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An Input-Output Analysis of Regional Economic Development

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An Input-Output Analysis of Regional Economic Development[1]

LEROY J. HUSHAK, YOUNG KEY RO, and ZAFAR Y. HUSAIN[2]

INTRODUCTION

Policymakers dealing with economic development need information especially on the structural interdependence of an economy. The structural interdependence of an economy can be expressed through an input-output model. For this reason, input-output analysis has been considered as a useful analytical tool of economic development (6, 7, 11).

As is well known, input-output analysis was pioneered by Leontief (8), and most of its development is attributable to Leontief and his associates. The usual application of input-output analysis has been to national economies.[3] In the last two decades, considerable progress has been made in applying input-output techniques to regional economies.

The major purpose of this paper is to present the results of an input-output analysis of regional economic development. The input-output model consists of 27 endogenous producing sectors, three exogenous final demand sectors, and three exogenous basic input sectors. Although several industries in the study region probably generate significant environmental effects, the analysis of these effects was beyond the scope of this study.

The region studied is composed of five counties of southeastern Ohio: Athens, Gallia, Jackson, Meigs, and Vinton. These counties were selected for study in Ohio under Title V of the Rural Development Act of 1972. Construction began on several deep shaft coal mines and an electric generating power plant in these counties in 1970. As a region for input-output analysis, these five counties appear to be a reasonable compromise. The region is large enough to have most potential industries represented and to have imports in most industries as a small fraction of total output. It is small enough so that the results are directly applicable in local government jurisdictions.

These counties are located in the least-developed area of the state of Ohio (1). The two major economic characteristics of this region, shown in Table 1, are low income and high unemployment. The per capita personal income for the five-county region in 1977 was $4,933 as compared to $7,102 for the state of Ohio. The average unemployment rate for the region in 1977 was 7.3%, which is about 1% higher than for the state of Ohio. In 1970, the difference in unemployment rates exceeded 3% (27). These two economic characteristics are the major problems of this region in dealing with economic growth.

The economy of this region consists of many different sectors, and the interdependence between sectors plays an important role in the economic growth of this region. Some of the sectors have relatively high potential for economic impacts because they are highly interdependent with other sectors; others do not. It is reasonable to believe that the reallocation of limited resources in favor of sectors with high economic impact potential may significantly contribute to the economic growth of this region. With this in mind, the general objective of this study is to identify sectors which have relatively high economic impact potential, and to explore possibilities for increasing output, income, and employment through resource reallocation. The specific objectives are:

- Identification of sectors with high potential for growth in terms of output, employment, and income
- Identification of bottleneck sectors
- Estimation of the dependence of the economy of the region on government demand and exports

[1]This bulletin has been developed from the unfinished Ph.D. dissertation work of Zafar Y. Husain. Helpful comments from A. Bishop, E. D. Baldwin, G. Doeksen, F. Hitzhusen, G. Morse, and F. E. Walker are gratefully acknowledged. All errors remain the responsibility of the authors.

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[3]The first input-output model of Leontief was based on the inter-industry transaction model of the United States (8).

TABLE 1.—Income and Unemployment in a Five-County Study Region in Southeastern Ohio and in Ohio, 1977.

	Athens	Gallia	Jackson	Meigs	Vinton	Ohio	Region
Personal Income per Capita ($)	5,065	5,379	4,707	5,423	4,092	7,102	4,933
Unemployment (%)	7.2	6.0	9.3	6.0	7.9	6.5	7.3

Sources: USDC-BEA (29) and OBES, 1977 (17).

- Estimation of effects of imports on the regional economy.

In the first section of this paper, the theoretical framework and the mathematical formulation of the input-output model used in the study are discussed. In the second, the empirical implementation of this methodology is discussed. The primary results of the input-output analysis including impact or multiplier analysis are presented in the third section. In the final section, the summary and policy implications are presented.

FRAMEWORK OF THE INPUT-OUTPUT MODEL

This section presents the theoretical framework and the mathematical formulation of an open, single-region, static input-output model. Since the input-output model was first developed by Leontief (8), a number of methodological improvements have been made. Hirsch (5) developed the concept of income multiplier, Moore and Peterson (12) the concept of employment multiplier, and Little and Doeksen (9) the concept of leakage multiplier. In addition, Martin and Carter (10) showed how to make technical and interdependence coefficients reflect both the direct and indirect effects of changes in the outputs of other sectors. The theoretical consideration of the basic framework of the input-output model is presented first. The discussion of the methodological improvements follows.

Basic Framework of the Input-Output Model

An input-output model is a set of linear equations representing total outputs of different sectors within a region as the sum of intermediate demand by endogenous intermediate sectors and final demand by the household, government, and export sectors. Three fundamental assumptions behind the model are fixed coefficient production functions, constant relative prices of inputs and outputs, and production of homogenous output in each sector (2, 7). It is also implicitly assumed that each sector maximizes its total output subject to a set of constraints stating that the total output less intermediate inputs is greater than or equal to available resources (labor, capital, and imports).

The total set of linear relationships of an input-output model includes output equations, input equations representing intermediate inputs and primary resource inputs, and identity equations of inputs and outputs of all sectors. These equations are:

(1) $X_i = x_{i.} + f_{i.}$; $i = 1, n$

(2) $Y_j = x_{.j} + r_{.j}$; $j = 1, n$

(3) $X_i = Y_j$; All $i = j$

where:

X_i = output of sector i

x_{ij} = amount of output of sector i sold to sector j

$x_{i.} = \sum_{j}^{n} x_{ij}$, total intermediate inputs sold by sector i to all sectors

$f_{i.}$ = final demand for output of sector i; **i.e.,** $f_{i.} = f_{ih} + f_{ig} + f_{ie}$, where h is household, g is government, and e is export

Y_j = total inputs used by sector j

$x_{.j} = \sum_{i}^{n} x_{ij}$; total intermediate inputs bought by sector j from all sectors

$r_{.j} = \sum_{p} r_{pj}$; total primary resource inputs employed by sector j, where p stands for labor (l), capital (k) and imports (m); **i.e.,** $r_{.j} = r_{lj} + r_{kj} + r_{mj}$.

Equation 1 shows the equality between total supply (X_i) and total demand as the sum of intermediate demand ($x_{i.}$) and final demand ($f_{i.}$). Intermediate demand is the amount of output produced by the ith endogenous or producing sector sold to itself and to all other processing sectors. The final demand for output of the ith sector is the sum of the final demand by the household sector (f_{ih}), by the government sector (f_{ig}), and by the export sector (f_{ie}).

Equation 2 shows the amount the jth sector as a processing sector buys as its inputs from n endogenous sectors including itself ($x_{.j}$) and three primary resource sectors which are comprised of labor, capital, and imports ($r_{.j}$). The total amount of each primary resource employed is subject to the constraint that the total amount of the primary resource used by the n processing sectors be equal to the total amount of that resource available within a region; *i.e.,*

$$(4)\quad r_{p.} = \sum_{j}^{n} r_{pj},\quad j = 1, n$$

where $r_{p.}$ is the total amount of a given primary resource available within a region. Equation 3 simply states an identity constraint that the total amount of outputs must be equal to the total amount of inputs stated in value terms.

On the basis of the linear relationships discussed above, Table 2 shows the general form of the transactions table of the input-output model as applied to the regional economy of this study. Rows are based on output equations (equation 1) stating that the output of the ith sector (X_i) is used up through total intermediate demand by processing sectors ($x_{i.}$) and total final demand by household, government, and export sectors ($f_{i.}$).

TABLE 2.—The General Form of Transactions Table of an Input-Output Model.

	Processing Sectors (Intermediate Demand)		Final Demand Sectors (Final Demand)		Total Output
Producing Sectors (Intermediate Inputs)	$\begin{bmatrix} x_{11} & \cdots & x_{1n} \\ \vdots & & \vdots \\ x_{n1} & \cdots & x_{nn} \end{bmatrix}$	+	$\begin{bmatrix} f_{1h} & f_{1g} & f_{1e} \\ & \vdots & \\ f_{nh} & f_{ng} & f_{ne} \end{bmatrix}$	=	$\begin{bmatrix} X_1 \\ \vdots \\ X_n \end{bmatrix}$
Primary Input Sectors (Primary Resources Inputs)	$\begin{bmatrix} r_{11} & \cdots & r_{1n} \\ r_{k1} & \cdots & r_{kn} \\ r_{m1} & \cdots & r_{mn} \end{bmatrix}$				
Total Inputs	$\begin{bmatrix} Y_1 & \cdots & Y_n \end{bmatrix}$				

Columns in Table 2 are based on input equations (equation 2). A column shows that the total input used by the jth processing sector (Y_j) is equal to the sum of the total intermediate inputs bought from all producing sectors ($x_{.j}$) and the total primary resource inputs of labor, capital, and imports ($r_{.j}$). Implied by equation 3 is that the row vector of total output is equal to the column vector of total input.

The matrix of the elements x_{ij} in the intermediate part of the transactions table is called the transactions matrix (T). From this transactions matrix and the assumption of a linear fixed proportions production function, the technical coefficients matrix can be defined. The i,jth element of the technical coefficients matrix (a_{ij}) is:

$$(5)\quad a_{ij} = x_{ij}/Y_j$$[4]

This technical coefficient indicates what proportion of total inputs used by sector j is bought from sector i, or it shows direct purchases of sector j from every other sector per dollar of output.

By rewriting equation 5 as $x_{ij} = a_{ij}\ Y_j = a_{ij}\ X_i$ from the identity of equation 3, equation 1 can be restated as:

$$(6)\quad X_i = \sum_j (a_{ij}\ X_j) + f_i.$$

This equation is the production relationship in the transactions table of the input-output model using the technical coefficients.

The technical coefficients matrix for primary resource inputs can be established in a similar way:

$$(7)\quad b_{pj} = r_{pj}/Y_j,\ p = 1, k, m$$

where b_{pj} is the technical coefficient for the primary resource. It shows the amount of the resource used as a proportion of total input by the jth sector. Since equation 7 implies that $r_{pj} = b_{pj}\ Y_j = b_{pj}\ X_j$, it follows from equation 4 that:

$$(8)\quad r_{p.} = \sum_j b_{pj} X_j,\ p = 1, k, m$$

where $r_{p.}$ is the total amount of the primary resource available to all sectors.

Manipulation of the input-output model presented above is simpler if the model is stated in matrix form. Equations 6 and 8 can be stated respectively as:

$$(9)\quad X = AX + F$$

$$(10)\quad R = BX$$

[4]Equation 5 may also be stated as $Y_j = x_{ij}/a_{ij}$, and thus $X_i = x_{ij}/a_{ij}$ which is a linear fixed proportion production function since $Y_j = X_i$; All $i = j$, and since $1/a_{ij}$ is fixed.

where:

X = n x 1 output vector with elements X_i; i = 1, n

A = n x n technical coefficients matrix with elements a_{ij}; i = 1, n; j = 1, n

F = n x 1 total final demand vector with elements f_i; i = 1, n

R = p x 1 vector of total primary resources available; p = l, k, m

B = p x n matrix of the technical coefficients for primary resource use with elements b_{pj}; p = l, k, m; i = 1, n

Interdependence Coefficients

The interdependence coefficients are derived from equations 9 and 10. Equation 9 can be restated as:

(11) $F = (I - A)X$, or

(12) $X = (I - A)^{-1}F$, or

(13) $X = CF$

where I is an n x n identity matrix, and C stands for $(I - A)^{-1}$, the n x n interdependence coefficients matrix with elements c_{ij}, i = l, n; j = l, n.

The matrix (I — A) in equation 11 is called the Leontief input-output matrix (11). This matrix is inverted, equation 12, to obtain a table of final demand plus direct plus indirect requirements of intermediate inputs per dollar of final demand. The matrix $(I - A)^{-1} = C$ is equal to the sum of the infinite series $I + A + A^2 + A^3 + \ldots$[5] The term I, the identity matrix, is the increase (of $1) in final demand. The term A, the technical coefficients matrix, is the direct requirement to produce $1 of final demand. The remainder of the series, $A^2 + A^3 + \ldots$ is the indirect requirement generated as all sectors purchase inputs to satisfy the direct requirement.

Substitution of equation 13 into equation 10 yields:

(14) $R = BCF$, or

(15) $R = DF$

where D(= BC) is the matrix with the elements d_{pj}; p = l, k, m; j = l, n. The element d_{pj} shows the total change (direct and indirect) in the use of resource p per $1 change in final demand for the output of sector j.

Import Adjustment

The total transactions of a regional economy consist of two components: purchases and sales among firms and households within the region, and purchases and sales with firms outside the region. In order to express the pure structural interdependence of a regional economy, the transactions matrix (T) for the region must consist of only the first component; *i.e.*, purchases and sales among firms within the region. Imported inputs are produced outside of the region and are not part of the interdependence (industrial structure) of a regional economy. In this model, the intermediate transactions matrix is adjusted to include only transactions among firms within the region, while imported inputs are implicitly incorporated as the primary resource row vector (r_{mj}).

Importing sectors can be identified from the transactions table through a set of export vector equations given by:

(16) $f_{ie} = X_i - x_{i.} - f_{ih} - f_{ig}$.

A negative value of the export vector, f_{ie}, implies imports. Those sectors with negative export vectors are identified as importing sectors.

In the cases of sectors importing from outside the region, $f_{ie} < 0$, both the regional transactions and regional final demand matrices are adjusted so that, for a given importing sector, the sum of intermediate demand and final demand by household and government sectors is equal to total output; *i.e.*, $X_i = x_{i.} + f_{ih} + f_{ig}$. This adjustment is accomplished by multiplying the associated row elements of the total transactions table by the ratio:

(17) $\phi_i = X_i/(X_i - f_{ie})$, $f_{ie} < 0$.

No adjustments are made if $f_{ie} \geq 0$. These adjustments generate a transactions table which does not contain the import components in its elements.[6]

Impact Coefficients or Multipliers

Input-output multipliers are useful for estimating the effect of a change in the final demand for goods and services from a particular sector on the output, employment, and income of the whole economy (18). Three primary multipliers are defined: output, employment, and income multipliers. On the basis of these primary multipliers, leakage and general multipliers are defined.

Output Multiplier: The output multiplier indicates how total production will change as final demand is changed in any one sector of the economy. The output multiplier (O_j) is:

(18) $O_{.j} = \sum_i c_{ij}$.

The output multiplier for sector j is the sum of column j of the interdependence coefficients matrix. This output multiplier measures the amount of out-

[5]Since all $a_{ij} < 1$, as A is carried to successively higher powers the coefficients will get closer and closer to zero. In practice, if the A matrix is carried to the twelfth power, a workable approximation to $(I - A)^{-1}$ can be obtained (11).

[6]The import components implicitly transferred to the import vector consist of primary resource inputs and direct imports for final demand. These adjustments are called balancing equations (19).

put generated by a $1 change in final demand for the output of the jth sector.

Employment Multiplier: The employment multiplier for sector j indicates the total change in employment from a unit change in direct employment in sector j. The employment multiplier ($E_{.j}$) is:

$$(19)\quad E_{.j} = \left(\sum_i (N_i/X_i)c_{ij}\right)/(N_j/X_j),$$

where N_i, N_j are employment in man-years for sectors i or j. The numerator is the sum of interdependence coefficients for sector j weighted by average employment per unit of output in each sector, or the direct plus indirect effects of a unit change in final demand (4). The denominator is average employment per unit of output in sector j, or the direct effect of a unit change in final demand.

Income Multiplier: The income multiplier measures the total change in income in sector j per $1 change in direct income to sector j. The income multiplier ($I_{.j}$) is:

$$(20)\quad I_{.j} = \left(\sum_i (U_i/X_i)c_{ij}\right)/(U_j/X_j)$$

where U_i, U_j are the incomes of sectors i or j in millions of dollars. The numerator is the sum of interdependence coefficients for sector j weighted by average income per unit of output in each sector, or the direct plus indirect effects of a unit change in final demand (4). The denominator is average income per unit of output in sector j, or the direct effect of a unit change in final demand.[7]

Leakage Multipliers: The leakage multiplier for a given sector is the difference between multipliers computed from the transactions table with and without the import components (9). Leakage multipliers are computed for the output, employment, and income multipliers. These leakage multipliers indicate how much of output, income, and employment is leaked out of the region as a result of the imports made by the given region instead of producing the output within the region. Stated another way, they show the net amount of output generated outside the region as a result of a change in final demand within the region.

General Multipliers: In addition to the primary multipliers, general or economy multipliers are useful in estimating the impact of changes in final demand spread equally among all sectors of the regional economy (9). Since they are not sector specific, they are more analogous to the impact multipliers used in impact models (13).

The general multiplier is a weighted average multiplier. It indicates by how much output, employment, or income of the whole economy would increase on the average when the final demand, employment, and income, respectively, change by one unit spread equally among all sectors of the regional economy. The general multipliers are defined as

$$(21)\quad \text{General output multiplier} = \sum_{i=j} f_{i.}\, O_{.j}/\sum_i f_{i.}$$

$$(21.a)\quad \text{General household multiplier} = \sum_{i=j} f_{ih}\, O_{.j}/\sum_i f_{ih}$$

$$(21.b)\quad \text{General government multiplier} = \sum_{i=j} f_{ig}\, O_{.j}/\sum_i f_{ig}$$

$$(21.c)\quad \text{General export multiplier} = \sum_{i=j} f_{ie}\, O_{.j}/\sum_i f_{ie}$$

$$(22)\quad \text{General employment multiplier} = \sum_{i=j} N_i\, E_{.j}/\sum_i N_i$$

$$(23)\quad \text{General income multiplier} = \sum_{i=j} U_i\, I_{.j}/\sum_i U_i$$

where all variables are as previously defined.

EMPIRICAL IMPLEMENTATION OF INPUT-OUTPUT MODEL

The major concern of this section is to present the research procedures for the implementation of the regional input-output model. Presented are the procedures for obtaining regional technical coefficients and transactions matrices from national tables, including the selection of sectors, and the accomplishment of specific objectives. The collection of data from primary sources for an input-output analysis is both time consuming and expensive, and in fact it is very difficult. Many research workers have used the national technical coefficients matrix to calculate the regional transactions table [for example, see Moore and Peterson (12), Schaffer and Chu (19), Shaffer (20), Mustafa (14), and Smith and Morrison (21)]. The regional transactions matrix was obtained from the U. S. national transactions matrix through use of the location quotient technique. Since the most recent national technical coefficients matrix prior to 1972 was for 1967, the 1967 national technical coefficients were updated to 1972. The detailed step-by-step research procedures follow.

Implementation Procedures

Selection of Sectors: Reduced U. S. Transactions Matrix for 1967: The 1974 Directory of Ohio Manufacturers (3) was used to make a list of firms which were in the five-county region in 1972. These

[7] The total change in employment or income per unit of final demand is obtained as $E_j(N_j/X_j) = \sum_i (N_i/X_i)c_{ij}$ or $I_j (U_j/X_j) = \sum_i (U_i/X_i)c_{ij}$, respectively

firms were then grouped into sectors according to the following categories: 1) the availability of data at the level of aggregation, 2) firms producing similar and closely related products, and 3) maintenance of conformity with the level of aggregation used by the Bureau of Economic Analysis in preparing the U. S. National Input-Output Model for 1967 (28).

The 85-sector transactions matrix of the U. S. national input-output table was used. Sectors identified in this national model with very small or no production in the region in 1972 were excluded. Of the 85 endogenous sectors, 39 sectors had no or very small production in the region studied. The remaining 46 sectors were aggregated to a total of 27 endogenous sectors for the region to form the reduced U. S. transactions matrix for 1967. These sectors and nine components of three final demand (exogenous) sectors are presented in Table 3. The endogenous sectors consist of the industries producing goods and services. These sectors make up the transactions matrix, the intermediate part of the input-output transactions table. The exogenous sectors consist of final household demand, government demand, and export demand sectors.

Since 39 sectors had little or no production in the region, the total sectoral outputs of the U. S. economy in 1967 were adjusted proportionately to reflect the reduced number of sectors (Table 4) as:

$$(24)\quad Y_j^{na} = (Y_j^{nt}/(x_{.j}^{na} + x_{.j}^{ne}))x_{.j}^{na}$$

TABLE 3.—Endogenous and Exogenous Sectors Included in the Input-Output Model of This Study.

Bureau of Economic Analysis Classification	Standard Industrial Classification	Sectors
A. Endogenous Sectors:		
1	2	Livestock
2.02-2.07	1	Crops
7	10	Coal
11, 12	15, 16, 17	Construction
14	20	Food and Food Products
15	21	Tobacco Manufactures
17, 18, 19	22, 23	Textile and Apparel
20	24	Lumber and Wood Products
22, 23	25	Furniture and Fixtures
26	27	Printing and Publishing
27	28	Chemicals
28	30	Plastics and Rubber
34	31	Leather Products
36	32	Stone and Clay Products
37, 38.08	33	Primary Metals
41.01, 41.02 42.02, 42.11	34	Fabricated Metals
43.02, 45.02, 47.03, 49.05, 52.05	35	Mechanical Machinery
53.01, 53.03, 57.02, 57.03, 62.01	36	Electrical Machinery
65	40-47	Transportation
66	48	Communication
68	49	Utility
69.01	50, 51	Wholesale Trade
69.02	52	Retail Trade
70, 71	60-67	Finance, Insurance, and Real Estate
72-77, 81	70, 73, 75, 79, 80, 82, 84	Services
78		Federal Government
79		State and Local Government
B. Exogenous Sectors		
91		Personal Consumption
92		Private Capital Formation
93		Net Inventory Changes
97.1		Federal Defense Spending
97.2		Federal Non-defense Spending
98.6		State and Local Govt. Education
98.7		State and Local Govt. Health
98.8		State and Local Govt. Safety
98.9		State and Local Govt. Others

where:

Y_j^{na} = adjusted total inputs of sector j of the reduced U. S. transactions table

Y_j^{nt} = total inputs of sector j of the pre-reduced U. S. transactions table

$x_{.j}^{na}$ = intermediate inputs of sector j from included sectors in the reduced U. S. transactions matrix

x_j^{ne} = intermediate inputs of sector j from sectors excluded from the reduced U. S. transactions matrix

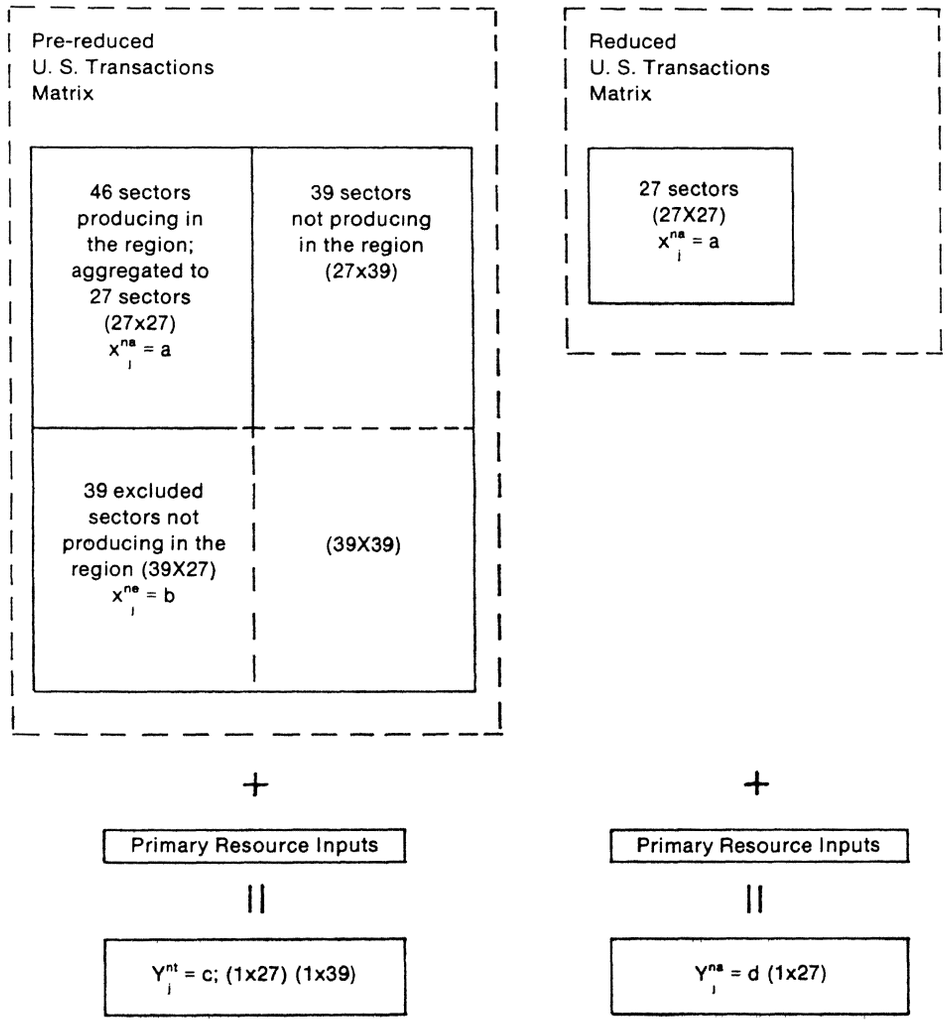
It is assumed in making this adjustment that the proportion between total and intermediate inputs of a given sector j in the adjusted U. S. national transactions table is equal to that in the pre-reduced table; *i.e.*

$$Y_j^{nt}/(x_j^{na} + x_{.j}^{ne}) = Y_j^{na} / x_{.j}^{na}$$

Since the inputs from 39 sectors of the 85 sector U. S. (pre-reduced) table must be imported into the region, it is also assumed that the regional production function for each sector is a simplified version of the national production function. Based on this, it is further assumed that the regional primary resource inputs are proportionately less than national primary inputs; *i.e.*, as reflected in equation 24.

Reduced U. S. Tecnical Coefficients Matrix (1967 and 1972): The reduced U. S. technical coefficients matrix for 1967 was obtained by dividing each column of the reduced U. S. transactions matrix for 1967 by the adjusted sectorial input ($\hat{Y}_j^{na}$) of each sector. The national technical coefficients were then updated to 1972 by premultiplying by a diagonal

TABLE 4.—An Adjustment of Reducing U. S. National Transactions Table.*



*The proportionality, $\frac{d}{a} = \frac{c}{a+b}$, is imposed in this adjustment.

matrix of price indices for all sectors and post-multiplying by a diagonal matrix of the reciprocals of the price indices (22):

$$(25)\quad A_{72} = PA_{67}P^{-1}$$

where:

A_{72} = 27x27 reduced U. S. technical coefficients matrix for 1972

A_{67} = 27x27 reduced U. S. technical coefficients matrix for 1967

P = 27x27 diagonal matrix of price indices for n sectors for 1972 with 1967 as as base year[8]

P^{-1} = 27x27 diagonal matrix of the inverse of price indices

This relative price adjustment multiplies each row by the price index for sector i and each column by the inverse of the sector j price index. Each production coefficient for 1972 (a_{ij}^{72}) is obtained from the 1967 coefficients (a_{ij}^{67}) as

$$(25.a)\quad a_{ij}^{72} = \frac{P_i}{P_j} a_{ij}^{67}$$

Regional Technical Coefficients Matrix with Imports for 1972: Several different techniques have been used to convert a national technical coefficients matrix to the regional matrix.[9] Among these techniques, the location quotient method appears to provide reasonable results (14, 19). The location quotient for sector i (q_i) is defined as

$$(26)\quad q_i = (X_i / \Sigma_i X_i)/(X_i^n / \Sigma_i X_i^n)$$

where X_i and X_i stand for the regional and national output of sector i, respectively.

The location quotient is a number which compares the relative importance of a given sector in a region to its relative importance in the national economy. The location quotient indicates the regional self-sufficiency of the productive capacity of various sectors. A location quotient of less than one means that the region produces less than its proportionate share of output in a given sector, and is probably not self-sufficient in that sector, but has to import from outside the region. A location quotient greater than one implies that the region produces more than its proportionate share of output and probably exports part of its output. A location quotient equal to one indicates that the region produces a proportionate share of output, and is self-sufficient, *i.e.*, it neither imports nor exports.

In order to obtain the regional technical coefficients matrix, the national technical coefficient matrix was adjusted on the basis of the location quotient:

$$(27)\quad A = q\ A_{72}$$

where A_{72} is from equation 25 and q is a 27x27 diagonal matrix of q_i. The diagonal elements of q are equal to q_i for $q_i < 1$ and equal to one for $q_i \geq 1$. For $q_i < 1$, the regional technical coefficients for row i are the national technical coefficients for row i multiplied by q_i, implying that sector i sells less output to all sectors, and firms in the region import part of their inputs from outside the region. When $q_i \geq 1$, no adjustments are made and the regional technical coefficients are equal to the national coefficients.

Regional Final Demand: Final demand data for the output of the 27 sectors in the study region were not available. Regional final demand was estimated from national final demand by:

$$(28)\quad D = D^n\ (\Sigma_i X_i/\Sigma_i X^n),$$

where D is a 27x3 regional final demand matrix, and D^n is a 27x3 national final demand matrix. The three final demand sectors are household, state and local government, and federal government. Regional final demand in sector i is national final demand in sector i multiplied by the ratio of total regional to total national output.

Sectoral Outputs for Regional Transactions Matrix: In order to generate the regional transactions matrix, complete information on the outputs of all sectors in the region is needed. However, published data provide sectoral outputs in the region for the livestock and crops sectors only. For the remaining sectors, sectoral outputs were computed, as suggested by Mustafa, on the basis of employment and wages:

$$(29)\quad X_i = Y_j = (N_i^r/N_i^n) * (W_i^{72}/W_i^{67}) * Y_j^{na},\ i = j$$

where:

X_i = total output of sector i in the region in 1972

Y_j = total input of sector j in the region in 1972

N_i = number of employees in sector i in 1972 (superscripts r and n for region and U. S., respectively)

W_i = national wages of sector i (superscripts stand for year)

Y_j^{na} = adjusted total inputs of sector j of the reduced U S. transactions table in 1967 *i.e.*,from equation 24.

From this equation, the sectoral output in the region in 1972 was approximated as the sectoral output in

[8]Price indices were obtained from more than one source since all the price indices were not available from a single source. The 1972 price indices for each sector and their sources are presented in Appendix A.

[9]See Moore and Peterson (12), Schaffer and Chu (19), and Mustafa (14) for different techniques.

the U. S. in 1967 multiplied by the ratio of the number of employees in a given sector in 1972 in the region to that in the U. S. and by the ratio of U. S. wages in 1972 to U. S. wages in 1967.[10]

Regional Transactions Matrix with Imports for 1972: The regional transactions matrix with imports for 1972 was generated from the regional technical coefficients matrix with imports for 1972 in equation 27 and the estimates of outputs in equation 29. This was done by a set of equations $x_{ij} = a_{ij} Y_j$ implied by equation 5.

Regional Transactions Matrix without Imports for 1972: The regional transactions matrix without imports for 1972 was computed by multiplying the coefficients of importing sector rows in the transactions matrix with imports for 1972, as identified by equation 16, by ϕ_i from 17. It is presented in Appendix B.

Regional Technical Coefficients Matrix without Imports for 1972: From equation 5 ($a_{ij} = x_{ij}/Y_j$), the regional technical coefficients matrix without imports for 1972 was generated from the regional transactions matrix without imports for 1972. On the basis of the technical coefficients matrix, the interdependence coefficients matrix without imports (equation 12) was computed. These matrices are presented in Appendices C and D, respectively. The differences between the multipliers computed from interdependence coefficients matrices with and without imports are the leakage multipliers.

Accomplishment of Specific Objectives

For a better understanding, the specific methodology for the accomplishment of each of the four objectives is described below.

Objective #1: Identification of sectors with high potential for economic impact is accomplished by ranking multipliers. Sectors with high ranks of output, income, and employment multipliers are identified as the sectors with high impact potential. Since the major regional economic problems are low income and high unemployment, the income and employment multipliers are central in the analysis.

Objective #2: The bottleneck sectors are those where current production capacity cannot meet an increase in the demand for the output of these sectors. Since the sectors which at present import indicate that their current capacity is not capable of meeting the existing demand, these sectors can be identified from the export vector (equation 16) as bottleneck sectors.

Objective #3: The dependence of the economy on government demand and exports is examined using the general government and general export multipliers defined by equations 21.b and 21.c, respectively.

Objective #4: The dependence of the economy on imports is estimated by the leakage multipliers.

RESULTS OF THE INPUT-OUTPUT ANALYSIS

An input-output analysis was done for the five-county region of southeastern Ohio in which low income and high unemployment are the two major economic problems. The primary results of this analysis are presented here. Included are an overview of the regional economy through the primary input-output matrices, an illustration of the use of the model, and the discussion of the results from the accomplishment of the four specific objectives through the multiplier analysis.

An Overview of the Regional Economy

A look at the sectoral outputs in the region provides useful information in understanding the results of the regional input-output analysis. Because of the unavailability of information on the sectoral outputs in the region, the outputs of 25 sectors out of 27 sectors were computed by equation 29. Computed outputs and incomes, and employment figures of all sectors in the region are presented in Table 5. It is evident from Table 5 that the region is dependent on a few sectors in terms of output, employment, and income. The six dominant sectors in terms of output are the utility, services, retail trade, food, finance, and construction sectors. They generated a total of $396 million in 1972, accounting for more than 72% of the total output of the region. Similarly, these six dominant sectors had about 50% of the regional employment, and generated more than 68% of the regional income.[11]

The regional transactions matrix drawn from the U. S. national input-output structure gives some insights into the structure of the regional economy. Table 6 shows the relative importance of the six dominant sectors in terms of outputs in the regional transactions.[12] The region is highly dependent on the six dominant sectors both in terms of selling their outputs and in terms of buying their inputs. As sellers, the six dominant sectors sell a considerably larger portion of their output among themselves than they sell to the other 21 sectors. For example, util-

[10]The employment and wages data for the region were obtained from OBES (17) and DECD (3), and those for the U. S. were obtained from USDC-BC (26).

[11]The dominant six sectors in terms of employment include livestock and state and local government, and exclude food and finance from those in terms of output. These six dominant employment sectors employ 19,089 persons, accounting for more than 67% of the regional total. For income, coal replaces finance as one of the six dominant sectors.

[12]The computed regional transactions, technical coefficients, and interdependence matrices are presented in Appendices B, C, and D, respectively.

ity sells 26.8% of its output to the six dominant sectors and only 3.1% to the other 21 sectors. For 21 of the 27 sectors, the figures in column 1 of Table 6 are greater than those in column 2.

The six dominant sectors show a similar picture as buyers of inputs to that as sellers of outputs. Except for the food and construction sectors, the dominant sectors obtain more of their inputs from among themselves than from the other 21 sectors.

Illustration

To illustrate the use of the I/O model, the impact of a $1 million increase in final demand for output of the chemicals sector is examined. Output in the chemicals sectors was $7.4 million in 1972, with employment of 321 and income of $1.5 million (Table 5).

The impacts of the $1 million increase in final demand are shown in Table 7. A critical assumption underlying the estimated impacts is that the import adjustments remain valid with the expansion; *i.e.*, the endogenous sectors expand to provide inputs to chemicals in the same proportion as without the increase in final demand.

The first column of Table 7 shows the direct increase in output resulting from the increase in final demand. It is the chemicals column of the technical coefficients matrix (Appendix C). Total direct inputs increase by $0.514 million. The second column shows the total (final demand + direct + indirect) increase in regional output resulting from the increase in final demand. The elements of the second column are the chemicals column of the $(I-A)^{-1}$ matrix (Appendix D). The total increase of $1.877 million is the output multiplier. Total output in the chemicals sector would expand by $1.4 million as a result of the $1 million increase in final demand. In addition to

TABLE 5.—Sectoral Output, Employment, and Income for the Region, 1972.

Sectors	Output ($ Million)*	Employment (Number)†	Income ($ Million)‡
Six Dominant Sectors in Terms of Output			
Utility	89.698	1,292	9.514
Services	70.621	3,686	26.954
Retail Trade	63.121	5,472	30.900
Food	58.876	938	12.463
Finance	56.691	894	8.497
Construction	56.594	1,988	27.923
Subtotal	395.601	14,270	116.254
The Other 21 Sectors			
Livestock	17.762	1,574	1.369
Crops	4.492	399	0.424
Coal	17.873	543	8.750
Tobacco Manufactures	3.325	20	0.362
Textile	1.042	111	0.603
Lumber	5.191	231	1.869
Furniture	0.796	50	0.362
Printing	12.440	697	5.431
Chemicals	7.444	321	1.546
Plastics	6.295	359	1.816
Leather	1.373	215	0.749
Stone and Clay	7.154	415	2.613
Primary Metals	2.408	111	1.193
Fabricated Metals	7.186	815	3.193
Mechanical Machinery	2.868	770	1.407
Electrical Machinery	0.789	162	0.434
Transportation	17.004	609	7.793
Communication	15.720	578	5.448
Wholesale Trade	10.927	581	4.699
Federal Govt.	1.086	435	0.893
State and Local Govt.	7.272	5,072	1.599
Subtotal	150.445	14,068	52.553
Grand Total	546.046	28,338	168.807

Sources:
*Computed by equation 29 except for livestock and crops sectors. Figures for these two sectors were obtained from 1972 Ohio Farm Income (16).
†(3, 17, 29).
‡Computed: income = wage x number of employees.

TABLE 6.—Output Sold to or Inputs Bought by Groups of Sectors, by Sector (Percent).*

Sectors	Selling Outputs				Buying Inputs		
	Dominant Six Sectors	Other 21 Sectors	Household and Govt.	Export	Dominant Six Sectors	Other 21 Sectors	Labor, Capital, and Imports
Utility	26 8	3.1	12.5	57.6	27.3	16.6	59.0
Services	22.8	7.5	67.1	2.8	16.3	12.8	71.0
Retail Trade	8.0	1.7	87.6	2.7	10.4	1.9	87.7
Food	20.9	3.9	76.0	— 0.8	23.2	29.5	47.3
Finance	12.0	4.1	83.8	0.0	12.5	3.0	84.5
Construction	9.9	4.6	9.0	76.4	11.8	20.6	67.6
Coal	24.5	17.2	1.9	56.5	5.1	19.7	75.2
Livestock	75.3	17.2	11.8	— 4.3	15.3	24.3	60.4
Transportation	35 4	26.1	30.2	8.2	9.6	15.1	75.2
Communication	19.2	7.5	41.5	31.8	7.9	3.1	89.0
Printing	46.8	20.3	27.0	5.9	11.2	23.6	65.2
Wholesale Trade	9.2	4.3	74.5	12.0	15.3	5.6	79.2
Chemicals	8.6	70.2	20.5	0.6	14.4	37.0	48.6
State and Local Govt.	90.6	4.0	6.7	— 1.3	31.5	13.5	65.0
Fabricated Metals	17.0	12.9	9.8	60.2	4.4	16.6	79.0
Stone and Clay	77.1	19.1	4.0	— 0.4	10.7	29.9	59.3
Plastics	1.3	12.8	2.0	83.8	8.7	42.2	49.1
Lumber	62.2	32.9	7.3	— 2.5	4.3	33.3	62.4
Crops	27.2	26.9	81.3	— 35.4	13.0	17.8	69.2
Tobacco Manufactures	1.6	10.6	101.9	— 14.0	4.4	16.7	78.9
Mechanical Machinery	4.1	33.2	15.6	47.1	6.4	23.8	69.8
Primary Metals	11.8	32.5	60.7	— 4.9	8.7	20.4	70.9
Leather	4.2	3.7	118.4	— 26.2	9.5	12.3	78.2
Federal Govt.	48.1	6.1	67.7	— 22.0	11.8	18.6	69.6
Textile and Apparel	0.3	0.6	135.1	— 36.0	5.9	13.0	81.1
Furniture	2.1	0.4	315.3	—217.8	6.5	25.0	68.5
Electrical Machinery	4.5	1.9	45.6	47.6	9.8	14.4	75.8

*Sectors are listed by size of output.
Source: Computed from the regional transactions matrix presented in Appendix B.

TABLE 7.—Economic Impact of a $1 Million Increase in Final Demand for Output of the Chemicals Sector ($ Million and No.).

Sectors		Direct Output	Final Demand + Direct + Indirect		
			Output	Employment	Income
1	Livestock	*	0.007	0.6	0.001
2	Crops	0.001	0.002	0.2	*
3	Coal	0.009	0.021	0.6	0.010
4	Construction	0.010	0.023	0.8	0.011
5	Food	0.014	0.027	0.4	0.006
6	Tobacco Manufactures	*	*	**	**
7	Textile	*	*	**	**
8	Lumber	0.003	0.009	0.4	0.003
9	Furniture	*	*	**	**
10	Printing	*	0.008	0.4	0.003
11	Chemicals	0.251	1.368	59.0	0.284
12	Plastics	0.048	0.069	3.9	0.020
13	Leather	*	*	**	**
14	Stone and Clay	0.005	0.011	0.6	0.004
15	Primary Metals	0.003	0.004	0.2	0.002
16	Fabricated Metals	*	0.002	0.2	0.001
17	Mechanical Machinery	0.001	0.002	0.5	0.001
18	Electrical Machinery	*	*	**	**
19	Transportation	0.038	0.067	2.4	0.031
20	Communication	0.006	0.013	0.5	0.005
21	Utility	0.055	0.105	1.5	0.011
22	Wholesale Trade	0.005	0.008	0.4	0.003
23	Retail Trade	0.003	0.009	0.8	0.004
24	Finance	0.018	0.033	0.5	0.005
25	Services	0.044	0.079	4.1	0.030
26	Federal Govt.	*	0.001	0.4	0.001
27	State and Local Govt.	*	0.009	6.3	0.002
Total		0.514	1.877	85.0†	0.439‡

*Less than $500 or 0.0005.
**Not computed.
†Employment multiplier (1.971) times Employment/Output (43.13).
‡Income multiplier (2.115) times Income/Output (0.208).

chemicals, the sectors most affected are utility, services, plastics, and transportation.

Column 3 shows the employment effect of the change in final demand. Each element of column 3 is the coefficient in column 2 multiplied by employment per $1 million of output, which can be computed from Table 5. The total employment impact is 85.[13] Of this 85, 59.0 would be employed in the chemicals sector followed by 6.3 in state and local government, 4.1 in services, 3.9 in plastics, and 2.4 in transportation.

The final column of Table 7 shows the income impacts from a $1 million increase in final demand for output of the chemicals sector. The computations are analogous to those for employment. An estimated $0.439 million in income would be generated by this change, of which $0.284 million is in chemicals, $0.031 million is in transportation, $0.030 million is in services, and $0.020 million is in plastics.

Sectors with High Impact Potential

The first objective was to identify sectors with high potential for economic impact. This objective was accomplished by ranking the output, employment, and income multipliers computed from the transactions matrix without imports. In Table 8, the top ten sectors are shown and ranked by these multipliers.[14] The first column of Table 8 is a list of the sectors ranked by the output multiplier. The output multiplier for a given sector indicates the amount of output generated in the economy per dollar change in the final demand for the output of that sector. The sector with the highest output multiplier is the plastics sector with a value of 1.895. This indicates that if the final demand for the output of the plastics sector increases by $1, the output of the total economy would increase by $1.895. The food and chemicals sectors also have output multipliers greater than 1.8.

The employment multiplier indicates the total change in employment per unit change in direct employment in sector j. The top ten sectors ranked by the employment multiplier are listed in the second column of Table 8. The sector at the top of the list is the utility sector. The employment multiplier for the utility sector of 6.166 implies that for every unit increase in direct employment, 6.166 man-years of additional jobs would be created in the economy of the region. However, the state and local government sector contributes 67% of this multiplier with an interdependence coefficient of 0.085 (Appendix D) and employment of 698 per $1 million of output (computed from Table 5). The second ranking employment multiplier is for the food sector at 4.167. The food, livestock, and crops sectors account for 81% of this multiplier. In addition to these, two sectors (tobacco manufactures and chemicals) show relatively higher impact potential in terms of employment than other sectors.

TABLE 8.—The Ten Sectors with Highest Values of Various Multipliers.*

Rank	Output Multiplier	Employment Multiplier	Income Multiplier
1	Plastics (1.895)	Utility† (6.166)	Livestock (2.594)
2	Food† (1.879)	Food† (4.167)	Utility† (2.477)
3	Chemicals (1.877)	Tobacco Manufactures (2.977)	Crops (2.284)
4	Livestock (1.643)	Chemicals (1.971)	Chemicals (2.115)
5	Utility† (1.633)	Construction† (1.766)	Food† (1.818)
6	Stone (1.618)	Transportation (1.759)	Plastics (1.803)
7	Lumber (1.578)	Finance† (1.756)	State and Local Govt. (1.772)
8	State and Local Govt. (1.530)	Plastics (1.741)	Stone (1.584)
9	Printing (1.508)	Lumber (1.652)	Lumber (1.572)
10	Crops (1.474)	Stone (1.623)	Tobacco Manufactures (1.557)

*Figures in parentheses are the values of multipliers. See also Appendices E, F, and G.

†One of the six dominant sectors in terms of total output generated within the region.

The last column of Table 8 provides a list of the top ten sectors ranked by the income multiplier. The income multiplier indicates the total income change in the economy due to a $1 direct change in the income of a given sector. The livestock sector has the highest income multiplier of 2.594. It is implied that a $1 direct increase in the income of the livestock sector would generate about $2.59 of income in the whole economy. The utility, crops, and chemicals sectors also have income multipliers greater than 2.

As can be noted in Table 8, the rankings of the sectors based on the three different multipliers are not identical. This result may be considered as providing conflicting criteria to policymakers. Policymakers, however, can use information provided by the above discussion based on Table 8 selectively according to problems with which they are faced.

Since the economic problems of the region studied are high unemployment and low income, relatively more attention should be on the employment and income multipliers in order to identify sectors with high impact potentials. From Table 8, the top five sec-

[13]See footnote 7.

[14]Complete listings of multipliers are ranked and presented in Appendices E, F, and G.

TABLE 9.—Relationship of Highest Impact Potential Sectors to Other Sectors Based on Interdependence Coefficients for Selling Outputs and Buying Inputs.

	Selling Outputs			Buying Inputs		
	1	2	3	1	2	3
Utility	Chemicals	Stone	Plastics	State and Local Govt.	Coal	Construction
Food	Livestock	Services	Federal Govt.	Livestock	Services	Transportation
Chemicals	Plastics	Crops	Textile	Utility	Services	Plastics
Plastics	Textile	Chemicals	Electrical Machinery	Chemicals	Services	Utility

Source: Regional interdependence coefficient matrix presented in Appendix D.

tors in terms of employment generating potential are the utility, food, tobacco manufactures, chemicals, and construction sectors. In terms of potential income expansion, the top five sectors are the livestock, utility, crops, chemicals, and food sectors. It is suggested that the regional policymaker dealing with the two problems of high unemployment and low income consider the food, chemicals, and utility sectors as three top sectors with relatively high potentials for generating employment and income in the region. These three sectors are also consistent with growth potential in terms of output. They are found within the group of the top five sectors ranked by the output multiplier.

The plastics sector also deserves to be considered in the economic development policies of the region. The plastics sector ranks first in terms of the output multiplier, and has employment and income multipliers that are only marginally lower than the respective fifth ranked sectors for each multiplier.

Of the dominant sectors in terms of output from Table 5, food and utility show high impact potentials in terms of the output, income, and employment multipliers (Table 8). Finance and construction have relatively high employment multipliers, while services and retail trade do not have multipliers ranking in the top ten.

Finally, the sectors most closely related, as measured by interdependence coefficients, to the high impact potential sectors in the region, are presented. Table 9 shows the top three sectors in terms of selling output (rows) and of buying inputs (columns) for each of the four high impact potential sectors. For example, the three largest buyers from the utility sector are the chemicals, stone, and plastics sectors. The utility sector makes its largest input purchases from the state and local government, coal, and construction sectors. For the food sector, sectors such as livestock and services are important in terms of both selling outputs and buying inputs. Of the four high impact potential sectors, the utility, chemicals, and plastics sectors are highly interrelated. The food, chemicals, and plastics sectors also are highly dependent on the services sector.

TABLE 10.—Volume of Exports and Imports by Sectors for the Region, 1972.

No.	Sectors	Exports ($ Million)	Imports ($ Million)
1	Livestock		2.282
2	Crops		2.876
3	Coal	10.239	
4	Construction		26.327
5	Food and Food Products		6.677
6	Tobacco Manufactures		1.493
7.	Textile and Apparel		15.166
8	Lumber and Wood Products		0.693
9	Furniture and Fixtures		4.384
10	Printing and Publishing		0.592
11	Chemicals		0.699
12	Plastics and Rubber Products	5.432	
13	Leather Products		1.722
14	Stone and Clay Products		0.585
15	Primary Metals	0.896	
16	Fabricated Metals	4.293	
17	Mechanical Machinery	0.181	
18	Electrical Machinery		1.408
19	Transportation	0.508	
20	Communication	3.729	
21	Utility	50.209	
22	Wholesale Trade		18.717
23	Retail Trade		11.093
24	Finance, Insurance, and Real Estate		36.946
25	Services		26.600
26	Federal Government		1.845
27	State and Local Government		10.803

Source: Computed (equation 16)

Bottleneck Sectors

The second objective of this study was to identify the bottleneck sectors. Table 10 shows the magnitude of imports and exports by different sectors in the region. Eight out of 27 sectors are exporting a part of their output. The remaining 19 sectors are importing sectors. Any increase in the final demand for the output of these importing sectors would further increase the volume of imports, unless the production capacities of those importing sectors are fur-

ther increased within the region. These importing sectors can be identified as bottleneck sectors in the sense that their present capacities are not capable of meeting the existing demand.

Among the 19 bottleneck sectors, the construction, textiles, wholesale trade, retail trade, finance, services, and state and local government sectors have magnitudes of imports which are relatively larger compared to those of other bottleneck sectors. The potential multiplier impacts of the food, chemicals, and plastics sectors are conditional upon the ability of the services sector to expand its output, while the impact of the utility sector is dependent upon output expansion in the state and local government and the construction sectors (Table 9). The food and chemicals sectors are two importing sectors, although the magnitude of their imports is relatively small, which were identified by various multipliers as sectors with the highest potential impacts on the growth of the regional economy.

Dependence of the Regional Economy on Final Demand

The extent of the dependence of the region on government and export demands is indicated by the general output multipliers. General multipliers are weighted average multipliers for the whole economy. These multipliers indicate by how much output of the whole economy would increase on the average when the final demand changes by $1. These general multipliers are shown in Table 11. For instance, the general output multiplier is $1.414, implying that if the final demand changes by $1 then the output of the whole economy would change by $1.414 on the average. A higher value of this general multiplier indicates a higher dependence of the whole economy on final demand.

As can be noted in Table 11, the general export multiplier is $1.564 which is greater than the federal government, state and local government, and household multipliers of 1.471, 1.468, and 1.403, respectively. This implied that the economy of this region is dependent more on export demand than on the federal government, state and local government, or household demand. The dependence of the regional economy on the federal government, state and local government, and household demand is about the same; *i.e.,* their general multipliers are about the same in magnitude.

Effects of Imports on the Regional Economy

When a regional economy imports some of its inputs from outside the region, part of the output, income, and employment generated in response to the increase in final demand is leaked outside the region. This effect of imports on the whole economy can be

TABLE 11.—General Multipliers for the Region.

Types of General Multipliers	Value of Multipliers
General Federal Government Multiplier	1.471
General Federal Defense Multiplier	1.468
General Federal Non-defense Multiplier	1.496
General State and Local Government Multiplier	1.468
General Education Expenditure Multiplier	1.491
General Health Expenditure Multiplier	1.456
General Safety Expenditure Multiplier	1.439
General "Others" Expenditure Multiplier	1.462
General Export Multiplier	1.564
General Income Multiplier	1.432
General Employment Multiplier	1.648
General Household Multiplier	1.403
General Output Multiplier	1.414

Source: Computed from various primary multipliers.

examined with leakage multipliers. The leakage multipliers are defined as the difference between multipliers with and without imports.[15] The top 10 sectors ranked by the three kinds of leakage multipliers are presented in Table 12.[16] The first column of Table 12 is a list of sectors ranked by the output leakage multiplier. The ouput leakage multiplier indicates the net amount of the change in total output which is generated outside the region as a result of the $1 change in final demand in the region. For example, if the final demand for the output of the utility sector changes by $1, about 30 cents would be generated outside the region, and $1.63 would be generated inside the region (Table 8).[17] Sectors such as food, livestock, chemicals, and plastics in addition to the utility sector have relatively high output leakage multipliers.

The second and third columns present the employment and income leakage multipliers, respectively. These two leakage multipliers indicate by how much employment and income are leaked out of the region as a result of a one unit change in employment and income, respectively. About 7 man-years of employment would be leaked out of the region per unit increase in direct employment of the utility sector. Similarly, if direct income of the utility sector increases by $1, about 90 cents in income impact from the utility sector would be leaked out of the region. In addition to the utility sector, tobacco manufacture, food, transportation, and finance make up the top five sectors in terms of the employment leakage multi-

[15]With imports, means before adjustments in importing sectors were made. Importing sectors were identified by the export vector equation 16.

[16]The output, employment, and income leakage multipliers for all sectors are ranked and presented in Appendices H, I, and J, respectively.

[17]The output multipliers with and without imports are 1.936 and 1.633, respectively. For detailed figures of various multipliers, see Appendices H, I, and J.

TABLE 12.—The Ten Sectors with Highest Values of Leakage Multipliers, 1972.

Rank	Output Leakage Multiplier	Employment Leakage Multiplier	Income Leakage Multiplier
1	Utility‡ (0.303)	Utility‡ (6.981)	Utility‡ (0.894)
2	Food‡ (0.285)	Tobacco Manufactures (1.515)	Livestock (0.682)
3	Livestock (0.245)	Food‡ (1.274)	Crops (0.569)
4	Chemicals† (0.228)	Transportation (0.759)	State and Local Govt. (0.383)
5	Plastics† (0.226)	Finance* (0.658)	Tobacco Manufactures (0.333)
6	State and Local Govt. (0.217)	Chemicals† (0.485)	Chemicals† (0.330)
7	Leather (0.192)	Services* (0.381)	Food‡ (0.305)
8	Crops (0.190)	Construction* (0.328)	Finance* (0.267)
9	Tobacco Manufactures (0.178)	Plastics† (0.312)	Plastics† (0.230)
10	Services* (0.167)	Stone (0.271)	Lumber (0.155)

*Dominant sector in terms of output (Table 5).
†High impact potential sector in general (Tables 8 and 9).
‡Dominant as well as high impact potential sector (Tables 5, 8, and 9).
Source: Appendices H, I and J.

plier, and livestock, crops, state and local government, and tobacco manufacture in terms of the income leakage multiplier.

As shown in Table 12, the utility sector appeared to have the highest leakage multiplier of all kinds. This is due in part to the fact that the utility sector itself imports some inputs as well as that it purchases large portions of its inputs from sectors such as the state and local government and construction sectors which are major importing sectors. The food, livestock, chemicals, plastics, and tobacco manufactures sectors, in addition to the utility sector, are the most common sectors in all three lists of the top ten sectors based on the three different leakage multipliers.

Table 12 also shows that the output dominant sectors (Table 5) and the high impact potential sectors (Tables 8 and 9) have higher leakage multipliers of all kinds. Five out of the six output dominant sectors are found in at least one of three lists of the top ten sectors ranked by the different leakage multipliers. The utility and food sectors are in all of the three lists, the services and finance sectors in two lists, and the construction sector in one list. The four high growth potential sectors, the utility, food, chemicals, and plastics sectors, are found in all three of the lists. It is implied that the higher the primary multiplier for a given sector, the higher the leakage multiplier. This is even more clear if Table 12 is compared with Table 8. Most sectors in the list of the top ten sectors based on each primary multiplier are in the list based on each associated leakage multiplier.

SUMMARY, CONCLUSIONS, AND POLICY IMPLICATIONS

The major purpose of this study was to explore the interstructural relations in the economy of the five-county region of southeastern Ohio through an input-output analysis. The input-output table for the study region was drawn from the U. S. national table on the basis of secondary data on price indices and sectoral employment, income, and output in the region.

Methodological Issues and Limitations

The application of this nonsurvey technique of input-output analysis was successful in drawing conclusions and policy implications which might be very useful in making policies for the economic development of the region studied.

The validity of the conclusions and policy implications to follow are subject to the accuracy of converting the national technical coefficients, final demand, and industry outputs to regional technical coefficients, final demand, and outputs. In retrospect, use of the location quotient technique appears unnecessary since the import adjustments must be made with or without the location quotients. Schaffer and Chu (19) found that results were similar between the location quotient followed by import adjustments and import adjustments only (sometimes called Supply-Demand Pool).

The input-output model allows determination of which industries have the largest potential economic impact, but it does not tell policymakers how to go about attracting these industries nor how much they can afford to spend. Also, many industries in this region have large potential environmental impacts. While these impacts can be incorporated in the input-output model, they were beyond the scope of this study.

Summary and Conclusions

Subject to the limitations of the analysis, five major conclusions are summarized. First, the six dominant sectors in terms of total output generated within the study region are utility, services, retail trade, food, finance, and construction. The regional economy is highly dependent on these six sectors in terms of both selling their output to and buying their input needs from each other.

Second, the utility, food, chemicals, and plastics sectors appeared to have high potential in terms of economic impact on regional employment and output. The services sector was found to be one of the most important input suppliers to these high growth potential sectors.

Third, the top five importing sectors are the finance, services, construction, textiles and wholesale trade sectors. Since these sectors cannot supply an increase in demand at present, they are identified as bottleneck sectors. The top two exporting sectors are the utility and coal sectors. The utility sector exports more than two-thirds of the regional total.

Fourth, the general multiplier analysis shows that the economy of the region studied is most highly dependent on export demand, followed by federal government demand, state and local government demand, and household demand.

Finally, the most common sectors in the top ten sectors in terms of output, employment, and income leakage multipliers are the utility, food, livestock, chemicals, plastics, and tobacco manufactures sectors. Most of the dominant sectors in terms of output and the high growth potential sectors seem to have higher leakage multipliers than others. The leakage multiplier analysis clearly shows that sectors with higher primary multipliers, in general, have higher leakage multipliers. The services sectors as an important supporting sector of the regional economy and one of the output dominant sectors, appears to have relatively low primary multipliers but high leakage multipliers.

Policy Implications and Recommendations

The two basic economic problems in the study region are low income and high unemployment. The results of this input-output analysis of the region provide several implications and recommendations to regional policymakers dealing with these two economic problems.

The results of the impact or multiplier analysis suggest that the utility, food, and chemicals sectors might be encouraged since these sectors were identified as the sectors which have relatively high impact potential in terms of generating income and employment. These three sectors are also consistent with the output impact potential.

Even though its employment and income multiplier rankings are marginally below the top five sectors, the plastics sector also merits attention since it has the greatest regional output expansion potential. The plastics sector has the highest output multiplier. The services sector also merits consideration since it appears to be an important supporting sector of the high impact potential sectors in the region.

The fact that the regional economy is highly dependent on a few sectors may imply that it is easier to carry out an intensive development program since it is simpler to handle a few sectors than many sectors. However, there is also the possibility of having negative effects when only a few sectors are involved in the development program since such a program might reduce the flexibility of the regional economy with respect to unexpected changes in external factors. Diversification is generally a good policy consideration. In this respect, expansion of the plastics and chemicals sectors merits consideration since they are not part of the six output dominant sectors, but were identified as having high potential for economic impact.

Since it was found that the regional economy is most highly dependent on final export demand, encouraging major exporting sectors such as utility, coal, and plastics sectors to find new export markets to promote the growth of the regional economy is suggested. This is consistent with policies of improving employment and income since the utility and plastics sectors show high impact potential in terms of employment and income. Encouraging the plastics sector is also consistent with the sectoral diversification of the regional economy.

In conclusion, based on the various criteria used to analyze and determine the importance of various economic sectors to the economy of this southeastern Ohio region, the utility, food processing, chemicals, plastics, and services sectors surface as the sectors which merit the most attention.

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APPENDIX A

Sectors		Price Index, 1972 1967 = 100
1.	Livestock*	126.0
2.	Crops*	115.0
3.	Coal†	193.0
4.	Construction†	139.0
5.	Food	120.8
6.	Tobacco Manufactures‡	121.0
7.	Textile	113.6
8.	Lumber	144.3
9.	Furniture	111.4
10.	Printing**	118.9
11.	Chemicals	104.2
12.	Plastics	109.3
13.	Leather	131.3
14.	Stone and Clay	126.1
15.	Primary Metals	128.4
16.	Fabricated Metals	117.5
17.	Mechanical Machinery	122.7
18.	Electrical Machinery	110.4
19.	Transportation	119.9
20.	Communication††	124.2
21.	Utility	120.1
22.	Wholesale Trade	119.1
23.	Retail Trade	125.3
24.	Finance	134.4
25.	Services‡‡	127.7
26.	Federal Government	124.2
27.	State and Local Government	124.2

*(23, p. 11).
†(29, June 1974, pp. 58-510).
‡(24, p. 22).
**(15, p. 109).
††(27, p. 416).
‡‡Average of BEA sectors: 72, 73, 75, 76 and 81 price indexes.

APPENDIX B

Regional Transactions Matrix, 1972, without Imports.

		1 Livestock	2 Crops	3 Coal	4 Construction	5 Food	6 Tobacco Manufactures	7 Textile
1.	Livestock	2.774514	0.274350	0.0	0.0	12.995805	0.0	0.009209
2.	Crops	1.012855	0.041783	0.0	0.013784	1.084474	0.130049	0.0
3.	Coal	0.003653	0.000292	2.621379	0.0	0.049465	0.001416	0.000656
4.	Construction	0.107189	0.063296	0.075025	0.018796	0.159998	0.002433	0.002148
5.	Food	1.942770	0.0	0.0	0.0	10.557141	0.000397	0.001044
6.	Tobacco Manufactures	0.0	0.0	0.0	0.0	0.0	0.350822	0.0
7.	Textile	0.000038	0.000105	0.000137	0.001342	0.000714	0.000005	0.002693
8.	Lumber	0.001267	0.000475	0 072000	3.202300	0.004449	0.000354	0.000493
9.	Furniture	0.0	0.0	0.0	0.016572	0.0	0.0	0.000033
10.	Printing	0.003345	0.002072	0.000383	0.002419	0.374181	0.014094	0.001223
11.	Chemicals	0.031724	0.351228	0.148785	0.089707	0.230477	0.004470	0.005922
12.	Plastics	0.0	0.0	0.0	0.0	0.059618	0.034091	0.075622
13.	Leather	0.002528	0.0	0.0	0.0	0.000376	0.0	0.000421
14.	Stone and Clay	0.001244	0.005180	0.045157	5.362364	0.000766	0.0	0.000991
15.	Primary Metals	0.0	0.0	0.030891	0.254733	0.002590	0.0	0.000001
16.	Fabricated Metals	0.024250	0.003402	0.171406	0.118262	0.253304	0.000345	0.004479
17.	Mechanical Machinery	0.0	0.0	0.271862	0.001434	0.041039	0.002287	0.002303
18.	Electrical Machinery	0.0	0.0	0.0	0.024084	0.0	0.0	0.000049
19.	Transportation	0.359605	0.080039	0.094296	1.896673	1.744475	0.013950	0.015241
20.	Communication	0.045407	0.015604	0.021534	0.281648	0.242309	0.002324	0.008172
21.	Utility	0.056373	0.043121	0.280444	0.059248	0.499604	0.005244	0.010625
22.	Wholesale Trade	0.052842	0.026250	0.030581	0.386244	0.295612	0.002264	0.007158
23.	Retail Trade	0.298273	0.097944	0.019529	3.008043	0.116286	0.005700	0.003753
24.	Finance	0.154195	0.180876	0.282834	0.394368	0.307636	0.010507	0.013458
25.	Services	0.157908	0.198648	0.257649	3.192320	1.975216	0.120231	0.030409
26.	Federal Government	0.000200	0.000117	0.001136	0.003410	0.006487	0.000759	0.000550
27.	State and Local Government	0.000363	0.0	0.0	0.011365	0.005907	0.000018	0.000048

		8 Lumber	9 Furniture	10 Printing	11 Chemicals	12 Plastics	13 Leather	14 Stone and Clay
1.	Livestock	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.	Crops	0.012408	0.0	0.0	0.004383	0.0	0.0	0.0
3.	Coal	0.002339	0.000767	0.001460	0.066635	0.048995	0.000502	0.083077
4.	Construction	0.024501	0.003640	0.056623	0.074168	0.042486	0.003697	0.072089
5.	Food	0.000175	0.000818	0.0	0.102205	0.045838	0.004370	0.004996
6.	Tobacco Manufactures	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7.	Textile	0.000084	0.000210	0.000393	0.000105	0.000027	0.001085	0.000202
8.	Lumber	1.364987	0.111780	0.004391	0.025869	0.003274	0.029576	0.023791
9.	Furniture	0.000636	0.001234	0.000128	0.0	0.0	0.000035	0.000006
10.	Printing	0.001369	0.000449	2.080468	0.002746	0.001911	0.002204	0.002605
11.	Chemicals	0.056269	0.001729	0.267324	1.864990	2.156209	0.003397	0.137130
12.	Plastics	0.006625	0.001883	0.035559	0.359299	0.217351	0.001422	0.048728
13.	Leather	0.000462	0.000053	0.000433	0.000027	0.000048	0.041702	0.000087
14.	Stone and Clay	0.040032	0.005714	0.0	0.034570	0.000986	0.0	1.102745
15.	Primary Metals	0.003742	0.011682	0.003845	0.019270	0.000893	0.0	0.020825
16.	Fabricated Metals	0.067978	0.025673	0.012362	0.002343	0.002486	0.030055	0.015089
17.	Mechanical Machinery	0.009173	0.003498	0.009287	0.005305	0.013190	0.007098	0.094354
18.	Electrical Machinery	0.000003	0.000122	0.000158	0.000037	0.000013	0.000045	0.000357
19.	Transportation	0.121157	0.022135	0.214135	0.284473	0.150710	0.024065	0.524344
20.	Communication	0.016065	0.006420	0.234982	0.045912	0.032588	0.014548	0.054429
21.	Utility	0.060183	0.008117	0.109950	0.408234	0.121955	0.016408	0.330492
22.	Wholesale Trade	0.024129	0.005608	0.049113	0.034693	0.025659	0.012682	0.029026
23.	Retail Trade	0.011523	0.002538	0.080183	0.025146	0.045019	0.005538	0.022737
24.	Finance	0.032961	0.009084	0.360944	0.135655	0.073791	0.024274	0.099377
25.	Services	0.092151	0.026919	0.775491	0.328118	0.220618	0.075948	0.239884
26.	Federal Government	0.000450	0.000211	0.033491	0.002710	0.000538	0.001346	0.001223
27.	State and Local Government	0.000403	0.000006	0.000755	0.001942	0.000422	0.0	0.003070

APPENDIX B (Continued)
Regional Transactions Matrix, 1972, without Imports.

		15 Primary Metals	16 Fabricated Metals	17 Mechanical Machinery	18 Electrical Machinery	19 Transportation	20 Commu-nication	21 Utility
1.	Livestock	0.0	0.0	0.0	0.0	0.000154	0.0	0.0
2.	Crops	0.0	0.0	0.0	0.0	0.005178	0.0	0.0
3.	Coal	0.111183	0.004514	0.001060	0.000181	0.003621	0.000529	4.285505
4.	Construction	0.025772	0.029848	0.010934	0.003340	0.557441	0.368311	2.671108
5.	Food	0.000096	0.000475	0.0	0.0	0.000989	0.0	0.004030
6.	Tobacco Manufactures	0.0	0.0	0.0	0.0	0.0	0.0	0.000427
7.	Textile	0.000016	0.000091	0.000024	0.000009	0.000296	0.000276	0.000282
8.	Lumber	0.006680	0.046880	0.002372	0.000666	0.000932	0.0	0.002159
9.	Furniture	0.000008	0.000761	0.000080	0.000050	0.0	0.0	0.000010
10.	Printing	0.000656	0.002312	0.000573	0.001107	0.025497	0.313729	0.020451
11.	Chemicals	0.031232	0.026210	0.005924	0.010205	0.019817	0.002983	0.120422
12.	Plastics	0.000039	0.014062	0.000831	0.008814	0.0	0.0	0.005692
13.	Leather	0.000051	0.000669	0.000169	0.000023	0.0	0.0	0.0
14.	Stone and Clay	0.011953	0.026069	0.046909	0.010286	0.002482	0.000079	0.002022
15.	Primary Metals	0.118517	0.455037	0.086552	0.005046	0.022818	0.0	0.021630
16.	Fabricated Metals	0.035539	0.259430	0.191996	0.032009	0.022595	0.0	0.0
17.	Mechanical Machinery	0.030368	0.162164	0.278905	0.009513	0.028954	0.0	0.000724
18.	Electrical Machinery	0.000162	0.000408	0.000498	0.013546	0.000157	0.000920	0.003135
19.	Transportation	0.122053	0.126692	0.029397	0.006765	1.868321	0.028495	1.437401
20.	Communication	0.011365	0.040867	0.023741	0.011301	0.208679	0.121471	0.306533
21.	Utility	0.093737	0.086655	0.018636	0.008507	0.082658	0.111174	20.560799
22.	Wholesale Trade	0.012583	0.023062	0.013174	0.003441	0.068164	0.007780	0.049916
23.	Retail Trade	0.003507	0.012756	0.026498	0.013165	0.185858	0.047715	0.091934
24.	Finance	0.011655	0.055058	0.036173	0.012275	0.328298	0.138449	0.261547
25.	Services	0.073717	0.136656	0.091970	0.040118	0.498843	0.583805	0.922717
26.	Federal Government	0.000290	0.000873	0.000552	0.000187	0.005596	0.008680	0.237157
27.	State and Local Government	0.000276	0.000255	0.000126	0.000041	0.277095	0.002088	5.751592

		22 Wholesale Trade	23 Retail Trade	24 Finance	25 Services	26 Federal Government	27 State and Local Government
1.	Livestock	0.0	0.0	0.326689	0.046183	0.0	0.0
2.	Crops	0.0	0.001430	0.080719	0.039513	0.001881	0.000392
3.	Coal	0.000879	0.0	0.021078	0.014391	0.025612	0.088637
4.	Construction	0.015150	0.236698	1.965305	0.566776	0.010476	1.063441
5.	Food	0.163740	0.017867	0.042522	1.696281	0.024161	0.0
6.	Tobacco Manufactures	0.000935	0.0	0.001307	0.051283	0.0	0.0
7.	Textile	0.000280	0.000270	0.000167	0.001060	0.000021	0.000040
8.	Lumber	0.013622	0.006391	0.007978	0.006338	0.0	0.0
9.	Furniture	0.000375	0.0	0.000133	0.0	0.0	0.0
10.	Printing	0.044249	0.100625	0.183471	5.147800	0.006038	0.019271
11.	Chemicals	0.031647	0.003800	0.074750	0.122278	0.000802	0.069656
12.	Plastics	0.001646	0.010237	0.009326	0.0	0.0	0.0
13.	Leather	0.003518	0.001216	0.000976	0.054525	0.000210	0.0
14.	Stone and Clay	0.024620	0.025314	0.012264	0.132782	0.000042	0.003823
15.	Primary Metals	0.001965	0.0	0.004147	0.001041	0.000003	0.001130
16.	Fabricated Metals	0.012663	0.028236	0.005416	0.822924	0.000801	0.008329
17.	Mechanical Machinery	0.013908	0.002183	0.007065	0.065560	0.000089	0.009459
18.	Electrical Machinery	0.001638	0.0	0.001656	0.006579	0.000004	0.000096
19.	Transportation	0.195189	0.116451	0.323937	0.493737	0.159883	0.007864
20.	Communication	0.218181	0.547336	0.418702	1.223403	0.004579	0.035210
21.	Utility	0.077567	1.412191	0.282835	1.213019	0.029241	0.894884
22.	Wholesale Trade	0.031152	0.060270	0.034325	0.180872	0.001780	0.008731
23.	Retail Trade	0.190116	0.245251	0.415576	1.126765	0.002196	0.012077
24.	Finance	0.257403	1.918440	2.207538	1.738208	0.021830	0.095070
25.	Services	0.966648	2.707806	2.142266	5.140172	0.040164	0.225686
26.	Federal Government	0.005910	0.144443	0.057153	0.074122	0.000058	0.001358
27.	State and Local Government	0.004531	0.154338	0.149283	0.514600	0.000184	0.001965

APPENDIX C

Regional Technical Coefficients Matrix, 1972, without Imports.

		1 Livestock	2 Crops	3 Coal	4 Construction	5 Food	6 Tobacco Manufactures	7 Textile
1.	Livestock	0.156205	0.061075	0.0	0.0	0.220730	0.0	0.008840
2.	Crops	0.057023	0.009301	0.0	0.000243	0.018419	0.039110	0.0
3.	Coal	0.000205	0.000065	0.146661	0.0	0.000840	0.000425	0.000630
4.	Construction	0.006034	0.014090	0.004197	0.000331	0.002717	0.000731	0.002062
5.	Food	0.109377	0.0	0.0	0.0	0.179310	0.000119	0.001002
6.	Tobacco Manufactures	0.0	0.0	0.0	0.0	0.0	0.105504	0.0
7.	Textile	0.000002	0.000023	0.000007	0.000023	0.000012	0.000001	0.002585
8.	Lumber	0.000071	0.000105	0.004028	0.056583	0.000075	0.000106	0.000473
9.	Furniture	0.0	0.0	0.0	0.000292	0.0	0.0	0.000032
10.	Printing	0.000188	0.000461	0.000021	0.000042	0.006355	0.004238	0.001174
11.	Chemicals	0.001786	0.078189	0.008324	0.001585	0.003914	0.001344	0.005684
12.	Plastics	0.0	0.0	0.0	0.0	0.001012	0.010252	0.072587
13.	Leather	0.000142	0.0	0.0	0.0	0.000006	0.0	0.000405
14.	Stone and Clay	0.000070	0.001153	0.002526	0.094751	0.000013	0.0	0.000951
15.	Primary Metals	0.0	0.0	0.001728	0.004501	0.000043	0.0	0.000001
16.	Fabricated Metals	0.001365	0.000757	0.009589	0.002089	0.004302	0.000103	0.004300
17.	Mechanical Machinery	0.0	0.0	0.015210	0.000025	0.000697	0.000688	0.002211
18.	Electrical Machinery	0.0	0.0	0.0	0.000425	0.0	0.0	0.000047
19.	Transportation	0.020245	0.017818	0.005275	0.033513	0.029629	0.004195	0.014629
20.	Communication	0.002556	0.003473	0.001204	0.004976	0.004115	0.000699	0.007844
21.	Utility	0.003173	0.009599	0.015690	0.001046	0.008485	0.001577	0.010198
22.	Wholesale Trade	0.002975	0.005843	0.001711	0.006824	0.005020	0.000681	0.006870
23.	Retail Trade	0.016792	0.021804	0.001092	0.053151	0.001975	0.001714	0.003602
24.	Finance	0.008681	0.040266	0.015824	0.006968	0.005225	0.003159	0.012918
25.	Services	0.008890	0.044222	0.014415	0.056407	0.033548	0.036157	0.029189
26.	Federal Government	0.000011	0.000026	0.000063	0.000060	0.000110	0.000228	0.000528
27.	State and Local Government	0.000020	0.0	0.0	0.000200	0.000100	0.000005	0.000046

		8 Lumber	9 Furniture	10 Printing	11 Chemicals	12 Plastics	13 Leather	14 Stone and Clay
1.	Livestock	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.	Crops	0.002390	0.0	0.0	0.000588	0.0	0.0	0.0
3.	Coal	0.000450	0.000963	0.000117	0.008952	0.007782	0.000365	0.011611
4.	Construction	0.004719	0.004572	0.004550	0.009964	0.006748	0.002692	0.010075
5.	Food	0.000033	0.001027	0.0	0.013730	0.007281	0.003181	0.000698
6.	Tobacco Manufactures	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7.	Textile	0.000016	0.000264	0.000031	0.000014	0.000004	0.000790	0.000028
8.	Lumber	0.262921	0.140396	0.000352	0.003475	0.000520	0.021534	0.003325
9.	Furniture	0.000122	0.001550	0.000010	0.0	0.0	0.000026	0.000000
10.	Printing	0.000263	0.000564	0.167182	0.000369	0.000303	0.001605	0.000364
11.	Chemicals	0.010838	0.002172	0.021481	0.250550	0.342500	0.002473	0.019166
12.	Plastics	0.001276	0.002365	0.002857	0.048269	0.034524	0.001035	0.006810
13.	Leather	0.000089	0.000066	0.000034	0.000003	0.000007	0.030363	0.000012
14.	Stone and Clay	0.007710	0.007177	0.0	0.004644	0.000156	0.0	0.154128
15.	Primary Metals	0.000720	0.014673	0.000309	0.002588	0.000141	0.0	0.002910
16.	Fabricated Metals	0.013093	0.032246	0.000993	0.000314	0.000395	0.021882	0.002109
17.	Mechanical Machinery	0.001766	0.004394	0.000746	0.000712	0.002095	0.005168	0.013187
18.	Electrical Machinery	0.000000	0.000153	0.000012	0.000005	0.000002	0.000033	0.000050
19.	Transportation	0.023337	0.027802	0.017207	0.038217	0.023939	0.017521	0.073286
20.	Communication	0.003094	0.008064	0.018882	0.006168	0.005176	0.010592	0.007607
21.	Utility	0.011592	0.010195	0.008835	0.054843	0.019371	0.011946	0.046192
22.	Wholesale Trade	0.004647	0.007044	0.003946	0.004660	0.004075	0.009234	0.004057
23.	Retail Trade	0.002219	0.003188	0.006443	0.003378	0.007151	0.004032	0.003177
24.	Finance	0.006348	0.011410	0.029004	0.018224	0.011721	0.017673	0.013889
25.	Services	0.017750	0.033811	0.062316	0.044080	0.035043	0.055296	0.033528
26.	Federal Government	0.000086	0.000265	0.002691	0.000364	0.000085	0.000980	0.000171
27.	State and Local Government	0.000077	0.000008	0.000060	0.000261	0.000067	0.0	0.000429

APPENDIX C (Continued)
Regional Technical Coefficients Matrix, 1972, without Imports.

	15 Primary Metals	16 Fabricated Metals	17 Mechanical Machinery	18 Electrical Machinery	19 Transportation	20 Commu-nication	21 Utility
1. Livestock	0.0	0.0	0.0	0.0	0.000009	0.0	0.0
2. Crops	0.0	0.0	0.0	0.0	0.000304	0.0	0.0
3. Coal	0.046159	0.000628	0.000369	0.000229	0.000213	0.000033	0.047777
4. Construction	0.010699	0.004153	0.003812	0.004233	0.032783	0.023429	0.029779
5. Food	0.000040	0.000066	0.0	0.0	0.000058	0.0	0.000044
6. Tobacco Manufactures	0.0	0.0	0.0	0.0	0.0	0.0	0.000004
7. Textile	0.000006	0.000012	0.000008	0.000012	0.000017	0.000017	0.000003
8. Lumber	0.002773	0.006523	0.000827	0.000844	0.000054	0.0	0.000024
9. Furniture	0.000003	0.000106	0.000028	0.000063	0.0	0.0	0.000000
10. Printing	0.000272	0.000321	0.000199	0.001404	0.001499	0.019957	0.000228
11. Chemicals	0.012966	0.003647	0.002065	0.012932	0.001165	0.000189	0.001342
12. Plastics	0.000016	0.001956	0.000290	0.011170	0.0	0.0	0.000063
13. Leather	0.000021	0.000093	0.000059	0.000030	0.0	0.0	0.0
14. Stone and Clay	0.004962	0.003627	0.016355	0.013035	0.000146	0.000005	0.000022
15. Primary Metals	0.049204	0.063321	0.030177	0.006395	0.001341	0.0	0.000241
16. Fabricated Metals	0.014754	0.036101	0.066941	0.040564	0.001328	0.0	0.0
17. Mechanical Machinery	0.012607	0.022566	0.097243	0.012056	0.001702	0.0	0.000008
18. Electrical Machinery	0.000067	0.000056	0.000173	0.017167	0.000009	0.000058	0.000034
19. Transportation	0.050672	0.017630	0.010249	0.008573	0.109875	0.001812	0.016025
20. Communication	0.004718	0.005686	0.008277	0.014322	0.012272	0.007727	0.003417
21. Utility	0.038916	0.012058	0.006497	0.010781	0.004861	0.007072	0.229225
22. Wholesale Trade	0.005224	0.003209	0.004593	0.004361	0.004008	0.000494	0.000556
23. Retail Trade	0.001456	0.001775	0.009238	0.016684	0.010930	0.003035	0.001014
24. Finance	0.004838	0.007661	0.012612	0.015556	0.019307	0.008807	0.002915
25. Services	0.030604	0.019016	0.032066	0.050841	0.029336	0.037137	0.010287
26. Federal Government	0.000120	0.000121	0.000192	0.000237	0.000329	0.000552	0.002644
27. State and Local Government	0.000114	0.000035	0.000044	0.000052	0.016295	0.000132	0.064122

	22 Wholesale Trade	23 Retail Trade	24 Finance	25 Services	26 Federal Government	27 State and Local Government
1. Livestock	0.0	0.0	0.005762	0.000653	0.0	0.0
2. Crops	0.0	0.000022	0.001423	0.000559	0.001732	0.000053
3. Coal	0.000080	0.0	0.000371	0.000203	0.023576	0.012189
4. Construction	0.001386	0.003749	0.034667	0.008025	0.009643	0.146241
5. Food	0.014985	0.000283	0.000750	0.024019	0.022241	0.0
6. Tobacco Manufactures	0.000085	0.0	0.000023	0.000726	0.0	0.0
7. Textile	0.000025	0.000004	0.000002	0.000015	0.000019	0.000005
8. Lumber	0.001246	0.000101	0.000140	0.000089	0.0	0.0
9. Furniture	0.000034	0.0	0.000002	0.0	0.0	0.0
10. Printing	0.004049	0.001594	0.003236	0.072892	0.005558	0.002650
11. Chemicals	0.002896	0.000060	0.001318	0.001731	0.000738	0.009579
12. Plastics	0.000150	0.000162	0.000164	0.0	0.0	0.0
13. Leather	0.000322	0.000019	0.000017	0.000772	0.000194	0.0
14. Stone and Clay	0.002253	0.000401	0.000216	0.001880	0.000039	0.000525
15. Primary Metals	0.000179	0.0	0.000073	0.000014	0.000003	0.000155
16. Fabricated Metals	0.001158	0.000447	0.000095	0.011652	0.000737	0.001145
17. Mechanical Machinery	0.001272	0.000034	0.000124	0.000928	0.000082	0.001300
18. Electrical Machinery	0.000149	0.0	0.000029	0.000093	0.000003	0.000013
19. Transportation	0.017863	0.001844	0.005714	0.006991	0.147174	0.001081
20. Communication	0.019967	0.008671	0.007385	0.017323	0.004215	0.004842
21. Utility	0.007098	0.022372	0.004989	0.017176	0.026917	0.123061
22. Wholesale Trade	0.002851	0.000954	0.000605	0.002561	0.001639	0.001200
23. Retail Trade	0.017399	0.003885	0.007330	0.015954	0.002021	0.001660
24, Finance	0.023557	0.030392	0.038939	0.024612	0.020095	0.013073
25. Services	0.088466	0.042898	0.037788	0.072784	0.036971	0.031035
26. Federal Government	0.000540	0.002288	0.001008	0.001049	0.000054	0.000186
27. State and Local Government	0.000414	0.002445	0.002633	0.007286	0.000169	0.000270

APPENDIX D

Regional (I-A) Inverse Matrix, without Imports.

		1 Livestock	2 Crops	3 Coal	4 Construction	5 Food	6 Tobacco Manufactures	7 Textile
1.	Livestock	1.233957	0.077533	0.000450	0.000927	0.334216	0.003965	0.012207
2.	Crops	0.074172	1.014311	0.000121	0.000628	0.042848	0.044462	0.000898
3.	Coal	0.001326	0.002895	1.173897	0.002920	0.002776	0.001204	0.003232
4.	Construction	0.012022	0.020691	0.007819	1.006207	0.010411	0.003091	0.006164
5.	Food	0.165602	0.014255	0.001060	0.002749	1.265169	0.002501	0.005673
6.	Tobacco Manufactures	0.000023	0.000053	0.000019	0.000061	0.000048	1.117989	0.000034
7.	Textile	0.000008	0.000028	0.000010	0.000031	0.000020	0.000004	1.002595
8.	Lumber	0.001204	0.002363	0.007279	0.077980	0.001166	0.000512	0.001511
9.	Furniture	0.000004	0.000007	0.000005	0.000305	0.000004	0.000001	0.000035
10.	Printing	0.004335	0.006754	0.002286	0.007226	0.015307	0.010167	0.005560
11.	Chemicals	0.012395	0.109460	0.014123	0.007622	0.013790	0.012922	0.043834
12.	Plastics	0.000836	0.005565	0.000800	0.001345	0.002099	0.012561	0.077630
13.	Leather	0.000207	0.000066	0.000023	0.000073	0.000108	0.000041	0.000458
14.	Stone and Clay	0.001757	0.004552	0.005069	0.113813	0.001602	0.000632	0.002312
15.	Primary Metals	0.000382	0.000624	0.003806	0.005684	0.000769	0.000167	0.000676
16.	Fabricated Metals	0.003053	0.002003	0.013592	0.004836	0.007157	0.000904	0.005422
17.	Mechanical Machinery	0.000388	0.000440	0.020329	0.002312	0.001447	0.001028	0.003022
18.	Electrical Machinery	0.000010	0.000020	0.000012	0.000453	0.000014	0.000007	0.000059
19.	Transportation	0.037166	0.030374	0.010210	0.051731	0.053489	0.008300	0.022840
19.	Communication	0.005834	0.007139	0.002802	0.009241	0.008925	0.002453	0.010326
21.	Utility	0.011071	0.024861	0.027161	0.014861	0.020091	0.005861	0.020809
22.	Wholesale Trade	0.005406	0.007357	0.002501	0.008349	0.008280	0.001412	0.007862
23.	Retail Trade	0.024596	0.027011	0.002760	0.056463	0.011669	0.004326	0.006230
24.	Finance	0.018176	0.049365	0.021351	0.015159	0.016000	0.008025	0.017948
25.	Services	0.027205	0.062696	0.023117	0.074622	0.058141	0.049054	0.041365
26.	Federal Government	0.000203	0.000351	0.000224	0.000401	0.000377	0.000380	0.000720
27.	State and Local Government	0.001674	0.002785	0.002151	0.002783	0.002801	0.000913	0.002142

		8 Lumber	9 Furniture	10 Printing	11 Chemicals	12 Plastics	13 Leather	14 Stone and Clay
1.	Livestock	0.000800	0.001038	0.001347	0.007486	0.005712	0.001981	0.001176
2.	Crops	0.003419	0.000657	0.000303	0.001889	0.001117	0.000400	0.000280
3.	Coal	0.002821	0.003840	0.002026	0.021486	0.018829	0.001936	0.021483
4.	Construction	0.010336	0.009814	0.010767	0.023337	0.018822	0.006708	0.021178
5.	Food	0.001689	0.003187	0.003723	0.027008	0.020602	0.006628	0.003640
6.	Tobacco Manufactures	0.000027	0.000040	0.000074	0.000065	0.000060	0.000057	0.000046
7.	Textile	0.000025	0.000272	0.000042	0.000025	0.000015	0.000821	0.000039
8.	Lumber	1.357933	0.192097	0.001673	0.008543	0.004687	0.030977	0.007395
9.	Furniture	0.000172	1.001584	0.000016	0.000008	0.000006	0.000036	0.000009
10.	Printing	0.003671	0.005474	1.209544	0.008393	0.007661	0.008609	0.006077
11.	Chemicals	0.022345	0.008670	0.037813	1.367689	0.485993	0.005513	0.036376
12.	Plastics	0.003072	0.003353	0.005509	0.068541	1.060165	0.001590	0.010245
13.	Leather	0.000156	0.000133	0.000119	0.000074	0.000073	1.031379	0.000064
14.	Stone and Clay	0.013949	0.011962	0.001716	0.010587	0.005373	0.001520	1.185496
15.	Primary Metals	0.002658	0.018513	0.000825	0.004277	0.001990	0.002030	0.004972
16.	Fabricated Metals	0.019317	0.037654	0.002603	0.002308	0.002257	0.025313	0.005174
17.	Mechanical Machinery	0.003585	0.006863	0.001349	0.002156	0.003557	0.006843	0.018232
18.	Electrical Machinery	0.000014	0.000174	0.000034	0.000033	0.000026	0.000051	0.000085
19.	Transportation	0.040004	0.041463	0.028145	0.067348	0.054196	0.024443	0.103703
20.	Communication	0.006246	0.011240	0.025931	0.012555	0.011680	0.013635	0.012786
21.	Utility	0.025349	0.021564	0.020616	0.105291	0.066191	0.020430	0.078768
22.	Wholesale Trade	0.006998	0.008773	0.005535	0.007774	0.007485	0.010306	0.006067
23.	Retail Trade	0.005138	0.006051	0.010888	0.009293	0.012757	0.006649	0.007840
24.	Finance	0.012399	0.017064	0.041274	0.032546	0.027143	0.022995	0.023403
25.	Services	0.032765	0.047918	0.089482	0.078526	0.072060	0.068529	0.055071
26.	Federal Government	0.000289	0.000475	0.003514	0.000986	0.000632	0.001231	0.000595
27.	State and Local Government	0.002687	0.002510	0.002662	0.008912	0.005969	0.002300	0.007755

APPENDIX D (Continued)
Regional (I-A) Inverse Matrix, without Imports.

	15 Primary Metals	16 Fabricated Metals	17 Mechanical Machinery	18 Electrical Machinery	19 Transportation	20 Commu-nication	21 Utility
1. Livestock	0.000627	0.000440	0.000626	0.000925	0.000682	0.000512	0.000370
2. Crops	0.000166	0.000123	0.000142	0.000203	0.000501	0.000116	0.000116
3. Coal	0.060850	0.006135	0.004133	0.002815	0.001548	0.000819	0.075143
4. Construction	0.017688	0.008195	0.008165	0.008552	0.042088	0.025370	0.053737
5. Food	0.001940	0.001264	0.001733	0.002727	0.001625	0 001479	0.001083
6. Tobacco Manufactures	0.000037	0.000024	0.000039	0.000054	0.000036	0.000037	0.000027
7. Textile	0.000011	0.000016	0.000013	0.000016	0.000022	0.000020	0.000008
8. Lumber	0.006011	0.010286	0.002914	0.002546	0.003421	0.002007	0.004667
9. Furniture	0.000012	0.000115	0.000042	0.000073	0.000013	0.000008	0.000016
10. Printing	0.004675	0.003319	0.004897	0.008095	0.006424	0.028266	0.003111
11. Chemicals	0.020535	0.008292	0.005715	0.025191	0.002889	0.001529	0.005078
12. Plastics	0.001184	0.002612	0.000974	0.013293	0.000223	0.000193	0.000410
13. Leather	0.000064	0.000129	0.000116	0.000092	0.000038	0.000038	0.000022
14. Stone and Clay	0.009053	0.006572	0.023178	0.017542	0.005168	0.002997	0.006517
15. Primary Metals	1.053917	0.070353	0.040662	0.010538	0.002075	0.000211	0.000973
16. Fabricated Metals	0.018697	1.041085	0.078555	0.045036	0.002498	0.000716	0.001535
17. Mechanical Machinery	0.016569	0.027338	1.110781	0.015343	0.002421	0.000171	0.001650
18. Electrical Machinery	0.000093	0.000079	0.000216	1.017487	0.000037	0.000077	0.000075
19. Transportation	0.065297	0.027521	0.020455	0.016347	1.127097	0.004823	0.028241
20. Communication	0.007805	0.007940	0.011798	0.017573	0.015727	1.009568	0.006439
21. Utility	0.059719	0.022951	0.016825	0.021876	0.012967	0.011536	1.314689
22. Wholesale Trade	0.006512	0.004275	0.006061	0.005380	0.005123	0.000990	0.001641
23. Retail Trade	0.004619	0.003759	0.012376	0.019615	0.015811	0.005554	0.005362
24. Finance	0.010627	0.011344	0.018529	0.021397	0.025613	0.011947	0.008695
25. Services	0.044145	0.029011	0.046851	0.065067	0.043092	0.045412	0.024889
26. Federal Government	0.000415	0.000282	0.000406	0.000499	0.000551	0.000742	0.003573
27. State and Local Government	0.005395	0.002228	0.001907	0.002327	0.019641	0.001338	0.085019

	22 Wholesale Trade	23 Retail Trade	24 Finance	25 Services	26 Federal Government	27 State and Local Government
1. Livestock	0.006185	0.000827	0.008248	0.010003	0.008261	0.000700
2. Crops	0.000898	0.000108	0.002095	0.001920	0.002914	0.000271
3. Coal	0.001173	0.002000	0.001238	0.002401	0.030184	0.024340
4. Construction	0.005778	0.007545	0.038282	0.014247	0.019337	0.155320
5. Food	0.022316	0.002074	0.003570	0.033600	0.029889	0.001958
6. Tobacco Manufactures	0.000180	0.000042	0.000065	0.000888	0.000043	0.000042
7. Textile	0.000030	0.000006	0.000005	0.000022	0.000025	0.000012
8. Lumber	0.002271	0.000772	0.003211	0.001514	0.001749	0.012284
9. Furniture	0.000037	0.000002	0.000014	0.000007	0.000006	0.000047
10. Printing	0.014829	0.006791	0.008570	0.096742	0.012147	0.008059
11. Chemicals	0.005355	0.000837	0.003000	0.006609	0.003019	0.015426
12. Plastics	0.000543	0.000256	0.000401	0.000737	0.000255	0.000969
13. Leather	0.000418	0.000062	0.000059	0.000879	0.000245	0.000044
14. Stone and Clay	0.003680	0.001479	0.004741	0.004226	0.002544	0.018502
15. Primary Metals	0.000541	0.000153	0.000384	0.001161	0.000614	0.001386
16. Fabricated Metals	0.002836	0.001182	0.000931	0.013782	0.002274	0.002844
17. Mechanical Machinery	0.001771	0.000210	0.000360	0.001764	0.001135	0.002368
18. Electrical Machinery	0.000169	0.000011	0.000053	0.000116	0.000022	0.000095
19. Transportation	0.023766	0.004479	0.010143	0.014654	0.169685	0.013910
20. Communication	0.023284	0.010357	0.009384	0.022200	0.008343	0.008166
21. Utility	0.014357	0.031911	0.009838	0.029860	0.040257	0.166704
22. Wholesale Trade	1.003594	0.001281	0.001235	0.003769	0.002993	0.002912
23. Retail Trade	0.020386	1.005593	0.010958	0.019857	0.006507	0.011598
24. Finance	0.029624	0.033905	1.043423	0.033256	0.027733	0.018883
25. Services	0.102777	0.050407	0.047811	1.093033	0.052121	0.050426
26. Federal Government	0.000833	0.002501	0.001191	0.001598	1.000363	0.000782
27. State and Local Government	0.002612	0.005041	0.003933	0.010278	0.005998	1.011682

APPENDIX E

Ranked Output Multipliers.

1.	Plastics	1.895
2.	Food	1.878
3.	Chemicals	1.877
4.	Livestock	1.643
5.	Utility	1.633
6.	Stone and Clay	1.617
7.	Lumber	1.577
8.	State and Local Government	1.529
9.	Printing	1.507
10.	Crops	1.473
11.	Construction	1.468
12.	Furniture	1.462
13.	Federal Government	1.428
14.	Services	1.419
15.	Mechanical Machinery	1.418
16.	Primary Metals	1.416
17.	Coal	1.342
18,	Electrical Machinery	1.340
19.	Transportation	1.337
20.	Leather	1.302
21.	Textile	1.301
22.	Fabricated Metals	1.295
23.	Tobacco Manufactures	1.292
24.	Wholesale Trade	1.290
25.	Finance	1.213
26.	Retail Trade	1.169
27.	Communication	1.156

APPENDIX F

Ranked Employment Multipliers.

1.	Utility	6.166
2.	Food	4.166
3.	Tobacco Manufactures	2.977
4.	Chemicals	1.970
5.	Construction	1.766
6.	Transportation	1.759
7.	Finance	1.755
8.	Plastics	1.741
9.	Lumber	1.651
10.	Stone and Clay	1.622
11.	Coal	1.611
12.	Primary Metals	1.527
13.	Services	1.524
14.	Printing	1.487
15.	Livestock	1.439
16.	Furniture	1.411
17.	Crops	1.292
18.	Wholesale Trade	1.289
19.	Communication	1.220
20.	Fabricated Metals	1.201
21.	Mechanical Machinery	1.186
22.	Textile	1.158
23.	Leather	1.137
24.	Electrical Machinery	1.128
25.	Retail Trade	1.120
26.	Federal Government	1.049
27.	State and Local Government	1.037

APPENDIX G

Ranked Income Multipliers.

1.	Livestock	2.593
2.	Utility	2.477
3.	Crops	2.284
4.	Chemicals	2.115
5.	Food	1.818
6.	Plastics	1.802
7.	State and Local Government	1.772
8.	Stone and Clay	1.583
9.	Lumber	1.572
10.	Tobacco Manufactures	1.556
11.	Finance	1.472
12.	Printing	1.429
13.	Furniture	1.383
14.	Services	1.379
15.	Mechanical Machinery	1.371
16.	Construction	1.361
17.	Primary Metals	1.323
18.	Transportation	1.288
19.	Coal	1.287
20.	Electrical Machinery	1.236
21.	Wholesale Trade	1.229
22.	Fabricated Metals	1.226
23.	Leather	1.212
24.	Federal Government	1.190
25.	Communication	1.168
26.	Textile	1.157
27.	Retail Trade	1.101

APPENDIX H
Ranked Regional Output Leakage Multipliers, 1972.

Rank	Sectors	Multipliers with Imports	Multipliers without Imports	Leakage Multipliers
1.	Utility	1.936	1.633	0.302
2.	Food	2.163	1.878	0.284
3.	Livestock	1.888	1.643	0.245
4.	Chemicals	2.104	1.877	0.227
5.	Plastics	2.120	1.895	0.225
6.	State and Local Government	1.747	1.529	0.217
7.	Leather	1.495	1.302	0.192
8.	Crops	1.663	1.473	0.190
9.	Tobacco Manufactures	1.470	1.292	0.177
10.	Services	1.585	1.419	0.166
11.	Lumber	1.737	1.577	0.159
12.	Printing	1.666	1.507	0.159
13.	Transportation	1.490	1.337	0.153
14.	Furniture	1.614	1.462	0.151
15.	Construction	1.615	1.468	0.146
16.	Stone and Clay	1.764	1.617	0.146
17.	Electrical Machinery	1.487	1.340	0.146
18.	Textile	1.445	1.301	0.144
19.	Wholesale Trade	1.418	1.290	0.127
20.	Finance	1.335	1.213	0.122
21.	Federal Government	1.540	1.428	0.111
22.	Retail Trade	1.261	1.169	0.092
23.	Primary Metals	1.506	1.416	0.089
24.	Mechanical Machinery	1.499	1.418	0.081
25,	Communication	1.227	1.156	0.071
26.	Fabricated Metals	1.354	1.295	0.058
27.	Coal	1.400	1.342	0.057

APPENDIX I
Ranked Regional Employment Leakage Multipliers, 1972.

Rank	Sectors	Multipliers with Imports	Multipliers without Imports	Leakage Multipliers
1.	Utility	13.147	6.166	6.981
2.	Tobacco Manufactures	4.491	2.977	1.514
3.	Food	5.440	4.166	1.274
4.	Transportation	2.518	1.759	0.759
5.	Finance	2.414	1.755	0.658
6.	Chemicals	2.455	1.970	0.485
7.	Services	1.905	1.524	0.381
8.	Construction	2.094	1.766	0.328
9.	Plastics	2.052	1.741	0.311
10.	Stone and Clay	1.894	1.622	0.271
11.	Lumber	1.898	1.651	0.247
12.	Printing	1.718	1.487	0.231
13.	Primary Metals	1.750	1.527	0.223
14.	Livestock	1.636	1.439	0.196
15.	Wholesale Trade	1.479	1.289	0.189
16.	Furniture	1.586	1.411	0.175
17.	Coal	1.774	1.611	0.163
18.	Communication	1.369	1.220	0.149
19.	Crops	1.440	1.292	0.148
20.	Retail Trade	1.245	1.120	0.125
21.	Leather	1.256	1.137	0.118
22.	Textile	1.275	1.158	0.116
23.	Electrical Machinery	1.204	1.128	0.076
24.	Fabricated Metals	1.249	1.201	0.048
25.	State and Local Government	1.069	1.037	0.032
26.	Federal Government	1.079	1.049	0.029
27.	Mechanical Machinery	1.211	1.186	0.024

APPENDIX J

Ranked Regional Income Leakage Multipliers, 1972.

Rank	Sectors	Multipliers with Imports	Multipliers without Imports	Leakage Multipliers
1.	Utility	3.371	2.477	0.893
2.	Livestock	3.275	2.593	0.681
3.	Crops	2.853	2.284	0.569
4.	State and Local Government	2.155	1.772	0.382
5.	Tobacco Manufactures	1.890	1.556	0.333
6.	Chemicals	2.445	2.115	0.330
7.	Food	2.122	1.818	0.304
8.	Finance	1.739	1.472	0.267
9.	Plastics	2.032	1.802	0.230
10.	Lumber	1.726	1.572	0.154
11.	Leather	1.355	1.212	0.143
12.	Services	1.522	1.379	0.142
13.	Stone and Clay	1.719	1.583	0.135
14.	Printing	1.556	1.429	0.126
15.	Furniture	1.504	1.383	0.121
16.	Transportation	1.399	1.288	0.111
17.	Construction	1.468	1.361	0.107
18.	Electrical Machinery	1.339	1.236	0.103
19.	Textile	1.255	1.157	0.098
20.	Wholesale Trade	1.327	1.229	0.098
21.	Communication	1.244	1.168	0.075
22.	Primary Metals	1.386	1.323	0.063
23.	Retail Trade	1.162	1.101	0.060
24.	Mechanical Machinery	1.429	1.371	0.057
25.	Federal Government	1.232	1.190	0.042
26.	Fabricated Metals	1.263	1.226	0.037
27.	Coal	1.324	1.287	0.036

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