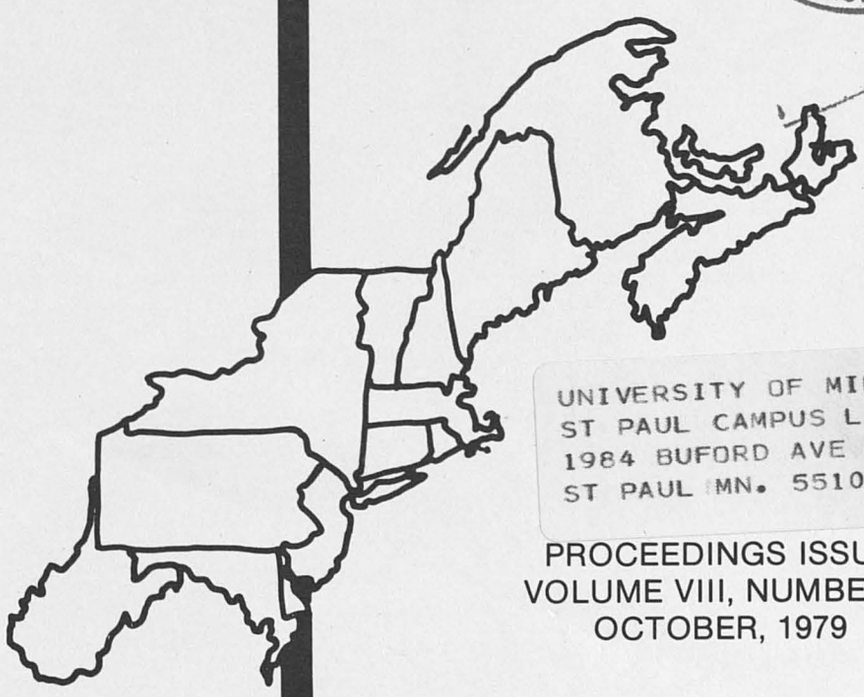
JOURNAL OF THE

Northeastern Agricultural Economics Council



PROCEEDINGS ISSUE
VOLUME VIII, NUMBER 2
OCTOBER, 1979

SUSSEX COUNTY INPUT-OUTPUT ANALYSIS: IMPLICATIONS FOR POLICY DECISIONS

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Economic development in rural areas of the Northeast has received much recent attention. This paper presents an evaluation of the impact of possible development policies for one such rural area, Sussex County, Delaware. The evaluation is based on measures derived from a regional, primary data, input-output model. The paper is divided into three parts: (I) a description of the input-output model with special emphasis on the design of this model, a design which enables the in-depth study of several industries which are important to the Sussex County economy; (II) estimated measures for evaluating the relative significance of each sector to the region's economy; and (III) illustrations as to how the findings might be used to facilitate policy decisions currently facing or likely to face regional planners and representatives.

The Model

The study follows a standard input-output framework. Primary data were used so that the production activities in the county could be highly and selectively disaggregated into 42 industries or sectors. By collecting primary data, the study permits an evaluation of the unique impacts of important specific production activities which are usually combined in input-output models relying on secondary data sources. For example, five separate types of agricultural production were identified as sectors. This made possible a separate sector for the integrated broiler industry's grow-out operations, as distinct from their processing operations. The relevance of this will be shown in the applications portion of this paper. Since the study region encompasses the southern half of Delaware and is bounded on the East by the Atlantic Ocean, beach resources play an important role in the economy. Therefore, to enable a more detailed analysis of the significance of beach related activity, a separate final demand sector, tourism (usually grouped as part of exports), was created. Also, to enable a more precise and inclusive measure of tourism's impact, retail trade and service sectors were greatly disaggregated so that tourist purchases such as restaurant meals, motel services and camping services could be identified and correctly included as part of this industry.

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Methodology

The input-output methodology employed was of the standard variety outlined in Miernyk. The first step was to create a table of transactions occurring in the economy during 1972. The table was estimated from survey data especially collected for this study. The survey data were collected to facilitate the degree of disaggregation deemed desirable and in recogniton of the fact that the type and mix of inputs for Sussex County industries would be significantly different from those represented in the national model. The survey was designed to: (1) determine input requirements for each sector, (2) identify sectors of origin of purchases and sectors of distribution for sales by sampled firms, and (3) determine whether the transactions were made inside or outside the region.

Field interviews throughout Sussex County were conducted for farms in 1971 and for businesses and households in 1973. This enabled the inclusion of a region-specific household expenditure (purchase column) sector in the model. This survey was made by randomly sampling a list of residences obtained from the electric companies. A sample of seasonal residents was clearly identified and, therefore, their spending profiles were calculated and used later as a partial basis for the tourist sector in the final demand portion of the matrix.

Since the survey data were collected for two different years, it was necessary to adjust one set of data in order to make it compatible with the other and to make all survey data comparable to secondary source data for the year 1972. The data from 1970 were weighted on the basis of inflation indexes. A different inflator was used for each expense item because using a single value such as the change in the consumer price index from 1970 to 1972 would not capture the change in the expenditures on various inputs due to changes in relative prices. For example, both the consumer and wholesale price index for commercial vegetables changed from 103 to 115 for an 11 percent change while the feed grain price index changed only from 103 in 1970 to 104 in 1972 for a nine percent change.[1]

Based on the assumption that the sampled firms were representative of all those in the sector, the purchases and sales that appear in the transaction matrix are based on the spending patterns found in the sampled firms, assuming that the mean of the sample would coincide with the mean of the population. The total output figures for each sector were estimated by finding the mean total income (sales) figure for the sampled firms of a given sector and multiplying that mean figure by the number of establishments in the given sector. In a few cases, secondary sources were consulted to adjust the total output.[2] The establishments were assigned to sectors on the basis of their primary product (50 percent or more of sales). The total agricultural production figures represent dollar value of the commodity. In the interest of conserving space, the entire transactions matrix does not appear here, but is available in a bulletin [Boucher and Cole]. The most relevant portions of the matrix have been abstracted and are reported in Table 1.

Measures of Industries' Contributions to an Economy

While total output figures reported as column 1 in Table 1 can be

used for ranking the importance of industries, it should be done with caution due to the use of value-added measurements in trade sectors and a recognition that total output is not coincident with benefits to area residents. When output is produced using many inputs that are imported, the payment for the use of those inputs goes out of the region. Therefore, a better measure of significant contribution to the region's economic health is the amount of income directly generated by production in a given sector (also abstracted from the full transactions table and reported in Table 1 as columns 2 and 4). In order to measure the various sectors' direct contribution to Sussex County income without the bias created by the trade-nontrade dichotomy, column 6 shows each sector's direct payments to households as a percent of total Sussex County income. Using this criteria, the Other Manufacturing Sector (15) provides 33.4 percent and would be considered of prime importance. However, another dimension of any sector's importance to the economy is the output and income indirectly resulting from production in that sector. These non-obvious indirect effects can be measured through the input-output technique.

To determine the magnitude of these indirect effects, a direct requirements matrix was constructed and then, using matrix inversion techniques, and interdependence table was derived.[3] This interdependence table can be interpreted to show the additional production necessary from each sector to support an increase in final demand for output from any one sector. The needed production includes both that required for the initial increase plus all indirectly created needs during subsequent rounds. By summing these coefficients vertically, the total direct plus indirect impact on total economic activity can be determined. This sum is called a multiplier; it shows by what multiple total economic activity will eventually increase or decrease if final demand for a sector's output changes by one dollar.

A further impact on the economy will occur when employees who earn additional income as a result of this increased production spend the income on goods and services produced in Sussex County. This impact is called an induced effect. A second multiplier, allowing for this interaction, was also calculated by including the household sector as a 43rd sector in the direct requirements matrix before the inversion. This multiplier, allowing for direct, indirect and induced effects will be referred to as a Type II output multiplier.

For ease of comparison, the output multipliers for Sussex County are shown in Table 2 and their rank by size reported in the adjacent column. For example, it can be seen that the Field Crop Sector (1) has the largest output multiplier, 1.53. In other words, for every additional dollar's worth of grain demanded, approximately fifty-three cents of other Sussex County produced goods will be used as inputs, thereby increasing the total value of production in Sussex county by $1.53. The next largest output multipliers are Livestock 1.48, Vegetable and Fruits 1.39, Hotels and Motels 1.34, Poultry Processing 1.35, Campgrounds and Parks 1.35 and Real Estate 1.35. Other relatively large multipliers are 1.30 for Gas Service Stations, 1.26 for Restaurants, and 1.26 for Integrated Broiler Industry grow-out. It is significant to note that two sectors, Apparel Products, and Other

TABLE 1. Data Abstracted from Transaction Matrix, Sussex County, Delaware, 1972.

Sector No.	Sector Name	Total Output* (1)	Wages & Salaries* (2)	Per cent+ (3)	Payments to Proprietors* (4)	Per-cent+ (5)	Income Payments Percent of Total County Income** (6)	Purchases from 1-42 (7)	Per-cent+ (8)	Imports* (9)	Per-cent+ (10)	Sales to Sectors 1-42* (11)	Sales to Tourists* (12)
1	Field Crop Farms	14,396	1,003	07	3,500	24	1.1	6,013	42	2,262	16	13,944	0
2	Fruit & Veg. Farms	9,133	1,973	22	1,525	17	0.9	2,874	31	1,783	20	4,597	82
3	Livestock Farms	7,237	724	10	2,521	35	0.8	2,649	37	828	11	178	0
4	Int. Broiler Ind.	82,136	4,923	06	1,643	02	1.7	15,630	19	54,418	66	12,923	0
5	Farm Rental	1,507	0	00	1,230	82	0.3	103	07	21	01	1,502	0
6	Veterinary Ser.	4,197	512	12	1,878	45	0.6	239	06	1,513	36	1,954	0
7	Farm Equipment	1,759	752	43	348	20	0.3	337	19	25	01	546	0
8	Ag Supply & Ser.	5,486	726	13	2,908	53	0.9	616	11	326	06	2,818	54
9	Poultry, Meat & Dairy	50,821	7,921	16	155	02	2.3	14,281	28	25,053	49	162	616
10	Veg. & Fish Proc.	40,753	5,512	14	787	02	1.6	6,424	16	24,934	61	458	205
11	Fish, Forest & Mining	894	248	28	397	44	0.2	90,318	10	54	06	782	41
12	New Construction	53,392	10,100	18	1,597	03	3.0	9,416	18	27,453	51	0	0
13	Main. Construction	20,172	5,943	29	382	02	1.6	2,918	14	8,691	43	6,030	2,017
14	Apparel & Textile	33,842	2,486	07	3,497	10	1.5	356	01	20,939	62	0	0
15	Other Manufacturing	377,832	56,788	15	73,337	19	33.4	6,106	02	135,279	36	5,189	527
16	Transportation	16,624	2,869	17	2,111	13	1.3	2,071	12	4,839	29	3,148	0
17	Communication	9,362	3,490	37	732	08	1.1	415	04	1,487	16	3,731	464
18	Elect., Gas & San.	16,933	3,133	19	1,710	10	1.2	2,132	13	2,606	15	9,309	830
19	Wholesale Trade	8,406	2,347	28	758	09	0.8	1,868	22	1,981	24	3,952	300
20	Bldg. Materials	5,407	2,710	50	463	09	0.8	801	15	427	08	1,601	511
21	Mobile Homes	3,647	539	15	108	03	0.2	652	18	1,913	52	3	1,094
22	General Merch.	10,094	2,615	26	2,552	25	1.3	1,158	11	2,707	27	2	1,514
23	Food Stores	17,703	4,626	26	556	03	1.3	3,566	20	6,539	37	5	5,665
24	Motor Veh. & Parts	6,924	3,482	50	483	07	1.0	936	14	1,218	18	656	138
25	Gasoline Stations	5,699	1,241	22	1,441	25	0.7	1,436	25	784	14	1,767	269
26	Boats & Trailers	351	205	58	9	02	0.1	54	15	44	13	1	211
27	Furniture	3,718	1,289	35	729	20	0.5	754	20	413	11	0	223
28	Eating & Drinking	19,732	3,573	18	834	06	1.2	4,313	22	9,573	49	285	6,814
29	Liquor Stores	2,884	638	22	1,578	55	0.6	309	11	64	02	0	721
30	Fuel	4,663	1,749	38	265	06	0.6	717	15	711	15	1,304	132
31	Misc. Retail	4,466	1,969	44	237	05	0.6	780	17	577	13	500	535
32	Bank, Credit & Sec.	13,939	8,626	61	1,147	08	2.5	2,334	17	285	02	10,187	998
33	Insurance	22,062	4,205	19	2,295	10	1.7	1,793	08	12,732	58	8,043	0
34	Real Estate & Hold.	16,480	5,274	32	3,954	24	2.4	5,041	31	1,701	10	7,343	1,314
35	Hotels, Rooms, Apts.	4,110	473	11	1,721	42	0.6	1,215	30	523	13	38	3,724
36	Camps & Parks	1,942	304	16	335	17	0.2	585	30	248	13	0	1,421
37	Personal Services	4,449	980	22	1,183	27	0.6	934	21	897	20	124	335
38	Repair Services	2,792	458	16	168	06	0.2	398	14	1,468	53	945	0
39	Amusement	3,752	469	12	1,360	36	0.5	369	10	1,008	27	1	2,141
40	Educational	18,335	13,704	75	0	0	3.5	2,648	14	1,983	11	2	0
41	Prof. Services	8,255	1,493	18	4,109	50	1.4	626	08	1,604	19	2,037	0
42	Other Services	6,573	2,226	34	249	04	0.6	1,414	22	1,964	30	1,296	237
Σ 1-42		942,879	175,529	18	126,712	13		107,372	11	368,882	38	107,372	33,147
43	Wages & Salaries	263,090	NA		NA			NA		NA		175,528	5
44	Proprietary Payments	126,712	NA		NA			NA		NA		126,712	0
45	Local Gov.	10,689	5,668		0		1.4	5,623		639		2,933	1,037
46	State & Fed. Gov.	145,419	57,136		0		14.6	19,302		1,578		41,595	0
47	Imports	448,492	NA		NA			NA		NA		363,882	4,433
48	Depreciation	29,061	NA		NA			NA		NA		29,061	0
49	Unallocated Residual	139,898	NA		NA			NA		NA		95,794	2
TOTAL INPUT												942,879	38,626

* In thousands of dollars.
** Sectoral sum of column 2 + 4 divided by sum of 2 + 4 for Σ1-42 or 389,803,000.
\+ Dollars divided by total expenditures.
NA Non-applicable.

Table 2

Estimates of Measures for Evaluation of Sectoral Contributions
to the Economy of Sussex County, Delaware, 1972

Sector No.	Sector Name	Type I Output Multiplier	Rank	Type II Output Multiplier	Rank	Income Retention Coefficient	Rank
1	Field Crop Farm	1.528	1	2.638	8	0.771	20
2	Fruit & Veg. Farms	1.385	3	2.500	12	0.775	19
3	Livestock Farms	1.478	2	2.771	1	0.898	11
4	Int. Broiler	1.263	9	1.620	41	0.248	42
5	Farm Rental	1.082	38	2.736	4	1.149	1
6	Veterninary Ser.	1.068	39	2.225	23	0.804	17
7	Farm Equipment	1.223	16	2.621	9	0.971	6
8	Ag Supply & Ser.	1.132	32	2.514	11	0.960	8
9	Poultry, Meat & Dairy	1.352	4	1.804	34	0.314	40
10	Veg. & Fish Proc.	1.208	18	1.676	40	0.325	39
11	Fish, Forest & Mining	1.114	34	2.588	10	1.024	5
12	New Construction	1.220	17	1.840	32	0.431	36
13	Main. Construction	1.170	24	1.930	31	0.528	29
14	Apparel & Textile	1.012	42	1.361	42	0.242	41
15	Other Manufacturing	1.018	41	1.694	39	0.469	33
16	Transportation	1.43	30	1.830	33	0.477	32
17	Communication	1.051	40	1.958	29	0.630	28
18	Elec., Gas & San.	1.145	29	1.795	35	0.452	33
19	Wholesale Trade	1.256	12	2.200	25	0.656	26
20	Bldg. Materials	1.170	23	2.438	17	0.881	13
21	Mobile Homes	1.205	19	1.734	37	0.368	38
22	General Merch.	1.136	31	2.238	22	0.766	22
23	Food Stores	1.236	14	1.958	28	0.501	30
24	Motor Veh. & Parts	1.157	28	2.389	18	0.856	15
25	Gasoline Stations	1.303	8	2.470	14	0.810	16
26	Boats & Trailers	1.169	25	2.463	15	0.898	12
27	Furniture	1.236	15	2.477	13	0.862	14
28	Eating & Drinking	1.261	11	1.952	30	0.480	31
29	Liquor Stores	1.128	33	2.718	5	1.104	2
30	Fuel	1.177	22	2.153	26	0.678	24
31	Misc. Retail	1.199	20	2.307	20	0.770	21
32	Bank, Credit, Sec.	1.196	21	2.751	2	1.080	3
33	Insurance	1.097	36	1.747	36	0.452	35
34	Real Estate & Hold.	1.346	6	2.742	3	0.970	7
35	Hotels, Rooms, Apts.	1.345	7	2.680	7	0.928	10
36	Camps & Parks	1.346	5	2.282	21	0.650	27
37	Personal Services	1.243	13	2.381	19	0.791	18
38	Repair Services	1.159	27	1.710	38	0.382	37
39	Amusement	1.112	35	2.139	27	0.714	23
40	Educational	1.167	26	2.706	6	1.068	4
41	Prof. Services	1.087	37	2.460	16	0.953	9
42	Other Services	1.262	10	2.215	24	0.661	25

TABLE 3

Impact of Loss of 10% of Poultry Processing Final Demand

	Case 1 no other change	Case 2 accompanied by increased broiler contracts
Initial decrease in final demand	-$5,082,140	-$5,082,140
Change in purchases from Integrated Broiler Industry	-$1,262,251	0 (assume decrease offset by new contracts)
Total change in Sussex County output	-$9,168,108	-$7,123,261 (9,168,108 - 2,044,847)
Total change in Sussex County income	-$1,595,792	-$1,282,754 (1,595,792 - 313,038)
Output multiplier	1.80373	1.40163

Manufacturing, have the smallest multipliers, 1.01 and 1.02, respectively. Thus, although these two manufacturing sectors provide large amounts of income directly to employees, their very limited purchase of inputs from other Sussex County producers in combination with frequent out-of-region ownership causes any growth of these sectors to have little indirect effect on overall economic growth. The input-output analysis has shed an entirely different light on the importance of the manufacturing sectors relative to the others, especially the agricultural and tourist-related sectors which have large output multipliers.

The relative sizes of the sectors' Type II output multipliers are similar to the Type I since the degree of interdependence of a sector is directly related to the size of its multipliers. However, Type II multipliers also vary with the percent of total expenditure for income payments since the induced effects of these payments are included in the total output required. Field Crop Farms (1), Livestock Farms (3), Hotel and Motels (35), and Real Estate (34) are among the top ten ranking for both Type I and II output multipliers.

Although it is desirable to identify in which sectors increased final demand for production can have its greatest impact on overall county economic activity, to many policy makers it is of greater concern how increasing demand for various sectors will impact income to Sussex Countians. Given our awareness of indirect and induced effects, it is necessary to find some measure of total impact on regional income resulting from a change in final demand for production. Such a measure can be found in the household row in the interdependence table.

In this study, in order to highlight its value for policy decisions, this coefficient will be called the income retention coefficient.[4] It will indicate the amount of increased income expected to be paid to county residents as a result of a one dollar increase in final demand for the output of the sector. The magnitude of this income retention coefficient will be determined by the labor intensity of a sector's production process, the profitability to local owners, and the sector's interdependence with other county production. This coefficient indicates the total income effect - direct, indirect and induced. In other words, if there is one additional dollar of final demand in a region, the coefficient will show what portion of it will eventually accrue to residents of the region as income. These coefficients appear in Table 2. The reported rankings, on the basis of size, show that industries such as banking, education, real estate sales and professional services are likely to generate much income for the County. These industries could be characterized as labor and/or management intensive rather than physical capital intensive sectors. Also, highly interdependent and profitable sectors, as indicated by large output multipliers and large proprietary payment (shown in column 2, Table 1), such as livestock production, crop production and hotels and motels, will keep as income for Sussex Countians between 75¢ and 95¢ of every dollar of additional final demand for this output. The retail sectors' income retention coefficients (IRC's) appear large because of the trade margin, i.e. valuation of their output. The payments to households will be a much larger fraction of their total output expenditures than if they were a

fraction of total sales that included dollar value of merchandise. Therefore, the percent of total sales spent on labor (direct income effect) is over stated and thus, the income retention coefficient (IRC) is also overstated and appears large. It should be noted that the poultry processing, integrated broiler grow-out, vegetable processing and apparel products sectors have the smallest IRC's due to the combined facts that they are not labor intensive and import a large percent of their inputs, including services of capital and management skills.

Applications

The information and analysis made possible by this disaggregated model can provide considerable guidance for economic development policy. However, some caution should be taken when using income retention coefficients and output multipliers to compare sectors as targets for development policies. The assumptions implicit in a multiplier are that final demand for the sector's output will increase by some given amount, production will increase to meet the new demand and the necessary inputs from other sectors will be forthcoming. The feasibility of increasing all the inputs must be carefully considered. For example, for the farm rental sector, the income retention coefficient 1.14851 is the largest of any sector. However, a $100,000 change in output would require a 6.63 percent increase in farmland. Also, the likelihood of a given change in demand should be evaluated. The same dollar increase in demand will be a different percent of each sector's current total output. The question arises whether the $102,420 increase in income resulting from a 11.18 percent increase in final demand from Fishing, Forestry and Mining (11), although obviously more desirable, is as realistic a target for a development effort as the $77,456 increase from a 1.09 percent increase in output in Fruit and Vegetables (2). Many examples of this nature could be given to suggest the need for an appraisal of the capacity for expansion as a part of the evaluation of the sector's growth potential.[5]

In this section, the model will be used to address two specific policy issues. Recently several large firms have closed poultry processing plants and followed the trend, all too common in the Northeast, of moving their plants to the "Sunbelt." Attempts by planners and development officials to encourage the reopening of processing plants are based on an assumption that any continued out-migration will severely retard the Sussex economy by also reducing grow-out operations. However, the dollar volume of broiler contracts has grown at approximately an 8 percent per year rate since 1972. One micro effect would appear to be that when a plant closes, productivity of contract growers is evaluated and the most productive receive new, sometimes additional, contracts. Therefore, the overall impact on the region <u>may</u> be actually to increase broiler grow-out operations; predicated on expansion of out-of-region processing plants. By recognizing that this integrated industry has two segments (sectors 4 and 9) and by comparing them in terms of their overall direct and indirect effects on the economy, a clearer picture of the total impact can be provided.

Two outcomes are compared. First, the predicted total impact on Sussex County economic activity (total production) and income is calculated for

a ten percent decrease in poultry processing activity (sector 9). In this case it is assumed that a concommitent decrease in contracts for broiler growth (sector 4) will occur to the extent indicated by the transaction matrix for Sussex County. Second, assuming the same percent decrease in poultry processing, an off-setting increase in contracts for broiler growth will be included to simulate what has happened in Sussex County where other out-of-the-region processors make new contracts with farmers who formerly worked for the closed plant. In other words, in case two, it is assumed that management for growth of broilers will be provided even if management for processing has migrated. This management for growth of broilers can be provided "long distance," especially from neighboring Maryland or by growth of other processing plants within the region. The quantitative predictions in Table 3 show that the projected decrease in County production associated with a 10 percent decrease in processing will be $9,168,108. However, in case two, if broiler contracts continue in spite of loss of processing plants, then the loss in output would be only $7,123,261.[6] Using output multiplier analysis, it can be said that the output multiplier is reduced from 1.80373 to 1.40163. This would be consistent with theory which suggests the more interdependence existent, the larger the multiplier. If the integrated broiler industry is capable of functioning as two separate industries then there is less interdependence than originally assumed. In terms of development efforts, in a period of growth of an industry, large multipliers are desirable. However, when dealing with out-migration of industry, the smaller the multiplier the better.

Other recent development discussions have centered around expanding the industrial base in Sussex County. Efforts have been made to attract electronic firms and to support offshore drilling or fish processing. Reaction by businessmen and farmers has been that such actions would seriously harm the tourist trade and agricultural production, which they argue is more important to the economy. If the assumption is made that using the area as an industrial base necessitates decreases, or certainly no increases, in tourism and farming then a comparison of the total impact of the four types of activities will facilitate development decisions in this area.

In other words, which of four potential uses of Sussex County land is likely to increase county economic activity and/or income by the greatest amount? Using the dollar estimates from Table 4, it can be seen that a $300,000 increase in tourism would result in the largest increase in both overall economic activity and income to Sussex Countians. However, it would necessitate a .78 percent increase in final demand. The feasibility of this would depend on attracting a .78 percent increase in tourists and having the recreational resources to supply an increase of that magnitude. Naturally, all the options would have costs involved, such as encouraging industry to locate in the region and availability of currently unfarmed fertile land. Also, in terms of net benefit to the region, the costs of social services required to support the various alternatives would also have to be considered in any policy decision. At some point, the original assumption that the options are mutually exclusive need be questioned. Obviously, increased tourism and increased field crop production can coexist over some range; but some new industries in Sussex County might preclude

TABLE 4

Problem II

	Manufacturing	Fish Processing	Tourism	Field Crop Production
Initial increase to final demand	$300,000	$300,000	$300,000	$300,000
Percent of 1972 total production	.08	.59[b]	.78	2.08
Additional output resulting from this change	$208,167[a]	$241,119[a]	$555,108[a]	$491,430[a]
Income generated for Sussex Countians by this change	$140,748	$ 94,161	$165,847	$231,384
Income retention coefficient	.46916	.31387	.55283	.77128

[a]Output total does not include the direct effect, but does represent the additional change in local sales generated by the increase.

[b]This is a percent of the output of the combined fish and poultry processing 1972 production. In that year and currently, there is very little fish processing. Therefore in reality, the percentage increase would be large.

the growth of tourism and farming.

In the two problems discussed, the primary data and design of the model have proven helpful in measuring opportunity costs and more accurate than less region-specific or disaggregated models could be.

The disaggregation of this model to include both broiler grow out and processing sectors has provided a more accurate and predictive model regarding the broiler industry and its impact on a region. Use of the model has shown that the different agricultural products have significantly different regional output multipliers. Thus, for Sussex County increases in livestock production would increase overall economic activity by the greatest amount. Finally, it has been shown that the size and nature of the tourism industry's impact on the county economy can be measured and explained by this model.

FOOTNOTES

[1]In most cases a separate index was used for each product to weight sales figures and most expense items were also individually weighted by indices such as fuel and utilities, construction materials, seed, farm supplies, building and fences, interest, and fertilizer. These indices were found mainly in The Statistical Abstract 1975, pages 416-423 and Agricultural Statistics 1970 and 1972, pages 454-457.

[2]Details for these calculations are available in a forthcoming bulletin by Brucker and Cole. For example, problems with branch banks' survey responses led to use of FDIC area reports as a source for total operating revenue for sector 32. In sector 20, Food Stores, lack of cooperation from large chain stores led to a sample over-representation of smaller stores. Therefore, the mean total sales figure was deemed biased and the census mean sales for food stores was used and multiplied by the number of establishments identified in the region.

[3]Both the full direct requirements matrix and the full interdependence matrix appear in a bulletin report of this study [Brucker and Cole].

[4]This is to avoid confusion with the term Income Multiplier used in some studies to refer to a number calculated by dividing the total income effect by the direct income effect. See Bills and Barr; Doeksen and Schreiner; Grubb; Hiser and Fisher.

[5]This question has been addressed by Ayer and Bashett. They have derived an elasticity measure to quantify this element of how large a percentage change is required.

[6]This was calculated by taking predicted loss, $9,168,108 minus 2,044,847, which is the offsetting increase in Broiler contracts and their indirect effects [or $1,262,251] times the multiplier for sector 4 = 1,262,251 x 1.619 = 2,044,847]. The same process can be followed to determine income

effects using the income retention coefficients.

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