

THREE COMPARISONS OF REGIONAL PURCHASE COEFFICIENTS USED IN ESTIMATING THE ECONOMIC IMPACTS OF TOURISM AND OUTDOOR RECREATION

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Introduction

In recent years there has been increasing interest in the regional economic impacts of tourism and outdoor recreation. This interest is the result of efforts to expand traditional rural development programs beyond strict reliance on industrial recruitment as the primary development strategy (Bergstrom, Cordell, Watson, and Ashley, 1990). In addition, many government agencies responsible for managing natural resources are being asked to provide information on the regional economic impact of recreational and other uses of these resources. In some cases this information is mandated by legislation.

Many economic impact analyses have utilized the U.S. Forest Service's IMPLAN input-output modeling system (Bergstrom, Cordell, Watson, and Ashley, 1990; Johnson, Hospodarsky, and Anderson, 1990; Johnson, Obermiller, and Radtke, 1989). The IMPLAN data base consists of two major parts: a national level technology matrix and estimates of final demand, final payments, gross output, and employment by sector for each county in the United States. The system has the capability of producing an input-output model that is not survey-based for any region of the country, down to the county level. This capability, combined with the introduction of the microcomputer version of IMPLAN, has increased its application for estimating the economic impact of tourism and outdoor recreation. This paper compares the effects of modifying the regional purchase coefficients of an IMPLAN model when estimating the economic impact of tourism for a four county region in north central Wyoming.

Problem Statement

Due to specific assumptions embodied in the structure of the IMPLAN system, "... the data base must be considered a point of departure" (U.S. Forest Service, 1989). As such, the system provides initial estimates of regional economic structure. According to the U.S. Forest Service (1989), "If actual data can be obtained, the system is

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designed to incorporate user-supplied data at each stage of the model building process to produce superior 'hybrid' accounts."

IMPLAN uses regional purchase coefficients (RPCs) from secondary sources to construct regional consumption (use) matrices based on national level technology matrices. RPCs, which represent the proportion of regional demand for a good or service that is fulfilled by regional production, are used to estimate regional trade flows. This is particularly important in estimating the indirect and induced effects of an economic activity on the regional economy. As noted by Stevens *et al.* (1989), there seems to be general agreement that the accuracy of the RPCs is the most crucial factor in determining the accuracy of any nonsurvey regional input-output model.

RPCs are important because the size of the impact from a change in a region's economic activity depends on the relative amount of internal trade. Larger amounts of internal trade will tend to increase the size of the impact, while proportionally smaller amounts of internal trade will decrease the size of the impact. If the estimated RPC is too high, it will overestimate internal trade because the proportion of regional demand fulfilled by regional production will be overestimated. This causes the multipliers and associated economic impacts estimated by the IMPLAN model to be too large. Similarly, if the estimated RPC is too low, it will underestimate internal trade because the proportion of regional demand fulfilled by regional production will be underestimated. This causes the multipliers and associated economic impacts estimated by the IMPLAN model to be too small.

Current IMPLAN RPC estimates were developed from empirical trade flow data obtained from the 1977 Multiregional Input-Output Accounts developed by the U.S. Department of Health and Human Services (U.S. Forest Service, 1989). These accounts are a cross-sectional data base of state input-output accounts linked with interstate trade flows. RPCs for IMPLAN sectors 1 through 445 are localized through predictive equations that consider the ratios of wage rate, employment, and land area between the region and the U.S. (U.S. Forest Service, 1989). The predictive equations essentially estimate relative shipments as a function of relative delivery costs including both production and shipment costs. IMPLAN sectors 1 through 445 correspond to those sectors with shippable commodities, including agriculture, mining, and manufacturing. The RPCs for IMPLAN construction sectors are assumed to be 1.0.

The RPCs for IMPLAN sectors 446 to 526 (including lodging and eating-drinking) are not localized, but rather represent the observed values for each state based on the Multiregion Input-Output Accounts data. Because an RPC value cannot exceed the supply-demand pooling ratios, RPCs for all sectors may be the supply-demand pooling ratios.

This procedure may present problems for estimating the economic impact of tourist expenditures at the substate level as most of these expenditures involve sectors 446 to 526. It is likely that many RPCs for substate regions are substantially lower than the state level RPCs because the proportion of regional demand fulfilled by regional production is probably less at the substate level. This is particularly true for sectors such as lodging and, to a lesser extent, eating-drinking, where much of the demand by regional residents tends to be satisfied by purchases made outside the region. As a result, there may be an overestimate of the economic impact of visitor expenditure on the local economy. The purpose of this paper is to evaluate the importance of incorporating localized RPCs in the estimation of the economic impact of tourism and outdoor recreation on a regional economy.

The regional economy considered in this study is a four county area in north central Wyoming that includes Big Horn, Johnson, Sheridan, and Washakie counties. Table 1 provides a summary of the industry composition of the area's economy in terms of employment (BEA, 1992). There are also 472 coal miners who live in the study area but work at coal mines located in Montana. It is estimated that tourism accounts for 1,031 full-time equivalents of employment in the region (Taylor, Fletcher, and Clabaugh, 1990).

Procedures

Actual survey-based RPCs for the lodging and the eating-drinking sectors for a four county study area are substituted for the IMPLAN values for the region. The regional economic impacts of tourist expenditures for lodging and eating-drinking in the area are estimated using both sets of RPCs. As a further comparison, the economic impact of tourist expenditures for lodging and eating-drinking also are estimated using a supply-demand pooling approach for all sectors, where it is assumed that local demand does not go outside the region until local supply is exhausted. This approach was used in earlier versions of IMPLAN.

This analysis focuses exclusively on tourist expenditures for lodging and eating-drinking. This is appropriate because such expenditures represent the largest categories of visitor trip-related expenditures and because of the large amount of cross-hauling associated with the lodging sector.

Localized RPC figures for the lodging and eating-drinking sectors are estimated from a survey of businesses providing these services in the four county study area. A stratified sample is selected from a list of sales tax licenses for the area. As shown in Table 2, there are a total of 116 eating-drinking and 64 lodging businesses in the study area. Fifty of these firms were interviewed to determine purchasing and sales pat-

terns (Appendix 1). The 50 firms accounted for 62 percent of lodging sector employment and 57 percent of the eating-drinking sector employment in the area.

This information was used to estimate an intraregional commodity sales coefficient (RSC) for both sectors in the area. The RSC represents the proportion of local commodity supply sold to regional demand. The estimated RSC figures are used to calculate the direct survey RPC for each sector based on the following relationship:

$$(1) \text{ RPC} = \frac{\text{Net Commodity Supply} * \text{RSC}}{\text{Gross Regional Commodity Demand}}$$

where:

Net commodity supply = Total commodity supply – foreign exports; and
Gross regional commodity demand = Intermediate + final demand.

This procedure is used to estimate regional RPCs because of the research efficiency in contacting regional sellers of the commodity rather than regional buyers of the commodity.

A supply-demand pooling model of the study area is obtained by modifying the regional accounts in the IMPLAN system. Total visitor expenditures on lodging and eating-drinking are estimated from primary data on tourist expenditures and occupancy rates for lodging accommodations in the area (Taylor, Fletcher, and Clabaugh, 1990). The regional economic impact of visitor expenditures are estimated using the supply-demand pooling model, the IMPLAN RPCs model, and the IMPLAN model using direct survey RPCs.

Results

Table 3 summarizes the effects of the alternative model specifications on regional trade patterns for the lodging and eating-drinking sectors. The RPC for lodging decreases from .91 with supply-demand pooling to .82 for the IMPLAN data base to an observed value of .03. Similarly, the RPC for eating-drinking decreases from .91 to .90 to .51, respectively. Because regional demand is constant, the net effect of reducing the RPCs is to increase regional imports for both sectors. Because regional supply is also constant, regional exports increase a like amount. Regional exports for lodging change from \$0.9 million with the IMPLAN RPC to \$9.1 million with the direct survey RPC. Regional exports for eating-drinking change from \$0.2 million to \$16.4 million. Regional exports are zero for both sectors with supply-demand pooling.

Based on primary data, total visitor expenditures in the region for private lodging and eating-drinking are estimated to be \$15.2 million. Approximately 40 percent of these expenditures are for lodging. Table 4

summarizes the total economic impact from this level of visitor expenditures in these two sectors on the regional economy for the three models. An increase in regional imports and exports implies a reduction in the indirect and induced effects throughout the regional economy (i.e., smaller multipliers for these two sectors). As a result, the economic impacts would be expected to decrease as the RPCs decrease. Table 4 indicates that this is the case.

Comparison of the economic impact estimated by the supply-demand pooling model with that of the IMPLAN RPCs model indicates that the IMPLAN RPCs impacts are 12 percent to 24 percent smaller. Comparison of the same impact estimated by the IMPLAN RPCs model and the direct survey RPCs model indicates that the direct survey RPCs impacts are about 4 percent smaller. The difference in impacts between the supply-demand pooling estimate and the IMPLAN RPCs estimate is relatively large because the RPCs for a number of sectors are different for the two models. The difference between the IMPLAN RPCs estimate and the direct survey RPCs estimate is relatively smaller because only two RPCs are modified and because the resulting change in exports and imports is only a small portion of the total for the region. The \$24.3 million dollar increase in regional exports and imports as a result of the change in RPCs represents an increase of less than 4 percent in total regional exports and imports.

Table 5 compares the relative difference in the disaggregated economic impact of visitor expenditures between the IMPLAN RPCs model and the direct survey RPCs model. The third column of Table 5 indicates that there was a fairly substantial reduction in the induced effect as a result of the changes in RPCs, with over a 14 percent decrease in employment and population. The large decrease in the induced effect is a result of less local spending on lodging and eating-drinking by employees of sectors direct and indirectly linked to tourism. The decrease in the indirect effect is relatively smaller because most of the expenditures for lodging and eating-drinking come from the household sector. Because the direct effect is unchanged and the indirect effect is reduced only slightly, the change in the estimated total economic impact between the two models is relatively modest in this example.

Summary and Conclusions

The results suggest that the regional purchase coefficient approach for adjusting national level technology matrix for use in regional models is superior to supply-demand pooling because it allows for cross-hauling. Without this adjustment, the model will tend to overestimate the economic impact of visitor expenditures. In the example, the IMPLAN RPCs model estimate of economic impact is as much as 24 percent less than the supply-demand pooling estimate.

The superiority of the hybrid model with localized RPCs is less obvious. From a descriptive perspective, the localized RPCs result in more logical exports and imports for the lodging and eating-drinking sectors. Despite rather large changes in the RPCs for the lodging and eating-drinking sectors, however, the direct survey RPCs model economic estimate of impact is only about 4 percent less than the IMPLAN RPCs model. There are several factors that need to be considered. The 4 percent decrease in total economic impact in the study area occurs as a result of modifying the RPCs of only two sectors. If the localized RPCs of nonshippable commodities in the other sectors changed by a similar magnitude, the decrease in estimated economic impact would be much greater. The question of trade-off between cost and time of primary survey data versus errors using secondary methods for the study area is beyond the scope of this paper.

In addition, the size of the impacted sector in relationship to the total economy, the linkages between the rest of the regional economy and the impacted sector, and the relative size of the total economy also may affect the magnitude of the change in estimated economic impact from modification of the RPCs. The results show that adjusting the RPCs in just two sectors, eating-drinking and lodging, does not affect the estimate of total economic impact substantially. This would not hold if IMPLAN data were used to develop a localized input/output model using exports estimated for the eating-drinking and lodging sectors as a proxy for tourism sales in the region.

In conclusion, when utilizing IMPLAN to estimate the economic impacts of tourism and outdoor recreation it seems important to consider the use of some direct survey technique to estimate the RPCs for lodging and eating-drinking as a minimum. This becomes even more important when IMPLAN data are used to develop regional models using eating-drinking and lodging exports as a proxy for tourism.

In situations where localized RPCs are deemed desirable and there are more buyers than sellers in the region, it may be more efficient to estimate intraregional commodity sales coefficients and use these estimates to develop direct survey RPCs.

References

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Table 1—Full-Time and Part-Time Employees by Major Industry for Study Area, 1990

Sector	Employment
Government and Government Enterprises	5,757
Services	5,585
Retail and Wholesale Trade	5,125
Farm	2,411
Construction	1,512
Transportation and Public Utilities	1,437
Finance, Insurance, and Real Estate	1,363
Manufacturing	1,357
Mining	687
Ag. Serv, For, Fish, and Other	686
Total Employment	25,920

Table 2—Eating/Drinking and Lodging Businesses in the Study Area

	Eating/Drinking	Lodging
Number of Firms	116	64
Total Employees	1,288	503
1-4 Employees	46	49
5-9 Employees	22	5
10-19 Employees	25	4
20-49 Employees	22	3
50-99 Employees	1	2
100-249 Employees	0	1

Table 3—Regional Trade Patterns for Lodging and Eating-Drinking Sectors

	Lodging S/D Pooling	Lodging IMPLAN RPCs	Lodging Survey RPCs
Net Commodity Supply (MM\$)	9.36834	9.36834	9.36834
Reg. Commodity Demand (MM\$)	10.24827	10.24827	10.24827
RPCs	0.91414	0.82454	0.03000
Ave. Import Propensity	0.08586	0.17546	0.97000
Imports (MM\$)	0.87993	1.79817	9.94083
Sales Coefficient	1.00000	0.90198	0.03282
Exports (MM\$)	0.00000	0.91824	9.06089
	Eat/Drink S/D Pooling	Eat/Drink IMPLAN RPCs	Eat/Drink Survey RPCs
Net Commodity Supply (MM\$)	37.53163	37.53163	37.53163
Reg. Commodity Demand (MM\$)	41.41788	41.41788	41.41788
RPCs	0.90617	0.90004	0.51000
Ave. Import Propensity	0.09383	0.09996	0.49000
Imports (MM\$)	3.88625	4.13993	20.29476
Sales Coefficient	1.00000	0.99324	0.56281
Exports (MM\$)	0.00000	0.25368	16.40851

Table 4—Total Regional Economic Impact of Visitor Expenditures

	S/D Pooling	IMPLAN RPCs	Survey RPCs	Change IMPLAN vs. S/D Pooling	Change Survey vs. IMPLAN
Final Demand (MM\$)	29.5987	26.1703	25.1690	-11.6%	-3.8%
TIO (MM\$)	39.5949	31.9501	30.5744	-19.3%	-4.3%
Employee Comp. (MM\$)	9.8946	8.1822	7.8282	-17.3%	-4.3%
Property Income (MM\$)	9.2866	7.0907	6.7917	-23.6%	-4.2%
Total Income (MM\$)	19.1812	15.2729	14.6199	-20.4%	-4.3%
Value Added (MM\$)	22.7468	18.2055	17.4274	-20.0%	-4.3%
Employment	896.75	780.22	746.53	-13.0%	-4.3%
Population	2156	1876	1795	-13.0%	-4.3%

Table 5—Comparison of Direct, Indirect, and Induced Impacts Between IMPLAN RPCs Model and Direct Survey RPCs Model

	Percent Difference Direct	Percent Difference Indirect	Percent Difference Induced	Percent Difference Total
Final Demand	0.0%	0.0%	-9.1%	-3.8%
TIO	0.0%	-1.8%	10.0%	-4.3%
Employee Comp	0.0%	-2.3%	-10.2%	-4.3%
Property Income	0.0%	-1.0%	-7.5%	-4.2%
Total Income	0.0%	-1.5%	-8.8%	-4.3%
Value Added	0.0%	-1.5%	-8.7%	-4.3%
Employment	0.0%	-4.4%	-14.1%	-4.3%
Population	0.0%	-4.7%	-14.1%	-4.3%

APPENDIX—THE SURVEY QUESTIONNAIRE

Name: Location: Date:

Sales by Your Motel/Restaurant/Lounge Business—1989

1. Total Sales \$ Other Income \$

(Breakdown of Sales by Department or Source)

Rooms	\$	Banquet Room	\$
Restaurant	\$	Vending Machines	\$
Lounge	\$	Telephone	\$

(Breakdown of Sales by Type and Location of Clientele)

	Sales (\$ or %)			Sales (\$ or %)			Sales (\$ or %)		
	<u>Rooms</u>			<u>Restaurant</u>			<u>Lounge</u>		
	In County	Other WYO	Out of State	In County	Other WYO	Out of State	In County	Other WYO	Out of State
Commercial
Government
Groups
Tourists

2. Occupancy rates (rooms rented per month) Total rooms available

	<u>Commercial</u>		<u>Government</u>		<u>Tourists</u>	
	In State	Out of State	In State	Out of State	In State	Out of State
January
February
March
April
May
June
July
August
September
October
November
December
Total

APPENDIX (cont.)—SURVEY QUESTIONNAIRE

Name: Location: Date:

Expenses for Your Motel Business—1989 FY to
Total Expenses

	Total	In County (\$ or %)	Other WYO (\$ or %)	Out of State (\$ or %)
1. Labor				
Salaries and Wages	\$.....
Social Security	\$.....
Workers' Compensation	\$.....
Unemployment Taxes	\$.....
Employee Paid Benefits	\$.....
2. Supplies	\$.....
3. Services	\$.....
Pest Control	\$.....
Professional (Accountants, Attorneys)	\$.....
4. Finance Charges	\$.....
Credit Card Fees	\$.....
Interest Paid	\$.....
5. Utilities	\$.....
Gas	\$.....
Electricity	\$.....
Water	\$.....
Sewer	\$.....
Trash Removal	\$.....
Cable TV	\$.....
6. Communications	\$.....
Telephone	\$.....
Postage	\$.....
7. Transportation (Freight)	\$.....
8. Advertising	\$.....
9. Construction	\$.....
New or Remodeling				
10. Taxes	\$.....
Local (Property), Licenses	\$.....
State (Sales, Use, Unemployment, Workers' Compensation, Licenses)	\$.....
Federal (Income Tax, Social Security, Unemployment, Excise)	\$.....
11. Profits (Retained Earnings)	\$.....
12. Depreciation	\$.....
13. Other Expenses	\$.....
Not Elsewhere Classified				

APPENDIX (cont.)—SURVEY QUESTIONNAIRE

Name: Location: Date:

Expenses for Your Restaurant/Lounge Business—1989 FY to Total Expenses

	Total	In County (\$ or %)	Other WYO (\$ or %)	Out of State (\$ or %)
1. Labor				
Salaries and Wages	\$.....
Tips	\$.....
Social Security	\$.....
Workers' Compensation	\$.....
Unemployment Taxes	\$.....
Life & Health Insurance	\$.....
Other Employee Paid Benefits	\$.....
2. Supplies and Food				
Food	\$.....
Liquor	\$.....
Beer	\$.....
Cleaning/Laundry	\$.....
Nonfood Resale Items	\$.....
Restaurant Supplies	\$.....
Maintenance Supplies	\$.....
Other Supplies	\$.....
3. Services				
Pest Control	\$.....
Parking Lot	\$.....
Plumbing/Heating	\$.....
Electrical	\$.....
Health	\$.....
Professional (Accountants, Attorneys, etc.)	\$.....
4. Finance Charges				
Credit Cards	\$.....
Interest Paid	\$.....
5. Utilities				
Gas	\$.....
Electricity	\$.....
Water	\$.....
Sewer	\$.....
Trash Removal	\$.....
Cable TV	\$.....
6. Communications	\$.....
Telephone	\$.....
Postage	\$.....
7. Transportation (Freight)	\$.....
8. Advertising	\$.....

APPENDIX (cont.)—SURVEY QUESTIONNAIRE

Name: Location: Date:

	Total	In County (\$ or %)	Other WYO (\$ or %)	Out of State (\$ or %)
9. Construction New or Remodeling	\$.....
10. Taxes				
Local (Property), Licenses	\$.....
State (Sales, Use, Unemployment, Workers' Compensation, Licenses)	\$.....
Federal (Income Tax, Social Security, Unemployment, Excise)	\$.....
11. Profits (Retained Earnings)	\$.....
12. Equipment Rental	\$.....
13. Capital Purchases (Remodeling, Furniture)	\$.....
14. Depreciation	\$.....
15. Other Expenses Not Elsewhere Classified (Please List)	\$.....

Additional Questions

How many man-months of labor were required to operate your business?
.....

If you have more than one enterprise motel and restaurant and lounge, what percent of your labor went for

Motel Restaurant Lounge

What were your daily room rates, excluding state and local taxes?

Single from \$ minimum to \$ maximum

Double from \$ minimum to \$ maximum

For each additional person \$

What is your average food cost per dollar of sales? \$

What is your average liquor cost per dollar of sales? \$

What is your maximum seating capacity in:

Restaurant- Number of persons

Lounge- Number of persons

APPENDIX (cont.)—SURVEY QUESTIONNAIRE

Name: Location: Date:

Any general comments concerning your business and the tourism/recreation industry in Wyoming?

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