms, and parts suppliers
8. Local government	Schools, road department, law enforcement, special districts, etc.
9. Household	As sellers, families and individuals who provide labor, entrepreneurial ability, and capital to other economic units within the local economy. As purchasers, families and individuals who make expenditures, including savings, for nonbusiness purposes.

The Manufacturing and Processing Sector represented a relatively diverse group of firms. However, the number of firms and volume of business in apparel and furniture manufacturing weighted the data heavily. The Agriculture Sector, which represented all farm firms, was comprised of relatively homogenous small family farms. Agricultural production in the three counties included beef, dairy, tobacco, grain, hogs, and horticultural crops. The Trade Sector represented all retail and wholesale firms, excluding firms which specialized in automotive sales. The Finance, Insurance, and Real Estate (F.I.R.E.) Sector is self-explanatory, as is the Eating, Drinking, and Lodging Sector. The Other Services Sector included a diverse group of firms which provided services (as opposed to products) not specified in other sectors. The Automotive Sector represented firms which provided products or services related to automobiles (except petroleum products). The Local Government Sector represented local public institutions while the Household Sector represented individuals and families in twin roles of producer and consumer (supplying labor, entrepreneurial ability, and capital and alternatively making non-business expenditures).

Construction, Mining, and Utility sectors were included in the formative stages of the study but were later omitted. The Construction Sector was excluded after determining that few construction firms existed in the local economies and most of those were subsidiaries of firms in the Trade Sector. The Utility Sector was excluded after verifying that most of the utilities were neither locally owned or operated and purchased essentially no inputs locally. The few small utilities which were local operations were included in the Local Government Sector. The Mining Sector was excluded after it was determined that only one of the three counties in the study has substantial mining activity and that data for the sector would be difficult to obtain.

Sample Selection

The method of determining the sample of firms and economic units from which data were to be obtained varied among sectors. To obtain a sample of firms for six of the sectors (excluding the Agriculture, Local Government, and Household sectors), the firms identified from local telephone directories were subdivided into appropriate sectors. A random sample, stratified by size, was then drawn for each of the sectors. The sample of farm firms for the Agriculture Sector was composed of a random selection of full-time farmers from the Agricultural Extension Service mailing lists in the three counties. The sample of public institutions selected to represent the Local Government sector consisted of the local school, road, and law enforcement systems together with local, publicly-controlled utilities. These public

agencies were chosen because they represented the major portion of local public expenditures. The random sample of households used to represent the Household Sector was taken from a previous study (see Appendix A).

The number of firms from which data were obtained for each sector is shown in Table 5. Excluding the Household Sector, 107 usable questionnaires were obtained.

Table 5. Number of identified economic units and usable questionnaires, by sector, for a composite rural Tennessee economy, 1974

Sector	Number of economic units[a]	Usable questionnaires
1. Manufacturing and processing	27	7
2. Agriculture	4,141[b]	16
3. Trade	250	31
4. F.I.R.E.	32	10
5. Eating, drinking, and lodging	31	9
6. Other services	124	16
7. Automotive	35	9
8. Local government	—[c]	9
9. Household	—[d]	265[d]

[a]Identified in local telephone directories unless otherwise noted.

[b]Number of farms in 1969 [2, Table 1.7].

[c]The number of governmental units depends upon the level of aggregation used, e.g., there are three school systems but 34 public schools.

[d]See Appendix A.

Data Obtained

The management of each firm interviewed was requested to provide information on expenditures and employment for 1974. Total expenditures of each firm were divided into the portions which were made inside and outside the resident county. In addition, the expenditures made within the county were distributed among the identified sectors. Business profit (the difference between total receipts and expenditures) was included as an expenditure to the Household Sector as payment for labor, entrepreneurial skill, and/or capital.[6] This method of accounting for business profit maintained

[6]In certain instances, business profit accrued to parent companies or owners outside the local economy. In those cases, business profit was considered to be a leakage—expenditures outside the local economy.

equality of total receipts and total expenditures for each firm.

In addition to expenditure data, information was also obtained on employment by each firm. Specifically, data were collected on total full-time and part-time employment, with part-time employment data categorized to allow conversion to full-time equivalents.

Data from firms in the three counties were pooled as if all were from the same county. By doing so, a composite single area economy was synthesized with characteristics which reflected the structure of the three counties. Because each firm manager allocated expenditures within the context of a one-county area, pooling the data resulted in information on a composite economy of geographic size equivalent to an average of the three counties.[7]

Analytical Methods

The first step in the analysis was to calculate "direct requirements" for each sector. Direct requirements are defined as the percentage distribution of total expenditures which firms in a sector make in all local sectors (inside the economy under study). A sector's direct requirements may be interpreted as the distribution of local expenditures per dollar of total expenditures. Moreover, since each firm's total sales (output) were set equal to total expenditures by including profit as an expenditure, a sector's direct requirements may also be interpreted as the distribution of local expenditures per dollar of sales (output). Relationships which existed among economic sectors were specified in the set of direct requirements for all sectors in the composite economy. Therefore, they were the foundation for estimating secondary impacts which would be created in the local economy by a sector altering its level of output.

To illustrate, if a sector increased its export sales by one dollar, it would, given the assumptions of the model, increase its expenditures for inputs by one dollar. A portion of the expenditures, as shown by its direct requirements, would flow out of the local economy to buy imports and a portion would be spent in sectors within the local economy. In meeting the increased demand, the other sectors would have increased their output by the amount of the additional purchases. Moreover, by making these sales, the local sectors would have to increase purchases of inputs by the amount of the sales. Again, the expenditures for inputs by each of the affected sectors would flow partially inside and partially outside the economy. This cycle would continue in an iterative manner, spreading the output-increasing effects throughout the local economy. However, each iteration would have a smaller impact in the local economy than the

[7]The concept of an average as used here is, of course, not specific. It relates to the trading patterns of interviewed firms.

last because a portion of the expenditures in each round of transactions would be "leaked" or spent outside the local economy. Ultimately, the local output-increasing effects would diminish to zero. However, in the process, the original increase in output would have caused secondary output-increasing effects in other local sectors.

In this analysis, the total increase in output within the composite economy resulting from a one-dollar increase in sales to final demand[8] were estimated for each sector. The estimates are termed "final demand output multipliers." Computation involved constructing a "direct requirements matrix," a table showing direct requirements for each sector in columns (for example, see Table 6). From the direct requirements matrix, computation followed standard input-output analysis techniques.[9]

In addition to output effects, intersectoral linkages were used to estimate household income effects. Income effects indicate the additional income which would accrue to local households as a result of the total local output generated by a sector increasing its sales to final demand by one dollar. Further, income effects were used to estimate income multipliers, by sectors, which indicate the total increase in local household income due to a one-dollar increase in direct payment to the Household Sector.

The impact on local employment resulting from economic interaction was also estimated. Employment data obtained from the survey of local businesses were used in conjunction with results from the analysis of intersectoral linkages to estimate the total local employment which would occur if a sector increased its sales to final demand by a given amount. These estimates were then used to determine employment multipliers, the number of added local full-time jobs which would result from any sector hiring one more employee.

EMPIRICAL RESULTS

Direct Trade Requirements

The first step in quantifying the impact of sectoral linkages was the derivation of direct trade requirements for each sector. The percentage distributions which comprise the direct requirements for each sector are shown in Table 6. Entries in each column indicate the percent of total moneys spent locally by the respective purchasing

[8]Final demand sales represented sales for consumption by a sector, e.g., export sales and sales to households.

[9]Two sets of calculations were made—one including and one excluding the Household Sector. Results which exclude the impact of trade by the Household Sector are presented in Appendix B.

Table 6. Direct trade requirements per dollar of output for a composite rural Tennessee economy, 1974

Selling sector	Purchasing sector								
	Manu-facturing and processing	Agriculture	Trade	F.I.R.E.	Eating, drinking and lodging	Other services	Automotive	Local Government	Household
1. Manufacturing and processing	.0003	.0000	.0083	.0000	.0194	.0002	.0000	.0000	.0000
2. Agriculture	.0000	.0525	.0107	.0000	.0013	.0000	.0000	.0000	.0000
3. Trade	.0021	.3516	.0115	.0262	.0357	.0421	.0060	.0229	.3593
4. F.I.R.E.	.0007	.0601	.0063	.0063	.0257	.0074	.0028	.0128	.0283
5. Eating, drinking, and lodging	.0000	.0007	.0008	.0002	.0000	.0005	.0000	.0005	.0213
6. Other services	.0002	.0293	.0064	.0049	.0085	.0100	.0036	.0010	.0869
7. Automotive	.0002	.0332	.0058	.0026	.0051	.0079	.0166	.0116	.0644
8. Local government	.0012	.0230	.0107	.0050	.0042	.0028	.0036	.0051	.0072
9. Summation (Rc	.0047	.5504	.0605	.0452	.0999	.0709	.0326	.0539	.5674
10. Household	.2260	.2941	.1110	.5953	.3432	.5512	.1011	.5034	.0403
11. Total local purchases	.2307	.8445	.1715	.6405	.4431	.6221	.1337	.5573	.6077

sectors. For example, of each dollar spent by the Manufacturing and Processing Sector, $.0003 was spent among firms in the same sector, no discernible amount was spent in the Agriculture Sector and $.0021 was spent in the Trade Sector. In total $.0047 was spent in local business sectors while $.2260 was spent in the Household Sector. This means that total local purchases amounted to about $.23 of every dollar spent by the Manufacturing and Processing Sector. The direct requirements, or columns, for other sectors may be similarly interpreted.

Characteristics of local expenditure patterns among sectors may be seen by comparing columns of figures in Table 6. For example, the percentage of total expenditures made in local business and quasi-business sectors (row 9) range from 0.47% in the Manufacturing and Processing Sector to 55.04% in the Agriculture Sector. These figures show that manufacturers, probably by necessity, import the major portion of their inputs whereas farmers buy most of their inputs locally. The percent of inputs purchased locally among other sectors ranged from 3.26% in the Automotive Sector to 9.99% in the Eating, Drinking, and Lodging Sector, while the Household Sector purchased 56.74% of its products and services locally.

Figures in row 10 of Table 6 indicate the percent of total expenditures by each sector which went to the Household Sector. This figure was greatest among those sectors which provided a service, i.e., F.I.R.E., 59.53%; Other Services, 55.12%; and Local Government, 50.34%. The Eating, Drinking, and Lodging Sector which provided a mixture of products and services spent 34.32% of its total expenditures in the local Household Sector. The sectors which primarily purchased products and resold them in the local economy spent the lowest percentage of expenditures in the local Household Sector, 11.10% for the Trade Sector and 10.11% for the Automotive Sector.

Those sectors which resell products locally can have a large dollar volume of business with very little labor. Alternatively, in service sectors, much more labor is involved in each dollar of sales. The Agriculture and Manufacturing and Processing sectors, which transform raw products, made 29.41 and 22.60%, respectively, of their expenditures in the local Household Sector. These percentage figures lie between the service and product sales sectors.

Summing the percent of expenditures made by each sector to the local business and quasi-business sectors (row 9) and the local Household Sector (row 10) indicates the percent of total expenditures made within the local economy (row 11). This figure was highest for the Agriculture Sector with 84.45% and lowest for the Automotive Sector with 13.37%. The difference in the percent of total purchases

made locally among sectors was determined largely by the availability of local inputs. The necessary inputs for such sectors as Manufacturing and Processing, Automotive, and Trade were not available in the local area and, therefore, importation of inputs occurred. Alternatively, labor represented a large portion of the inputs for sectors which provided services, and local labor was comparatively more available than nonlabor inputs. The Agriculture Sector was unique in that both input supplies, services, and labor were purchased in the local economy.

The extent to which sectors purchase inputs locally was important not only because of the direct impact on the sectors from which the purchases were made, but also because of the effect on local secondary impacts.

Direct and Secondary Output Effects

Trade linkages, as reflected by direct trade requirements, were used to estimate total (direct and secondary) output increasing effects for each sector. Figures in the first eight rows of each column in Table 7 indicate the amount by which each sector listed at the left of the table would increase output if the sector listed at the top of a column increased sales to final demand by one dollar. The coefficients in each column include both the direct and secondary effects.

To illustrate, if the Agriculture Sector (column 2, Table 7) were to increase sales to final demand by one dollar, output in the local Manufacturing and Processing Sector would increase by $.0050. Further, output in the Agriculture Sector would increase by $1.0619. Note that one dollar of this amount represents the initial assumed increase in output. Also, output in the Trade Sector would increase by $.5755. Other entries in the column may be interpreted accordingly.

Figures in the first eight rows of Table 7 show the distributional impact of altered output by a given sector. Since the output effects are based on a one-dollar increase in output by a sector, conversion to larger, perhaps more realistic, figures can easily be made. For example, if information were available that the Manufacturing and Processing Sector were going to increase output by $500,000, firms in the Trade Sector would be expected to increase sales by $52,200 ($500,000 x 0.1044). Moreover, firms in the Automotive Sector would be expected to increase sales by $9,600 ($500,000 x 0.0192). Similar conversions may be made for other sectors.

Final Demand Multipliers

The detailed information concerning output effects contained in Table 7 were summarized in final demand multipliers. These

Table 7. Direct and secondary trade per dollar of output for a composite rural Tennessee economy, 1974

Selling sector	Purchasing sector: Manufacturing and processing	Agriculture	Trade	F.I.R.E.	Eating, drinking and lodging	Other services	Automotive	Local Government	Household
1. Manufacturing and processing	1.0013	.0050	.0090	.0028	.0213	.0030	.0005	.0024	.0043
2. Agriculture	.0012	1.0619	.0122	.0034	.0037	.0034	.0006	.0029	.0051
3. Trade	.1044	.5755	1.0763	.3004	.2070	.2994	.0556	.2574	.4492
4. F.I.R.E.	.0097	.0844	.0126	1.0307	.0412	.0304	.0073	.0337	.0395
5. Eating, drinking, and lodging	.0060	.0124	.0043	.0162	1.0099	.0155	.0029	.0141	.0262
6. Other services	.0253	.0819	.0216	.0721	.0504	1.0731	.0158	.0585	.1100
7. Automotive	.0192	.0749	.0177	.0537	.0370	.0559	1.0261	.0554	.0834
8. Local government	.0046	.0355	.0132	.0143	.0104	.0117	.0054	1.0131	.0146
9. Summation (Rows 1-8)	1.1717	1.9315	1.1669	1.4936	1.3809	1.4924	1.1142	1.4375	
10. Household	.2753	.5236	.1610	.7362	.4552	.6892	.1323	.6290	1.2101

multipliers are estimates of the total amount that output would increase in all business and quasi-business sectors if a given sector were to increase sales to final demand by one dollar.[10] Estimated final demand multipliers are presented in Table 8.

Table 8. Final demand output multipliers, by sector, for a composite rural Tennessee economy, 1974

Sector	Final demand output multiplier[a]
1. Manufacturing and processing	1.1717
2. Agriculture	1.9315
3. Trade	1.1669
4. F.I.R.E.	1.4936
5. Eating, drinking, and lodging	1.3809
6. Other services	1.4924
7. Automotive	1.1142
8. Local government	1.4375

[a]From row 9, Table 7.

The largest output multiplier was in the Agriculture Sector. The multiplier of 1.93 implies that for every additional dollar of output that the Agriculture Sector delivers to final demand, total output in the local economy would increase by $1.93. One dollar of this amount represents the increased sale by the Agriculture Sector to final demand while $.93 represents additional output.

Sectors with relatively low final demand multipliers included Automotive (1.11), Trade (1.17), and Manufacturing and Processing (1.17). The relatively small magnitude of these multipliers is due to the relatively low level of participation in the local economy by the sectors. This relatively low level of economic interaction was reflected in the direct requirements of these sectors which were the smallest estimated in the study. Sectors with relatively higher multipliers included Eating, Drinking, and Lodging (1.38), Local Government (1.44), Other Services (1.49), and F.I.R.E. (1.49).

[10]In this study, final demand multipliers were differentiated from output multipliers. Final demand multipliers estimate the impact of an additional dollar of sales to final demand such as exports. Output multipliers are based on a one-dollar increase in total output by a sector, including both sales to final demand and intermediate sales which would be generated. Output multipliers may be calculated by dividing a sector's final demand multiplier by the respective coefficient on the main diagonal of Table 7.

Income Effects and Multipliers

In addition to estimating the impact on local output, intersectoral linkages were used to estimate the impact of altered economic activity on local household income. Two separate but related measures, "income effects" and "income multipliers," were estimated because one might be more appropriate than the other due to data available to potential users of the estimates. Income effects measure additional income which accrues to the Household Sector given a one-dollar increase in output by a particular sector. Alternatively, income multipliers measure total additions in income which accrue to the Household Sector given a one-dollar increase in direct payments to the Household Sector by a particular sector. Obviously, a one-dollar direct payment to the Household Sector implies that the sector making the payment would have increased output by more than one dollar.

The analysis of household income effects and multipliers was essentially an extension of the calculations involved in determining output effects. Expenditures made by any sector to the Household Sector represented income for the Household Sector. Therefore, when a sector increased its output and sales to final demand by one dollar, a certain portion of the resulting expenditures, in accordance with its direct requirements, would flow directly to the Household Sector. This payment to the Household Sector is referred to as a direct income effect. Moreover, the expenditures flowing to the Household Sector from direct and secondary increases in output are referred to as total income effects. The household income effects are presented in Table 9. The figures in the first two columns indicate

Table 9. Household income effects and multipliers, by sector, for a composite rural Tennessee economy, 1974

Sector	Direct income effect[a]	Total income effect[b]	Income multipliers[c]
1. Manufacturing and processing	.2260	.2753	1.2181
2. Agriculture	.2941	.5236	1.7803
3. Trade	.1110	.1610	1.4505
4. F.I.R.E.	.5953	.7362	1.2367
5. Eating, drinking, and lodging	.3432	.4552	1.3263
6. Other services	.5512	.6892	1.2504
7. Automotive	.1011	.1323	1.3086
8. Local government	.5034	.6290	1.2495

[a]From row 10, Table 6.

[b]From row 10, Table 7.

[c]Total income effect divided by direct income effect.

the amount which Household Sector income would increase as a result of an increase in sales to final demand of one dollar by a sector at the left of the table. For example, if the Eating, Drinking, and Lodging Sector were to increase its sales by one dollar, the Household Sector would be expected to receive $.34 directly from that sector. Moreover, the Household Sector would be expected to receive a total of $.46 from direct and secondary effects.

Total income effects ranged from a low of $.13 for the Automotive Sector to a high of $.74 for the F.I.R.E. Sector. Generally, those sectors which purchased products and resold them had relatively low income effects whereas the comparable figures for the service sectors were relatively higher. The difference stemmed from the fact that income effects were based on a dollar of sales by a sector and its resultant local expenditures. On this per dollar basis, the service sectors made relatively greater direct expenditures to the Household Sector plus relatively greater local expenditures in total. These greater local expenditures influenced secondary output effects and, therefore, secondary income effects.

Income multipliers, the more traditional measures of impact on Household Sector income, were estimated for each sector. The largest income multiplier, 1.78, was in the Agriculture Sector (Table 9). This figure means that if the Agriculture Sector increased output sufficiently to make an additional one-dollar direct payment to the Household Sector, household income from both direct and secondary sources would increase by a total of $1.78. Income multipliers for other sectors ranged from 1.45 for the Trade Sector to 1.22 for the Manufacturing and Processing Sector.

In interpreting the estimated income effects and multipliers, it should be recalled that each was computed on a different base. This difference resulted in some sectors having relatively high total income effects while having relatively low income multipliers and vice versa.

For example, from Table 9 it may be seen that the Automotive Sector had the lowest total income effect (0.13) and the fourth highest income multiplier (1.31) while the F.I.R.E. Sector had the highest income effect (0.74) and the second lowest income multiplier (1.24). Income effects are based on a dollar of output whereas income multipliers are based on a dollar of direct payment to the Household Sector. For the F.I.R.E. Sector to make a one-dollar direct payment to the Household Sector and, therefore, have the impact estimated by the income multiplier (1.24), it would have to increase output by $1.68 (one dollar divided by 0.5953, its direct payment to the Household Sector per dollar of output). Alternatively, for the Automotive Sector to make a one-dollar direct payment

to the Household Sector, it would have to increase its output by $9.89 (one dollar divided by 0.1011, its direct payment to the Household Sector per dollar of output). By their nature, neither measure is wrong nor misleading—they are simply different measures. However, these examples should underscore the need for caution in assessing the "importance" or "potential importance" of any sector solely on the basis of a particular measure's magnitude.

Employment Multipliers

Employment effects and multipliers estimate the impact that altered economic activity in a given sector would have on local employment. This impact on employment stems from both the added employment required directly by the sector initiating the increased output and by sectors which increase their output due to secondary effects.

The direct employment per $10,000 output for each sector is presented in Table 10.[11] The figures reflect the labor intensiveness of the various sectors. The numbers of full-time employees used for every $10,000 of output was highest for the Eating, Drinking, and Lodging Sector (1.97), and Agriculture Sector (1.73). Somewhat less employment was used in the Other Services Sector (1.04), Local Government Sector (.84), and the Manufacturing and Processing Sector (.46). The lowest rates of employment per $10,000 of output were found for the F.I.R.E. Sector (.25),[12] Trade Sector (.19), and the Automotive Sector (.13).

The total change in employment per $10,000 change in output is shown in the second column of Table 10. These figures were estimates of the change in total local employment which would occur as a result of secondary effects in addition to direct effects. The greatest estimated total employment effect was in the Eating, Drink-

[11]These estimates stem from primary data collected in the survey of firms in the study area. Sample total employment in each sector was divided by the sector's sample total output. Part-time employment was included on the basis of 48 weeks to represent full-time employment. Estimation of employment effects and multipliers requires the assumption that the average ratio of employment to output is constant for additional output.

[12]It may be noted that for most sectors, there is a positive correlation between the direct employment per $10,000 of output and the direct payment to the Household Sector as shown in Table 6. However, this correlation does not hold for the F.I.R.E. Sector; the direct payment to the Household Sector was relatively high and direct employment per $10,000 was relatively low. The reason for this difference was that many of the payments which the F.I.R.E. Sector made to the Household Sector were in the form of interest payments rather than wages.

Table 10. Change in total employment resulting from a $10,000 change in output, by sector, for a composite rural Tennessee economy, 1974[a]

Sector	Per $10,000 change in output		
	Direct change in employment[b]	Total change in employment[c]	Employment multiplier[d]
1. Manufacturing and processing	.4643	.5340	1.1501
2. Agriculture	1.7270	2.1172	1.2259
3. Trade	.1916	.2791	1.4567
4. F.I.R.E.	.2523	.4509	1.7872
5. Eating, drinking, and lodging	1.9688	2.1208	1.0772
6. Other services	1.0434	1.2396	1.1880
7. Automotive	.1294	.1733	1.3393
8. Local government	.8420	1.0129	1.2030

[a]Part-time employment was weighted and included with full-time employment.

[b]For each sector, sample total employment times 10,000 divided by sample total output.

[c]Calculated by multiplying and summing entries in the direct change in employment column of this table times the respective entries in each column of Table 7.

[d]A sector's total change in employment (column 2) divided by its direct change in employment (column 1).

ing, and Lodging Sector (2.12), while the smallest employment effect was in the Automotive Sector where an additional $10,000 sale to final demand would result in only .17 additional jobs.

Employment multipliers are a more traditional measure of the impact that altered economic activity would have on employment. These multipliers are estimates of the change in total employment which would occur as a result of a given sector increasing its employment by one person. Employment multipliers are presented in the third column of Table 10. The smallest employment multiplier was 1.08 for Eating, Drinking, and Lodging Sector while the largest was 1.79 for the F.I.R.E. Sector. The figures mean that if the Eating, Drinking, and Lodging Sector adds an employee, an additional 0.08 jobs would be created in the local economy whereas an additional 0.79 jobs would result for every additional employee in the F.I.R.E. Sector.

LIMITATIONS

In interpreting the results of this study, limitations of the methodology should be recognized. First, the sectoral linkages used in the input-output model were assumed to be linear. That is, the direct requirements for a sector, based on its average expenditures, were used as estimates of its direct requirements given incremental changes in economic activity. The validity of this assumption depends not only upon the percent of capacity at which each sector was operating but also on recent changes in technology which would affect a sector's operational characteristics.

In addition, the firms which comprised some of the sectors were less homogenous than theoretically desirable. This led to an unknown degree of imprecision in estimates.

While a composite of three counties was used in this study to lend a degree of generality to the results, it should be recognized that a unique set of intersectoral linkages was derived. The results are applicable to other rural economies only to the extent that the economic interrelationships among sectors are similar to those used in the study.

These limitations do not imply that the estimates computed cannot be used to approximate the impact on a local economy of increases or decreases in sectoral output. However, they do invite discretion in the use of the estimates in making precise predictions.

The results are descriptive rather than prescriptive in nature. They can be used to estimate the impact that altering the output of a given sector would have on a county economy. However, they do not indicate whether the change in output is feasible or desirable. It is incumbent upon these who would use the results to verify the alternatives in question as being both possible and acceptable.

CONCLUSIONS

This study was undertaken to provide information on the economic interactions of rural economies. In particular, the study was intended to provide local decision makers with information concerning the total response within a county economy of a given sector altering its economic activity. With this information, local leaders should be better able to evaluate rural development alternatives.

To serve these purposes, an input-output analysis of a composite rural Tennessee area was conducted during 1975. Within the analysis, primary data were used to determine monetary linkages among sectors. These linkages were then used to estimate final demand output, income, and employment multipliers.

The core of the analysis was based on the percentage of total

purchases which the various sectors made within the local economy. These data allowed estimation of the direct impact which a given sector would have on the local economy if it increased its output. These data also permitted the determination of the secondary impacts (effects) that this direct impact would have. Of the sectors considered, the Agriculture Sector made the largest proportion of its total expenditures within the local economy. The sectors which provided services followed agriculture while those sectors which sold products locally made the smallest proportions of total expenditures within the local economy. With certain exceptions, the alignment of sectors with respect to the total impact on the local economy in terms of output, income, and employment followed the magnitudes of direct impacts.

The local economy made available most of the needed inputs for the Agriculture Sector, most of the labor input required by other sectors, and provided many of the consumer goods for the Household Sector. Where needed goods and services were available, purchases were made and secondary impacts occurred. Alternatively, where needed inputs were unavailable, imports were necessary and secondary impacts were not generated. These results point out the benefits of local economic integration.

In assessing the various effects and multipliers it was clear that agriculture and the service sectors had the greatest impact per dollar of output on the local economy. However, discretion should be used in examining alternative sectors in efforts to generate local economic growth; the decision-maker should look beyond the simple magnitude of the effects and multipliers. For example, figures indicate that a goal of increasing household income by $100,000 would require an additional $191,000 of output by the Agriculture Sector or $220,000 of output by the Eating, Drinking, and Lodging Sector or $363,000 of output by the Manufacturing and Processing Sector. Given different circumstances, any one of these alternatives might be obtained more easily than the others. That is, it might be more feasible for a county to increase tourism by taking advantage of a natural scenic resource and increase eating, drinking, and lodging output than to increase agricultural output. Alternatively, another county might more easily increase manufacturing and processing output than increase output in other sectors. These are decisions which must ultimately rest with local public and private decision makers.

Although the economic interaction among sectors was limited, it is believed that the economies under study were typical of many counties in East Tennessee. Because of this assumed similarity, the results of this study should provide decision makers with indications of the responses in their areas which would occur as a result of se-

lected changes in economic activity. However, additional research is needed to estimate the effects that observable differences in local economic characteristics have on interdependences among sectors. Only after such information becomes available will decision makers be able to use the resultant effects and multipliers as specific estimations rather than guidelines.

APPENDIX A

METHODS USED IN ESTIMATING DIRECT REQUIREMENTS FOR THE HOUSEHOLD SECTOR

The direct requirements for the Household Sector were derived from a report by the Bureau of Labor Statistics [10, Table 30A] and a survey of 265 randomly selected households in the three-county study area.

The Bureau of Labor Statistics report provided detailed information on average family income and detailed family expenditures for the Southern region of the United States. The expenditures were given for average farm and rural nonfarm families. The detailed expenditures for both were aggregated into the sectors used. The expenditures to each sector by the farm and rural nonfarm families were then aggregated, using weights which corresponded to the percentage of farm and nonfarm populations in the counties. It should be noted that the portion of Overton County's population which was classified as "urban" by the 1970 Census was considered to be rural nonfarm for purposes of these calculations. The expenditures to each sector were then divided by the weighted average family income. The result was a percentage distribution of an average family's total expenditures among the sectors. Since the data used were not current, the dollar value of income and expenditures would not be accurate. However, it was assumed that the percentage distribution of expenditures among sectors would have remained relatively constant over the time interval.

To use the percentage distribution of expenditures in an input-output analysis framework, it was also necessary to determine the portion of expenditures to each sector which were made inside and outside the local economy. To accomplish this, information from a 1974 random survey of 265 households in the study area was used. In that survey, categories of consumer goods and services were listed and each family was asked the percent of expenditures which were made inside the county for each category. This information was then used in conjunction with the described percentage distribution of total expenditures to obtain an estimate of the Household Sector's "direct requirements."

APPENDIX B

DIRECT AND INDIRECT EFFECTS AND MULTIPLIERS

As an intermediate step in the input-output analysis, output and income effects resulting from trade among business and quasi-business sectors only were estimated. The methods used were essentially the same as described in the text except the impact of trade by the Household Sector was excluded. That is, it was assumed that when a sector made a payment to the Household Sector, the Household Sector would not make additional expenditures back within the local economy. Excluding the Household Sector in this way provided an indication of the effect of trade linkages which exist among business sectors only, termed "indirect effects."

Output effects which include direct and indirect effects (but exclude the impact of trade by the Household Sector) are shown in Appendix Table 1. Figures in the first eight rows of each column indicate the amount by which sectors listed at the left of the table would be expected to increase output if the sector at the top of the column increased its sales to final demand by one dollar. Figures in row 9 show estimates of final demand output multipliers, including only direct and indirect effects.

Estimates of income multipliers based on direct and indirect effects were: Manufacturing and Processing, 1.0066; Agriculture, 1.4713; Trade, 1.1982; F.I.R.E., 1.0220; Eating, Drinking, and Lodging, 1.0959; Other Services, 1.0334; Automotive, 1.0821; Local Government, 1.0308.

Appendix Table 1. Direct and indirect trade per dollar of output for a composite rural Tennessee economy, 1974

Selling sector	Purchasing sector: Manufacturing and processing	Agriculture	Trade	F.I.R.E.	Eating, drinking and lodging	Other services	Automotive	Local Government
1. Manufacturing and processing	1.0003	.0032	.0085	.0002	.0197	.0006	.0001	.0002
2. Agriculture	.0000	1.0597	.0115	.0003	.0018	.0005	.0001	.0003
3. Trade	.0022	.3811	1.0166	.0272	.0380	.0436	.0065	.0239
4. F.I.R.E.	.0007	.0673	.0074	1.0067	.0264	.0079	.0030	.0132
5. Eating, drinking, and lodging	.0000	.0011	.0008	.0002	1.0000	.0005	.0000	.0005
6. Other services	.0002	.0343	.0070	.0052	.0090	1.0105	.0038	.0013
7. Automotive	.0002	.0388	.0066	.0029	.0057	.0085	1.0170	.0121
8. Local government	.0012	.0292	.0113	.0054	.0049	.0034	.0038	1.0055
9. Summation	1.0048	1.6147	1.0697	1.0481	1.1055	1.0755	1.0343	1.0570

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