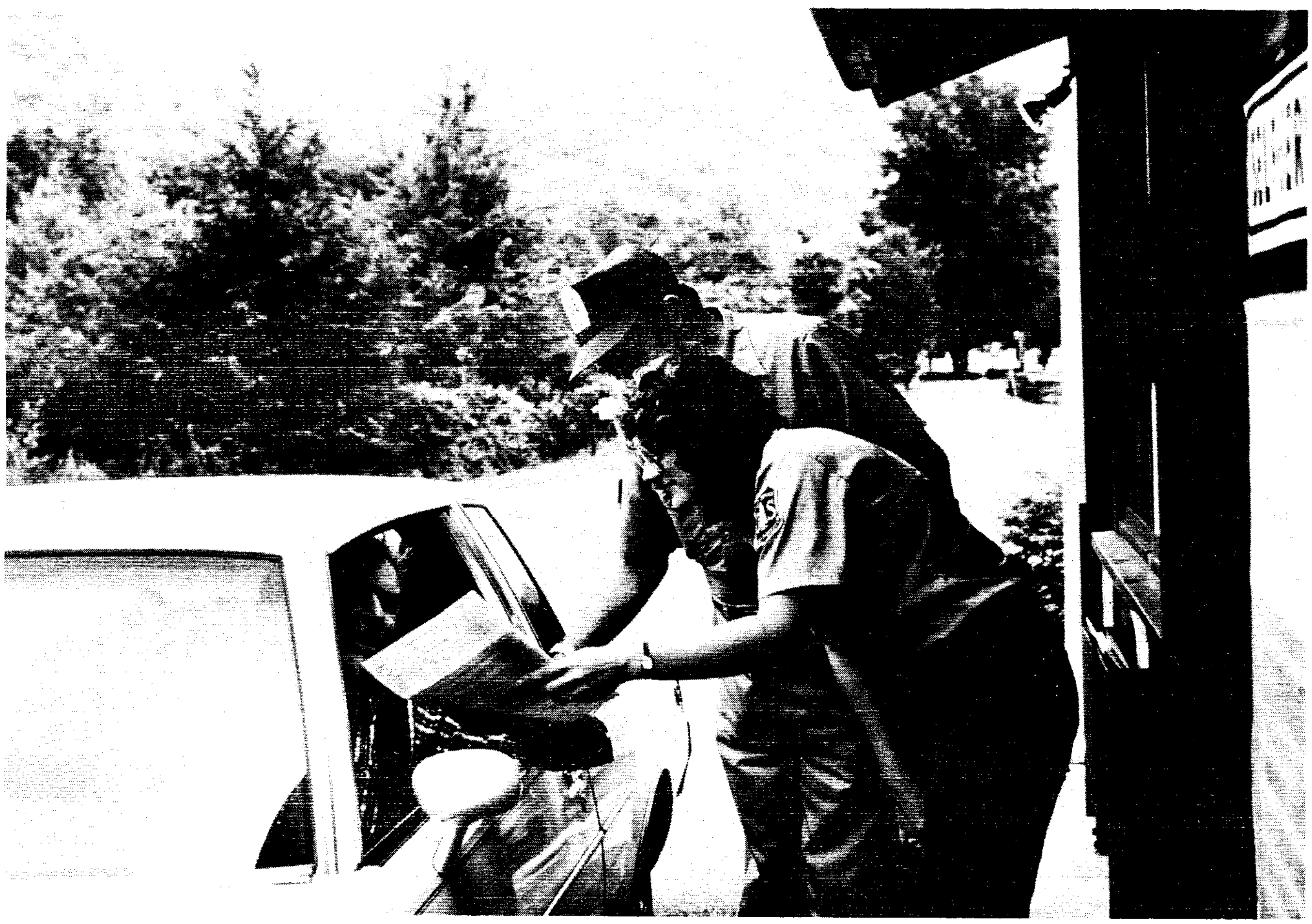
Assessing the Economic Impacts of Recreation and Tourism

Dennis B. Propst, Compiler



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Contents

Preface

The papers contained in this report are the result of a conference and workshop held at Michigan State University from May 14-16, 1984. The meeting had two goals pertaining to the economic impact assessment of recreation and tourism: (1) to explore and assess the best available technology, and (2) to recommend research strategies for meeting methodological and data needs. The meeting consisted of two parts. During the conference, regional scientists presented papers related to specific issues in assessing the economic impacts of recreation and tourism. The first seven papers come from this part of the meeting. In the second part of the meeting, regional scientists and recreation professionals worked in small groups to recommend solutions to the same issues addressed during the formal presentations. The last paper in this report describes in detail the structure and function of the entire meeting and presents the results of the workshop groups. The Appendix lists participants and their affiliation.

This collection of studies was not the result of a haphazard response to a call for papers. Instead, I asked decision makers in the USDA Forest Service and Corps of Engineers to describe the unresolved issues most important to them in assessing the economic impacts of recreation and tourism. I then sought out professionals with expertise in these specific issue areas. Each paper represents both guidelines for the Forest Service, Corps of Engineers, and others to follow and new research areas for academic pursuit. Thus, this report is intended for use by agency recreation planners and researchers in units of government and academic institutions. Reviews of these papers took place by thorough publisher editing, some external peer review, and extensive exchanges among participants during the meeting.

I wish to express my gratitude to the following individuals and agencies for their financial support of the meeting and subsequent research in this vital area:

Dr. H. Ken Cordell, Urban Forestry and Recreation Assessment Research in the South, USDA Forest Service, Southeastern Forest Experiment Station, Athens, GA;

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Mr. William H. Hansen, (formerly) Resource Analysis Group, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

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Department of Park &
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Strategies for Developing Multipliers

Useful in Assessing Economic Impacts

of Recreation and Tourism

Daniel F. Chappelle[1]

Our primary reason for being concerned with techniques for assessing economic impacts of recreation and tourism is, I assume, that there are clients out there who are involved in making investment decisions or in making recreation and tourism policy.

I propose that we constantly keep in mind the question, "What do we need to know and how well do we need to know it?" We need to be more concerned about the use of our results than I have observed in most cases in my reading of the regional economics literature. It seems to me that many papers on the subject are more concerned with development of mathematical models for evaluation by the profession than in guidelines to decision making.

This paper does not represent an exhaustive literature search, nor is it particularly concerned with the numerical magnitude of tourism multipliers derived by researchers. Rather, it is concerned with alternative strategies and methods that may be used by researchers to develop multipliers and with some major problems involved in deriving creditable, believable multipliers appropriate as guidelines to policy makers.

Before discussing strategies in the development of recreation and tourism multipliers, I want to highlight the main points that are essential to my discussion of multiplier analysis.

My primary message is that we need to be concerned about the ways in which information we develop will be used, and that guidelines to decision making must be patterned around real policy needs and use scientific methods to develop creditable, believable results that can be compared with results derived for other sectors of the economy. There is no place for allowing a recreation and tourism industry bias to enter into the analysis in order to derive the largest possible multipliers. Promotion of the recreation and tourism industry should not be our concern.

Nor is there a place for the invention of special sector terminology for concepts that already exist in regional economics. In my cursory venture into the tourism literature, I found that some unique terms seem to be used in place of perfectly adequate terms from regional economics.

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Another message of this paper is that the major barriers to correctly assessing economic impacts of recreation and tourism are not really directly attributable to derivation of multipliers. Rather, I believe the principal problems involve identification of recreation and tourism sector(s) in a definitive, unambiguous manner, within the context of the regional economic structure. In addition and connected to this question, is the problem of defining the appropriate impact region, that is, to identify the space that is inside the impact area and the space that is outside.

Another major concern, particularly in the case of recreation and tourism, is the time dimension. So much of the economic activity in this sector(s) is of a seasonal nature. There is considerable question as to how this problem should be handled within the context of regional economic accounts.

It is my contention that our main concern should be with appropriate levels of aggregation of space, time, and economic activities. If these concerns could be satisfied, and if appropriate data bases could be developed, then it should be possible to calculate multipliers with about the same degree of reliabilty (and the same limitations) as multipliers developed for other sectors of the economy using input-output analysis.

ECONOMIC MULTIPLIER CONCEPTS: TYPES, APPLICATIONS, AND ABUSES

The economic impact multiplier concept is very attractive to both analysts and decision makers. If it is possible to develop a single number that expresses the vast maze of interactions through the economic structure resulting from expenditures in the recreation and tourism sectors, this number could be used to evaluate projects and devise a sound system of private and public investment.

Successes in macroeconomic planning during the 1960's (by using econometric models based on Keynesian theory) colors the expectations of many economists involved in multiplier analysis. There seems to have been a belief that somehow the results of fine-tuning the economy during that brief period in the life of this Nation could be applied--with essentially equal efficacy--to a region of the country, or even to a sector within a regional economy. Such is not (and was not) a reasonable expectation! We should recognize multiplier analysis for what it is, and focus on its limitations (and strive, of course, to alleviate them). In addition, given the enthusiasm of policy makers for such numbers and the frequency at which they abuse multipliers that they do get, we should provide as many qualifiers as deemed justifiable before releasing such information to clients.

The concept of an input-output multiplier is relatively simple. It is merely the ratio of direct and indirect effects (plus occasionally some type of induced effect) to the direct effect. Multipliers can be based on various economic measurement scales (e.g., output or sales, income, employment) or even some physical measurement scales (e.g., residuals output per dollar of value output).

Multipliers have many limitations, several of which are of particular concern if one is interested in illuminating the recreation and tourism sector(s) of the regional economy:

1. Although multipliers can be derived for each recognized internal sector of the regional economy, they essentially apply to the average establishment of the sector at the time period during which the data were collected for the region as delineated. It is not possible to measure differences in impact that vary with scale of a proposed expansion of a sector's capacity. Also, there is no reason to expect that multipliers necessarily can be extrapolated to other situations. As was noted above, the definition of what types of establishments are included within the sector of concern is extremely important if the multiplier is to be useful. Also, if comparisons are to be made from one region to another, it is necessary that sectorizations be identical, or that the more detailed sectorization can be aggregated to be the same as the less detailed one.

2. Actually, multipliers strictly apply only to the next incremental change in the region's economic structure. This means, theoretically at least, that once a change is introduced into the economic structure, multipliers may change in magnitude. Since the input-output model is a static model, it is not sensitive to change. Multipliers can not reflect changes in economic structure except by recalculating them after changes have been introduced into the transactions table (or direct coefficients table). This is an illustration of the paradox that multipliers are derived from a static model, yet the multiplier process (that occurs as the initial expenditure reverberates through the regional economic structure) takes time to work itself out. This time interval is not accounted for nor defined in the model itself.

3. Different types of multipliers may rank prospective investments differently. From the standpoint of economic development planning, it would be desirable to be able to apply weights to the various multipliers in order to rank prospective opportunities. However, since measurement units differ from one multiplier to another (e.g., output, income, and jobs), it is not possible to apply weights and add their products. Of course, this is not a limitation of multipliers specifically, but rather is a problem associated with the multidimensionality of economic development planning.

ALTERNATIVE STRATEGIES IN DEVELOPING MULTIPLIERS

To explore alternative research strategies available for developing recreation and tourism multipliers, we can select from four possibilities:

1. Develop a regional input-output table from primary data developed in a sample survey for all sectors.

2. Develop a regional input-output table from a mix of primary and secondary data. Generally the primary data will be collected for sectors which analysts are interested in illuminating in terms of the identified research problem.

3. Develop a regional input-output table from completely secondary data.

4. Develop multipliers by using a method other than input-output analysis.

The first alternative has been used, particularly where a small area (such as a county or Standard Metropolitan Statistical Area) is the appropriate region. Development of a full input-output table on the basis of primary data collected by survey is normally expensive and usually not a feasible alternative. However, there is serious need for primary data collection efforts that will result in transactions tables which include unique Recreation and Tourism sector(s). Such models may serve as standards on which to judge models developed from secondary data sources. Usually it is possible to obtain data for such models only if input-output accounts are sponsored by some unit of government.

In an early-small area study, Gamble and Raphael (1965) found that for Clinton County, Pennsylvania, the external sector "Recreationists" had an export demand multiplier of 1.98, that the share of total direct local household income was 0.001, and that the household income multiplier associated with this sector was 0.36 (Gamble and Raphael, 1965:33). On the other hand, when evaluating the impact of new activities in the county, a ski and water resort had the highest regional multiplier ($, probably income), 2.744 because

> ... of the nature of this external income. This income is in the form of consumer expenditures and subsequently expenditures directly related to serving consumers. Such dollars will pass through several sectors of the region before they pass out again to the rest of the world. For example, a skier from outside the county will purchase gasoline, food, lodging and perhaps ski equipment. These will generate expenditures in such sectors as wholesale fuel, food processing, laundry, labor, and the like. On the other hand, industrial activities generally confine their major expenditures to a small number of regional sectors such as labor, power and perhaps, a local source of raw material. This results in lower multipliers for the industrial candidates. (Gamble and Raphael, 1965:59)

As I have indicated thus far, the ideal would be to have a complete regional input-output table developed from primary data that is sectored in such a way that the problems selected by researchers could be fully explored. Unfortunately, such an ideal is rarely, if ever, satisfied. The major question then comes down to what is the best feasible research strategy for developing tourism and recreation multipliers, given the available resources and time.

A second strategy that might be used is to base an input-output model on a mix of primary and secondary data. Normally in such an analysis, primary data would be collected for those sectors that one wishes to illuminate, i.e., tourism and recreation in this case.

In the subject area of tourism, a good example of an input-output analysis based on a combination of survey and secondary data is one developed by Strang (1970) for Door County, Wisconsin . In that study, all businesses in the study area were sent a questionnaire designed to trace their patterns of both sales and expenditures. Other sectors of the area's economy were traced from secondary sources. The time period for this static-open input-output model was 1968. Tourism was treated as a final demand sector and all other final demands were grouped into another final demand sector. Households (full time) were included as an internal sector. A tourism multiplier was derived through the application of Type II sales multipliers to increases in tourists' final demands, weighted according to the pattern of tourists' expeditures. It was found that the weighted multiplier for the tourism sector was 2.1741.

When Strang ranked sectors by total community impact, he found the following ranking occurred for the highest five sectors (percentage of total sales shown in parentheses): lodging places (24.9%); eating and drinking places (18.2%); financial, insurance, and real estate (12.6%); food stores (7.5%); and auto sales and services (7.2%). These five sectors accounted for 70.4 percent of the total community sales impact. Probably the reason why the financial, insurance, and real estate services sector was so important is that for purposes of this study, tourists "... were defined to include summer residents owning cottages or homes in the county as well as the shorter-term visitors" (Strang 1970:38).

Strang's analysis illustrates a significant question that must be answered by researchers carrying out multiplier analysis--namely, What is a tourist? Can we say that a person owning a second home who resides there during summer and part of autumn should be considered a tourist? Remember, tourism is classified as final demand and a form of export. It appears that Strang's findings may be confounded by the inclusion of second-home households in the tourism sector. I do not have any ready answer as to how a tourist should be defined for this type of study. I would think, however, that some very interesting results could have been derived by including second-home householders in a separate sector (either internal or final demand).

A major characteristic of recreation and tourism is that it is inherently a final demand type of industry, that is, for the most part, the product is delivered to final consumers at the producer's site. Many if not most consumers come from outside of the region and hence the service usually should be considered an export industry for purposes of regional analysis.

Another major problem is that most intermediate transactions generated on the basis of recreation and tourism are actually claimed by other sectors of the economy. That means that if the Recreation and Tourism sector is developed from primary data, and if one wishes to rely on secondary data for all of the other sectors of the economy, then it will be necessary to subtract transactions from other sectors that are to be included in this new sector. It may be difficult to do this, particularly in a consistent fashion.

A third possible strategy is to develop an input-output model entirely from secondary data for the purpose of developing recreation and tourism multipliers. In order to use data from a secondary source, however, the analyst must accept the sectorization that is used by the secondary source. To my knowledge, none of the secondary sources separates out the recreation and tourism sectors. As I see it, the major sectorization problem relative to recreation and tourism is that economic activities that we normally associate with this sector are currently distributed within a multitude of sectors in the existing national and regional input-output accounts. Since virtually all analyses are at least partially dependent on existing economic accounts (and usually much more so), the problem that analysts have is to decide how they can disaggregate activities that legitimately belong to the recreation and tourism sector from sectors of the economy where they are currently embedded. Part of the problem is that our national and regional accounts classify sectors on a number of bases, e.g., commodity produced, input mix, process, etc.

Criteria for inclusion of expenditures commonly used by tourism and recreation researchers (i.e., those expenditures incurred during recreational trips) do not form the basis for any currently supported multiuser, multipurpose sectorization schemes. Although this problem is likely more extreme for recreation and tourism activities, many other sectors (particularly nonindustrial sectors) have similar attributes. An important consequence of this problem is that it appears virtually impossible to disaggregate existing accounts to derive the information needed in order to develop valid multipliers on the basis of secondary information (e.g., the national input-output direct coefficients) regardless of how efficient our data reduction techniques, or how good our estimates of final demand.

There is a serious problem of aggregating dissimilar activities in conducting economic assessments of recreation and tourism. That is, the mix of recreational activities varies a great deal from place to place and from season to season. Given that in input-output work we are dealing with a static model where the period of observation is normally a year and that we effectively work on the basis of the average establishment when we develop input-output multipliers of the various types, the diverse and changing mix of activities is likely to be a serious problem in terms of stability of estimates.

A fourth strategy is to develop multipliers by a method other than input-output analysis. Usually this means developing a multiplier or multipliers on the basis of shortcut analysis less comprehensive than input-output analysis. This can be done by using expenditure distribution patterns or sales distribution patterns as a basis of the multiplier, and then collecting data on appropriate leakages so that they can be considered in the derivation of the multiplier. Various economic measures may be used for such multipliers, e.g., sales, income, employment, and residuals. Often these shortcut methods may be the most feasible from the standpoint of research budgets and available time. A major problem with such multipliers is, however, that only rarely are they directly comparable with those derived from a comprehensive input-output analysis of the area.

Archer and Owen (1972) presented a regional tourist multiplier (apparently an income multiplier) for Anglesey island, a county in Wales. This multiplier model was designed to calculate multipliers without the need of an input-output model. It requires data on the average propensity to consume, patterns of consumer spending, proportion of income spent by the region's inhabitants, and the income generation for each expenditure category. The model was designed to subtract leakages in the tradition of Tiebout's economic base multipliers. Archer and Owen (1972:13) calculated the following multipliers:

Hotel and guest house visitors = 1.25
Stationary caravan visitors = 1.14
Bed and breakfast and farmhouse visitors = 1.58
Camping visitors = 1.35
The composite multiplier = 1.25

and they explain the composite multiplier as follows:

> In each case the unit 1 is the initial £1 spent, the benefit of which accrues to the tourist. The remainder is the total repercussive benefit to the region after leakages. Thus for every £1 of tourist spending on Anglesey, 25 p. worth of income after leakages is generated. The initial £1 of spending has some additional indirect benefits to the region in the effects upon the value of businesses, which are partly assessed on the size of their turnover. Nevertheless, 75 p. of the £1 are lost to the regional economy as hoteliers, retailers, and other [sic] buy their goods from wholesalers off the island, and as profits leak away to owners on the mainland.

Multipliers derived by Archer and Owen appear low in comparison with many others observed in the literature. Possibly their multipliers are correct and they were able to trace the multitude of leakages better than most (note that their study area is an island). Also, it may be that their study area differs significantly from conditions found within the United States, in terms of the recreation and tourism sector.

Archer and Owen (1972:13) compared their results to several other studies:

> A from-to analysis of Walworth County, S.E. Wisconsin in 1963 (Kalter and Lord, 1968), produced a tourist regional 'impact' multiplier of 1.80. Another from-to analysis of outdoor recreation in Sullivan, Pennsylvania (Gamble, 1965) produced the multipliers 1.56 for hunter-fisherman, 1.58 for tourists and 1.62 for summer home owners. Residual incomes, i.e., the direct and indirect household incomes, returns to local government and non-profit organizations in the County, were assessed as 0.35 for tourists, 0.48 for hunter-fishermen and 0.50 for summer home owners.

Another example of this strategy was an analysis reported by Marino and Chappelle (1978). Actually the multiplier analysis was only a small part of the study, since the focus of the study was on spending patterns of lodging and restaurant establishments in northwest lower Michigan and impacts of alternative highway development. We essentially provided estimates of the part of the tourist dollar remaining in the study region during the first round of spending. The multiplier was developed through use of the power series approximation, and leakages were taken into account by subtracting their estimated values for the second and subsequent rounds. Five spending rounds were calculated, but leakages were assumed to remain constant after the second round because of a lack of comprehensive data about their impacts. A multiplier of 2.52 was calculated for the lodging industry and 2.53 was calculated for the restaurant industry. Of course, given the nature of this analysis, these multipliers do not differ significantly from one another.

PROBLEMS IN MEASURING ECONOMIC ACTIVITY

Serious valuation problems of recreation and tourism activities will likely continue to cause difficulties in developing valid multipliers. If we measure only transactions in monetary units actually transacted, many transactions logically belong in other sectors of the economy. For example, many costs measured in the Clawson (1959) travel cost approach appear in other sectors of the economy (e.g., fuel and auto repairs). Also, valuations developed by using this approach are much different from market prices (e.g., it is likely that the value of a priced good, such as timber stumpage, would be much different if this approach is used compared with using market price). The point is that consistent valuation procedures must be carried out for all sectors of the economy if the resulting multipliers are to be correct. Recreation specialists often maintain that such estimates will seriously underestimate the value of recreation and tourism because the reason for or intent of these expenditures was for the activities themselves. Although this rationale may be reasonable, it does not happen to form the basis for any existing economic accounting system, and it is unlikely to be accepted and implemented in the near future. It appears that if such an accounting system is to be developed, it will have to be developed by firms, agencies, universities, etc., interested in the sector themselves.

The problem of multipurpose and multidestination trips has continually caused problems in developing valuations of recreation and tourism activities. Although it is not immediately evident, this same problem is involved when we develop economic accounts. In fact, the same problem is encountered in most of service and information sectors of the economy.

PROBLEMS OF AGGREGATING TIME

Many recreational and tourism establishments are seasonal, which causes problems of economic instability for communities in which they operate. Analytically, I believe one could question the appropriateness of the 1- year time period for the usual input-output transactions table. However, it would be difficult to use a shorter period (e.g., a quarter of a year) because of data collection problems. Even if this could be done, it would be necessary to develop a dynamic model in order to interrelate seasons in the same way that we interrelate economic sectors.

IMPORTANCE OF SPATIAL MODELS

Most models that have been developed have not considered spatial relationships explicitly. Even if problems of correctly defining sectors and aggregating time are overcome, the typical input-output model may not be useful unless it is interregional in nature and unless regions defined within the system are fairly small. For example, given the travel behavior of recreationists and tourists, it would be desirable to have an interregional input-output model where regions consist of origins and destinations of recreational and tourism activities. In terms of activity mix considerations, it would be desirable to have a large number of regions represented in this system of regions. In terms of consumer behavior, fewer regions would be adequate. For both configurations, however, the problems (not to speak of costs) of completing this type of analysis would be enormous because most data would have to collected in a survey specifically designed for the recreation and tourism sectors.

CONCLUSIONS

A number of major questions have been raised in this paper--What do we actually need to know about secondary impacts and how well do we need to know it? Who cares? For those that do care, how precise must the information be in order to make decisions? It is important to develop guidelines to decision making by using professionally approved methods in a scientific, objective way. The goal should not be to simply develop the highest multipliers.

The greatest problem is that of deciding what purposes must be served by information developed by analysis and how precise must this information be. It does not seem feasible to develop multipliers that will serve every conceivable need at the appropriate level of precision. Entirely survey-based multipliers will probably be prohibitively expensive. Perhaps a combination of primary and secondary data collection will be the most feasible. In my opinion, the most serious current problems deal with aggregation of space, time, and activities. Until these have been clarified by analysts in response to clients' needs, I see lttle hope of developing useful economic multipliers from input-output analysis. It might be that some of the shortcut methods that do not require a full model of the regional economic structure will be more attractive for assessing secondary benefits from tourism and recreation. On the other hand, state governments need to have more comprehensive models that will permit comparisons of various sectors of the economy for purposes of targeting industries for public-incentives programs in order to pursue public goals.

In summary, it appears that the quickest way to get information suitable for public relations tasks by recreation and tourism organizations is to use shortcut methods rather than input-output models. For purposes of developing guidelines for state policy, however, a full survey-based input-output accounting system is desirable and, in this effort, the recreation and tourism sectors must be defined in such a way that policy questions can be explored in a definitive manner.

LITERATURE CITED

Archer, Brian H.; Owen, Christine B. Towards a tourist regional multiplier. Journal of Travel Research 11(2):9-13, 1972.

Clawson, Marion. Methods of measuring the demand for and value of outdoor recreation. Reprint No. 10. Washington, DC: Resources for the Future, Inc.: 1959.

Gamble, H.B. Community income from outdoor recreation. A paper presented to the Governor of Maryland's Recreation Conference, Ocean City, MD: 1965.

Gamble, Hays B.; Raphael, David L. A microregional analysis of Clinton County, Pennsylvania. Vol. I, University Park, PA: The Pennsylvania Regional Analysis Group, The Pennsylvania State University: 1965, 83 pp.

Kalter, R.J.; Lord, W.B. Measurement of the impact of recreation investments on a local economy. American Journal of Agricultural Economics 50:243-257, 1968.

Marino, Mary Lou; Chappelle, Daniel F. Lodging and restaurant establishment spending patterns in northwest lower Michigan. Res. Rep. 346, Michigan State University, Agricultural Experiment Station; East Lansing, MI:1978. 11 pp.

Strang, William A. 1970. Recreation and the local economy: An input-output model of a recreation-oriented economy. Sea Grant Tech. Rep. 4, WIS-SG-71-204. Madison, WI: University of Wisconsin; 1970. 67 pp.

Using Input-Output Analysis to Measure the Impact of Tourist Expenditures: The Case of Hawaii

William A. Schaffer[1]

INTRODUCTION

Few states depend on tourist expenditures as much as Hawaii. In 1977, the base year for this case study, visitor expenditures totalled over $1.85 billion. As seen in Figure 1, tourism completely dominates the major export activities of the state: in 1972, tourism surpassed defense activities as a major source of outside funds for Hawaii; by 1976, spending on tourism exceeded that on defense, sugar, and pineapple combined; by 1979, the visitor industry yielded twice the expenditures of the defense sector. Tourism became such a major activity that it was allocated its own final-demand sector in the 1977 Hawaii input-output model.

This paper demonstrates the use of an input-output model in tracing the impact of tourist expenditures in Hawaii. It is divided into three sections. First, I review the structure of the Hawaii model, showing the place of tourism in an input-output system. Second, I look at the alternatives and procedures for executing an impact analysis within an input-output framework. Third, I present the analysis of the impact of tourism as originally conceived, along with some second thoughts. And finally, I offer a few comments in critique.

THE 1977 HAWAII INPUT-OUTPUT MODEL

The Hawaii interindustry tables are an extension of the Hawaii Income and Expenditure Accounts. The 1977 tables are the third set to be produced by the Department of Planning and Economic Development (DPED), which has a long history of careful statistical work. Its system is based on the "standardized" United Nations format, which has been used by the U.S. Bureau of Economic Analysis since 1972.

Format

Since the typical regional input-output table is in the old industry-by-industry format, I have reproduced a schematic version of the standardized tables as Figure 2 to show how the standardized system is organized. Matrices 1, 2, 3, and 4 form the commodity flows table, showing the commodity purchases and factor payments made by industries and final-demand sectors. If commodities originated only in the industries bearing their names, then the commodity flows table would be identical to an interindustry flows table. But they do not, and the commodity origins table, based on matrices 5 and 6, accounts for the industrial and regional origins of commodities.

Tables 1 and 2 are highly aggregated versions of these tables for Hawaii.

The solution to this system is slightly more complicated than that to which we are accustomed, but yields essentially the same results:

$$R = (I - A)^{-1}$$

where I is the identity matrix, A is a matrix of regional or state interindustry flow coefficients, and R is the solution, or inverse matrix, or direct and indirect requirements matrix.

The problem we face in solving a standardized system is that of evolving A from the elements of Tables 1 and 2. A is a matrix with elements

$$a_{ij} = x_{ij}/g_j$$

where x_{ij} is purchases from local industry i by industry j and g_j is total output of industry j. In matrix notation, $A = X\hat{g}^{-1}$. The regional interindustry flows matrix, X, is derived as follows:

$$X = D(I - \hat{m})B$$

where: D is the matrix of market-share coefficients, showing the market shares of commodities produced by local industries; $\hat{m}$ is a diagonal matrix of import coefficients (imports divided by domestic demand for each commodity); and B is the matrix of commodity flows, showing the purchases of commodities by industries. $(I - \hat{m})$ is what Ben Stevens has popularized as "regional purchase coefficients" and represents a "constant imports assumption" (Stevens, et al., 1983) $(I - \hat{m})B$ is the state commodity flows matrix and shows purchases locally produced commodities. The final premultiplication by D converts the table to an industry-by-industry one on the assumption that market shares remain constant.

Construction

The 1977 Hawaii tables depend for data on a number of sources. Basic input, output, and demand coefficients were derived from the detailed 1972 U.S. tables adjusted to 1977 prices and with value added divided into five factor-payment categories based on national data for gross product originating by industry. These coefficients were significantly modified with data available at the DPED to reflect specifically Hawaiian transactions in both the industry and final-demand sectors. The gross outputs of industries were derived from diverse state and federal sources, including the Censuses of Agriculture, Business, Manufactures, Transportation, etc., and ES-202 employment data. Estimates of expenditures by final-demand sectors and of the incomes of primary-input categories were derived from the Hawaii Income and Expenditure Accounts and associated worksheets at DPED.

The tables were constructed at the 496-industry (commodity) level. A first estimate of imports

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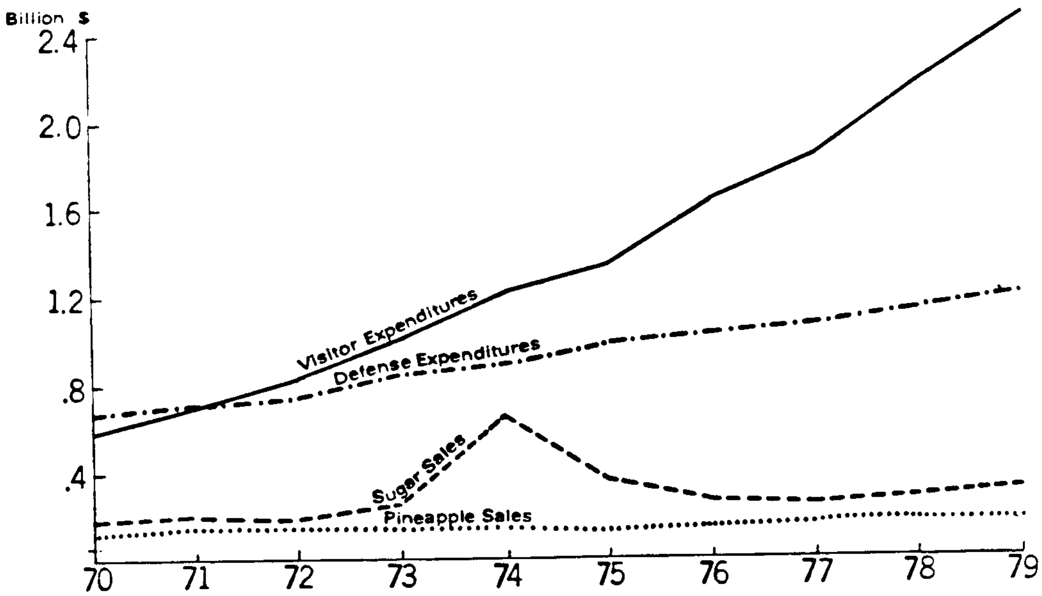

Figure 1.--Direct income from major export industries in Hawaii: 1970 to 1979

Source: Research and Economic Analysis Division, 1980.

and exports at the detailed level was made by the supply-demand pool techniques using commodity balance ratios. In several iterations, technical coefficients and final-demand coefficients were modified to reflect Hawaiian experience. The estimates of imports and exports, which are critical to the accuracy of the table, were also reviewed and altered until they came into close correspondence with available data.

One of the best sources of export data was the survey of tourist expenditures conducted on a regular basis by DPED. This survey yields expenditures classified in the 84 categories used by the U. S. Department of Labor in its Survey of Consumer Expenditures and by the Bureau of Economic Analysis in the personal consumption expenditures sector of the detailed U.S. input-output table. These data had to be transformed significantly for use; it is instructive to examine the transformation process. First, we had to transform the original data classification into an input-output commodity classification. This was done by multiplying the commodity-by-industry final-demand coefficient matrix (496x84) by the original tourist-expenditures vector (84x1). Since we used a producers' prices version of the coefficient matrix, the resulting 496-commodity vector was an estimate in producers' prices of tourist expenditures classified by input-output commodities. Second, we were obliged to treat tourist expenditures as if they were domestic. We premultiplied the tourist expenditures vector by $(I - \hat{m})$ in order to eliminate the possibility that imports for resale be counted against domestic supply. As a result, private exports include only the domestically produced part of tourist expenditures.

ECONOMIC CHANGE IN INPUT-OUTPUT MODELS

Economic change can take two forms in input-output analysis: structural change, or change in final demand. Let me briefly outline these alternatives before proceeding to our case.

Structural change

To an input-output analyst, structural change means change in regional production coefficients. In the standardized format, these changes would manifest themselves in the commodity mix of an industry (changes in a row of the D matrix described above), in the import coefficients for commodities (changes in elements of the $\hat{m}$ vector), or in the commodity purchase coefficients of an industry (changes in a column of the technology matrix, or the coefficient equivalent of the B matrix).

Of these, the interesting alternatives are the changes in trade coefficients and changes in technology of production. (I know of no case for study in which change in the commodity mix of an industry was a significant question.) But even these changes for existing industries are seldom important; isolated technological or trade changes rarely change the relationships in an inter-industry system enough to make a major difference.

Introduction of new industrial activities can take place in either of two ways. In an aggregated system, introduction of a new plant can be handled by changing the aggregation weights for the detailed industries. If a more apparent introduction is desired, a new plant or activity can be added to the system as completely new rows and columns in the tables. In the Hawaii system, procedures were established to accomplish these tasks in detail.

Changes in final demand

Although significant, and possibly unpredictable, changes in regional interindustry structures

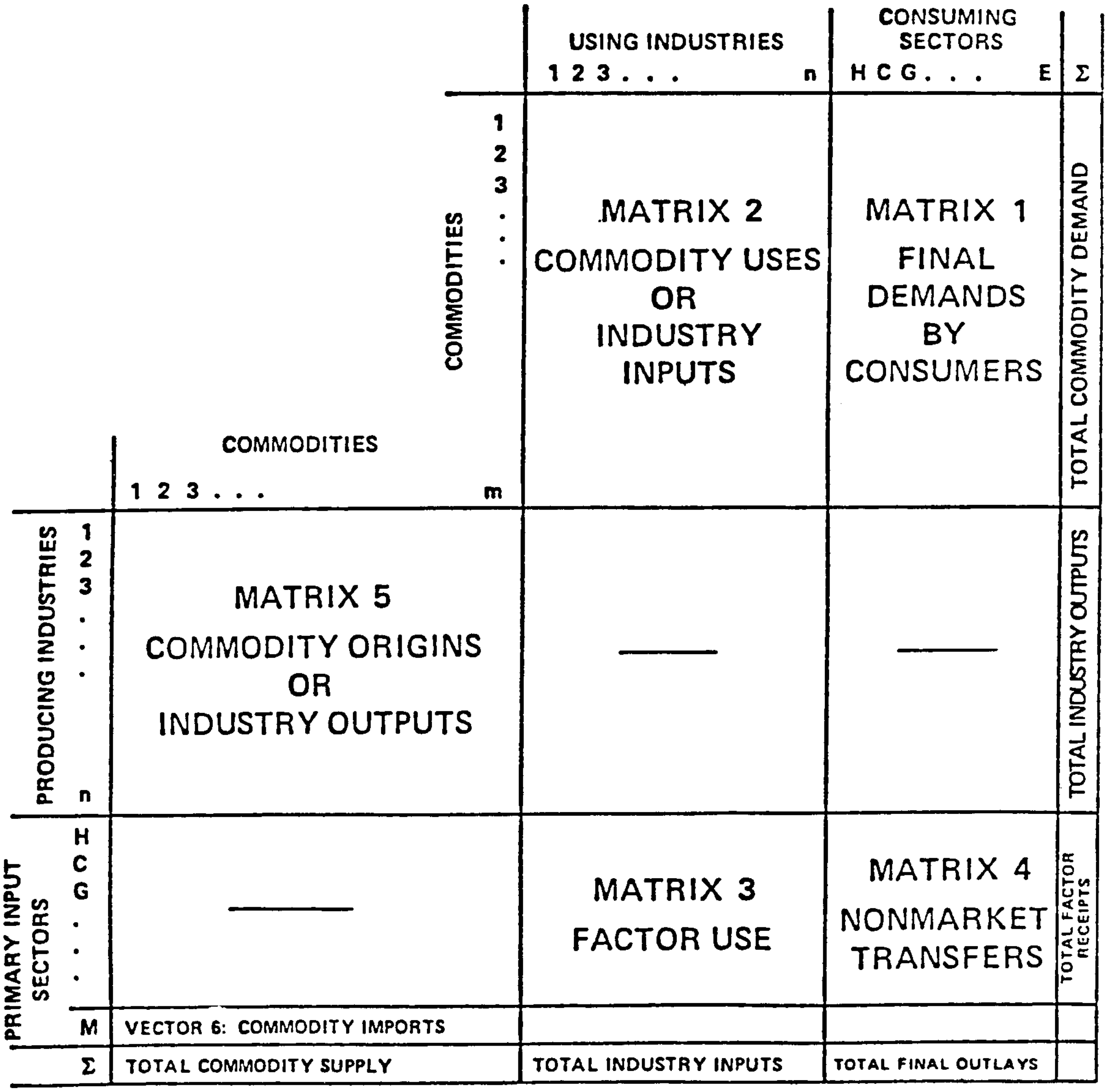

Figure 2.--Schematic input-output table
Source: Schaffer, et al., 1979.

may occur with the development of recreation and tourism activities, it is most likely that the analyst will devote little time to speculating on such possibilities. Instead, he will be concerned with the changes in final demand that are attributable to his topic of study. This approach is logical, because most regions have the components of a tourist industry in place--they are the same industries that serve local residents.

Alternatives in this case revolve around whether or not the inverse matrix is used to derive multipliers with which to show the secondary impacts of expenditures in the change vector. Traditionally, we have used inverse-based multipliers.

But now that the costs of computation are so low, an iterative approach may be taken, as in the next section. This approach has the advantage of flexibility in level of aggregation as well as simplicity in solution and explanation.

THE IMPACT OF TOURISM ON HAWAII

Now let us develop a statement of the primary and secondary impacts of tourism on Hawaii--a skeletal impact analysis. Our algorithm should be adequate for most simple impact analyses; it will cover the case where an industry that makes a series of local purchases sells its entire output outside the region.

The tourist "industry" is not defined in the Standard Industrial Classification. It is a group of industries united by a common set of customers but with dissimilar technologies. In 1977, sales to tourists in Hawaii totalled $1.8528 billion. These sales are reported in producers' prices in Table 3. Note that they have also been adjusted to reflect trade patterns. Table 3 can thus be considered an initial impact vector.

Table 1. -- Aggregated commodity flows, Hawaii, 1977

(millions of dollars)

COMMODITY	AGRICUL-TURE	CONSTRUC-TION	MANUFAC-TURING	TRADE AND TRANS-PORTATION	SERVICES	TOTAL INDUSTRY DEMANDS
1 AGRICULTURE	37.8	1.7	254.8	1.9	39.2	335.5
2 CONSTRUCTION	2.4	9.7	467.4	76.1	187.3	742.0
3 MANUFACTURING	69.0	381.1	576.2	192.1	509.2	1727.5
4 TRADE AND TRANSPORTATION	16.8	98.3	171.8	249.0	233.3	769.3
5 SERVICES	22.9	79.6	104.7	457.0	931.8	1595.9
6 TOTAL COMMODITY PURCHASES	149.0	570.8	1578.8	1015.2	1906.1	5219.0
7 HOUSEHOLD INCOME	221.0	408.2	448.3	1353.3	3726.4	6157.2
8 STATE AND LOCAL GOVT REVENUES	6.2	7.2	14.2	235.3	136.0	398.9
9 OTHER FINAL PAYMENTS	37.7	85.6	59.7	442.0	494.1	1119.2
10 UNALLOCATED AND EXTERNAL TFRS	-54.8	.4	65.2	-6.5	-35.6	-31.2
11 TOTAL PRIMARY INPUTS	210.1	501.0	583.5	1985.0	4315.7	7595.3
12 TOTAL PURCHASES	359.2	1071.7	2162.3	3000.2	6221.8	12815.2

Table 1. -- Aggregated commodity flows, Hawaii, 1977 (continued)

(millions of dollars)

COMMODITY	PERSONAL CONSUMP-TION EXP.	STATE AND LOCAL EX-PENDITURES	OTHER LOC.& FED. DEMANDS	TOTAL PRIVATE EXPORTS	TOTAL FINAL DEMANDS	TOTAL DEMANDS
1 AGRICULTURE	42.1	2.2	.0	70.9	115.2	458.7
2 CONSTRUCTION	.0	370.6	712.2	69.9	1152.8	1895.6
3 MANUFACTURING	1363.4	143.1	861.3	1465.1	3832.8	5560.6
4 TRADE AND TRANSPORTATION	1253.2	96.7	132.2	1089.5	2571.6	3340.9
5 SERVICES	2039.7	885.3	827.2	1737.3	5489.5	7085.4
6 TOTAL COMMODITY PURCHASES	4943.2	1497.9	2545.0	4434.8	13420.9	18640.7
7 HOUSEHOLD INCOME	0.0	246.0	600.8	24.6	871.4	7028.6
8 STATE AND LOCAL GOVT REVENUES	377.8	0.0	314.7	0.8	692.5	1091.4
9 OTHER FINAL PAYMENTS	1714.7	0.0	-451.0	1863.9	3127.6	4246.8
10 UNALLOCATED AND EXTERNAL TFRS	283.1	0.0	895.9	2.0	1181.1	1149.8
11 TOTAL PRIMARY INPUTS	2130.8	246.0	1348.3	1888.5	5613.6	13208.9
12 TOTAL PURCHASES	7074.0	1743.9	3893.3	6323.3	19034.5	31849.6

Table 2. -- Aggregated commodity origins, Hawaii, 1977

(millions of dollars)

COMMODITY	AGRICUL-TURE	CONSTRUC-TION	MANUFAC-TURING	TRADE AND TRANS-PORTATION	SERVICES	TOTAL DOMESTIC SUPPLY
1 AGRICULTURE	348.5	0.0	0.0	0.0	0.0	348.5
2 CONSTRUCTION	0.0	1071.7	2.9	0.0	0.0	1074.6
3 MANUFACTURING	10.6	0.0	2081.1	0.0	0.0	2091.7
4 TRADE AND TRANSPORTATION	0.0	0.0	0.0	2964.4	9.7	2974.1
5 SERVICES	0.0	0.0	78.3	35.8	6212.1	6326.2
6 TOTAL INDUSTRY OUTPUT	359.2	1071.7	2162.3	3000.2	6221.8	12815.2

Table 2. -- Aggregated commodity origins, Hawaii, 1977 (continued)

(millions of dollars)

	COMMODITY	TOTAL IMPORTS	TOTAL SUPPLY	TOTAL LOCAL DEMAND	TOURIST EXPENDI-TURES	OTHER COMMODITY EXPORTS	TOTAL DEMAND
1	AGRICULTURE	102.2	450.7	379.8	16.9	54.0	450.7
2	CONSTRUCTION	821.0	1895.6	1825.7	0.0	69.9	1895.6
3	MANUFACTURING	3468.7	5560.4	4095.3	255.8	1209.3	5560.4
4	TRADE AND TRANSPORTATION	366.8	3340.9	2251.3	544.9	544.6	3340.9
5	SERVICES	759.1	7085.4	5348.1	1033.1	704.2	7085.4
6	TOTAL INDUSTRY OUTPUT	5825.5	18640.7	14205.9	1852.8	2582.0	18640.7

Table 3. -- Expenditures by tourists in Hawaii, 1977

(millions of dollars)

	INDUSTRY	LOCAL EXPENDITURES
1	SUGAR, FIELD	0.0
2	PINEAPPLE, FIELD	9.5
3	OTHER AGRICULTURE	2.1
4	PINEAPPLE PROCESSING	0.0
5	SUGAR PROCESSING	0.0
6	OTHER FOOD PROCESSING	15.6
7	MANUFACTURING	29.8
8	PETROLEUM REFINING	0.0
9	CONSTRUCTION	0.0
10	TRANSPORTATION SERVICES	38.8
11	GROUND TRANSPORT, TRUCKING	58.8
12	AIR TRANSPORTATION	58.9
13	OCEAN TRANSPORTATION	6.3
14	COMMUNICATION	6.4
15	ELECTRICITY	0.0
16	GAS	0.0
17	WATER AND SANITARY SERVICES	0.0
18	WHOLESALE TRADE	59.9
19	RETAIL TRADE	215.4
20	EATING AND DRINKING	369.3
21	FINANCE, INS., REAL ESTATE	5.1
22	HOTELS	460.9
23	HEALTH AND PROFESSIONAL SERVICES	17.8
24	OTHER SERVICES	83.0
25	GOVERNMENT SERVICES	4.9
26	DUMMY INDUSTRY	0.0
27	TOTAL COMMODITY PURCHASES	1442.5
28	HOUSEHOLD INCOME	0.0
29	STATE GOVERNMENT REVENUE	0.0
30	LOCAL GOVERNMENT REVENUE	0.0
31	CAPITAL RESIDUAL	0.0
32	FEDERAL GOVERNMENT REVENUE	0.0
33	IMPORTS	410.3
34	EXTERNAL TRANSFERS, UNALLOCATED	0.0
35	TOTAL PRIMARY INPUTS	410.3
36	TOTAL PURCHASES	1852.8

Table 4. -- The economic impact of tourism in Hawaii, 1977

INDUSTRY	INITIAL CHANGE ($ MIL)	OUTPUT ($ MIL)	EMPLOYMENT (THOUS)	HOUSEHOLD INCOME ($ MIL)	STATE GOVT REVENUE ($ MIL)	LOCAL GOVT REVENUE ($ MIL)
1 SUGAR, FIELD	0.0	2.2	.1	1.2	.0	.0
2 PINEAPPLE, FIELD	9.5	12.4	.5	8.9	.2	.1
3 OTHER AGRICULTURE	2.1	33.2	1.5	21.6	.4	.1
4 PINEAPPLE PROCESSING	0.0	3.0	.1	.5	.0	.0
5 SUGAR PROCESSING	0.0	3.6	.1	1.0	.0	.0
6 OTHER FOOD PROCESSING	15.6	88.2	1.1	13.8	.2	.6
7 MANUFACTURING	29.6	75.2	1.2	20.5	.2	.1
8 PETROLEUM REFINING	0.0	1.2	.0	.0	.0	.0
9 CONSTRUCTION	0.0	8.8	.2	3.3	.0	.0
10 TRANSPORTATION SERVICES	38.8	40.7	2.8	29.7	.2	.1
11 GROUND TRANSPORT, TRUCKING	58.8	71.7	3.4	42.9	.3	1.0
12 AIR TRANSPORTATION	58.9	74.0	1.2	25.9	0.4	.7
13 OCEAN TRANSPORTATION	6.3	11.7	.2	4.2	1.5	0.0
14 COMMUNICATION	6.4	42.6	1.2	24.3	6.0	1.7
15 ELECTRICITY	0.0	59.2	.4	17.4	.3	.0
16 GAS	0.0	6.6	.1	1.3	.0	.1
17 WATER AND SANITARY SERVICES	0.0	8.5	.1	5.2	0.0	0.0
18 WHOLESALE TRADE	59.9	153.6	4.4	70.1	6.9	3.4
19 RETAIL TRADE	215.4	322.6	13.9	155.7	11.0	11.9
20 EATING AND DRINKING	369.3	432.9	16.8	126.3	1.5	5.5
21 FINANCE, INS., REAL ESTATE	5.1	330.3	4.5	143.0	6.3	13.3
22 HOTELS	460.9	475.8	18.1	234.5	.0	3.2
23 HEALTH AND PROFESSIONAL SERVICES	17.8	156.9	6.7	94.1	1.7	.3
24 OTHER SERVICES	83.0	151.8	9.2	78.6	.8	.9
25 GOVERNMENT SERVICES	4.9	13.5	1.0	9.9	0.0	0.0
26 DUMMY INDUSTRY	0.0	3.2	.0	3.0	0.0	0.0
27 HOUSEHOLD INCOME	0.0	1144.9	0.0	0.0	42.9	18.2
28 TOTAL	1442.5	3728.4	88.4	1144.9	89.6	61.9

Table 4 is what I call the "impact analysis table": it reports the total impact of the initial change vector in column 1, which is a repeat of the domestic part of Table 3. The remaining columns demand some elaboration, for they report the secondary impacts as well. Let us proceed with an algebraic statement of the elements of these impact columns. Let

x_j = the exogenous sales by industry j

r_{ij} = the total output required from industry i by industry j to produce one value unit of output (cell i j in the inverse or total requirement table)

q_i = the gross output of industry i

$q_{i(j)}$ = the gross output of industry i associated with unit output change in industry j

y_{ti} = the income received by primary-input sector t from industry i

a_{ti} = the input-output coefficient from primary-input sector t to industry i

e_i = employment in industry i

Δ = an operator denoting change

. = a subscript "dot" indicating summation over the replaced subscript

s = number of industries

The change in output of industry i associated with exogenous sales by industry j is

$$\Delta q_{i(j)} = \Delta x_j * r_{ij}$$

and the summary impact is

$$\Delta q_{.(j)} = \sum_{i=1}^{s+1} \Delta x_j * r_{ij} = \Delta x_j * r_{.j}$$

Note that $r_{.j}$ is the net-output multiplier for industry j. The summary results in column 2 of Table 4 could be obtained through the traditional multiplier system; this table only provides industry details to supplement the summary statement.

The change in employment in industry i associated with exogenous sales by industry j is

$$\Delta e_{i(j)} = \Delta q_{i(j)} * e_i / q_i$$

and the summary employment impact is

$$\Delta e_{.(j)} = \sum_{i=1}^{s+1} \Delta q_{i(j)} * e_i / q_i$$

$$= \sum_{i=1}^{s+1} \Delta x * r_{ij} * e_i / q_i$$

$$= \Delta x_j \sum_{i=1}^{s+1} r_{ij} * e_i / q_i$$

The summed term on the right is the employment multiplier for industry j. Thus column 3 of Table 4 expresses the total employment effects of the activities recorded in column 1.

The change in income to primary-input sector t in industry i associated with exogenous sales by industry j is

$$\Delta y_{ti(j)} = \Delta q_{i(j)} * a_{ti}$$

and the corresponding summary change in income is

$$\Delta y_{t.(j)} = \sum_{i=1}^{s+1} \Delta q_{i(j)} * y_{ti} / q_i$$

$$= \sum_{i=1}^{s+1} \Delta x_j * r_{ij} y_{ti} / q_i$$

$$= \Delta x_j \sum_{i=1}^{s+1} r_{ij} * y_{ti} / q_i$$

The summed term on the right is the income-generated multiplier for sector t, industry j.

Table 4 thus records the calculation of multiplier effects for the set of exogenous sales recorded in column 1. Since it is based on columns in the inverse matrix (from which comes the r_{ij}), it is simply an extension of the traditional approach.

Another alternative is to solve for total impact through an iterative procedure. This process uses the sum of an infinite series to approximate the results of using the inverse:

$$T = IX + AX + A^2X + A^3X + \ldots + A^nX \cong (I-A)^{-1} * X$$

As n approaches infinity, the approximation approaches equality. We have set n = 10 for convenience in printing the results.

Table 5 reports the rounds of spending associated with tourist spending (the vector X) in Hawaii, tracing the additive parts of the above calculation of total impact. The last column of this table is an approximation of change in outputs associated with tourism in Hawaii. Note that the iterative procedure with n = 10 captures 99 percent of the changes derived from calculations using the inverse (column 1 in Table 4).

The calculations involved in this example are now several years old. They were intended to illustrate the process of impact analysis when a complete and aggregated model is available. Since the analysis was embedded in a study report and thus had to remain consistent with the system there recorded, it was based on aggregated data. If I were called upon to redo the analysis to stand alone, I would now base the process on the detailed work tables that had been aggregated for presentation. Although I am not certain that the summary results would be significantly different, using the detailed coefficients in the iterative procedure would certainly lead to sharper statements of individual industry impacts.

These detailed calculations would be easy primarily because the data on tourist expenditures were available in a conveniently detailed form. Under other conditions, however, it might be wise to use the aggregated model. That model is best when tourist expenditures are available only as highly aggregated totals for which subdivision might yield large errors.

COMMENTS

When we speak of impact analysis in the context of an input-output model, it is important to keep in mind some of the important limitations and characteristics of this approach. It is also important to remember that these limitations also apply to every other modeling approach. They are handicaps that must be overcome or at least compensated for by skill, art, and craft.

An input-output model is based on a linear system of equations relating the final expenditures of a set of final demand sectors to the transactions of a set of industries with other industries and final-payment categories. Its linearity implies constant economies of scale that normally only apply in the long run. It is static and almost always depends on a database several years old. It assumes perfect elasticity of supply, or no resource constraints, thus encouraging us to ignore the normal forces of supply and demand. The old admonition that "what you see is what you get" was never more appropriate than it is here. Input-output analysis measures benefits and costs as pure monetary transactions, ignoring all externalities. It leads the unwary into many logical traps, permitting us too readily to convert the act of spending into a benefit. (Money spent for gasoline can be gleefully regarded by the service station owner as a great benefit, while society might better regard it as permanent loss of a nonrenewable resource.)

Input-output analysis is demand-driven, making us all Keynesians or mercantilists (take your choice if either appellation strikes you as abusive). The analyst with a regional point of view can be particularly mercantilistic, for he

Table 5. -- Rounds of spending associated with tourism in Hawaii, 1977 (millions of dollars)

INDUSTRY	ROUND 1	ROUND 2	ROUND 3	ROUND 4	ROUND 5	ROUND 6
1 SUGAR, FIELD	0.0	0.0	.6	.8	.4	.2
2 PINEAPPLE, FIELD	9.5	.9	1.0	.4	.3	.1
3 OTHER AGRICULTURE	2.1	10.6	9.2	5.1	2.5	1.6
4 PINEAPPLE PROCESSING	0.0	1.5	.7	.3	.2	.1
5 SUGAR PROCESSING	0.0	.9	1.3	.6	.3	.2
6 OTHER FOOD PROCESSING	15.6	35.8	17.4	7.6	5.2	2.7
7 MANUFACTURING	29.8	12.4	15.4	7.0	4.7	2.5
8 PETROLEUM REFINING	0.0	.3	.4	.2	.1	.1
9 CONSTRUCTION	0.0	3.2	1.9	1.7	.8	.5
10 TRANSPORTATION SERVICES	38.8	1.1	.3	.2	.1	.1
11 GROUND TRANSPORT, TRUCKING	58.8	4.2	4.1	1.8	1.2	.6
12 AIR TRANSPORTATION	58.9	1.8	6.9	2.2	1.9	.9
13 OCEAN TRANSPORTATION	6.3	1.7	1.7	.8	.5	.3
14 COMMUNICATION	6.4	8.8	12.8	5.6	3.9	2.1
15 ELECTRICITY	0.0	29.1	13.0	7.2	4.2	2.4
16 GAS	0.0	3.2	1.4	.9	.4	.3
17 WATER AND SANITARY SERVICES	0.0	4.5	1.8	.9	.6	.3
18 WHOLESALE TRADE	59.9	39.4	25.3	11.4	7.7	4.1
19 RETAIL TRADE	215.4	3.2	57.4	14.4	15.2	6.5
20 EATING AND DRINKING	369.3	6.3	30.1	9.2	6.3	3.8
21 FINANCE, INS., REAL ESTATE	5.1	111.7	97.8	45.1	30.7	16.3
22 HOTELS	460.9	1.5	6.9	2.2	1.9	.9
23 HEALTH AND PROFESSIONAL SERVICES	17.8	46.4	41.5	20.5	13.2	7.2
24 OTHER SERVICES	83.0	25.1	21.0	8.5	6.2	3.2
25 GOVERNMENT SERVICES	4.9	3.0	2.2	1.4	.8	.5
26 DUMMY INDUSTRY	0.0	0.0	1.6	.4	.5	.2
27 HOUSEHOLD INCOME	0.0	637.7	154.7	167.8	78.5	50.3
28 TOTAL	1442.5	994.6	528.6	324.0	182.4	108.8

Table 5. -- Rounds of spending associated with tourism in Hawaii, 1977 (continued) (millions of dollars)

INDUSTRY	ROUND 7	ROUND 8	ROUND 9	ROUND 10	ROUND 11	TOTAL 12
1 SUGAR, FIELD	.1	.1	.0	.0	.0	2.2
2 PINEAPPLE, FIELD	.1	.0	.0	.0	.0	12.3
3 OTHER AGRICULTURE	.9	.5	.3	.2	.1	33.1
4 PINEAPPLE PROCESSING	.1	.0	.0	.0	.0	3.0
5 SUGAR PROCESSING	.1	.1	.0	.0	.0	3.6
6 OTHER FOOD PROCESSING	1.7	.9	.6	.3	.2	88.0
7 MANUFACTURING	1.5	.9	.5	.3	.2	75.0
8 PETROLEUM REFINING	.0	.0	.0	.0	.0	1.2
9 CONSTRUCTION	.3	.2	.1	.1	.0	8.7
10 TRANSPORTATION SERVICES	.0	.0	.0	.0	.0	48.7
11 GROUND TRANSPORT, TRUCKING	.4	.2	.1	.1	.0	71.6
12 AIR TRANSPORTATION	.6	.3	.2	.1	.1	73.9
13 OCEAN TRANSPORTATION	.2	.1	.1	.0	.0	11.7
14 COMMUNICATION	1.3	.7	.4	.2	.1	42.4
15 ELECTRICITY	1.4	.8	.5	.3	.2	59.8
16 GAS	.2	.1	.1	.0	.0	6.6
17 WATER AND SANITARY SERVICES	.2	.1	.1	.0	.0	8.5
18 WHOLESALE TRADE	2.5	1.4	.8	.5	.3	153.2
19 RETAIL TRADE	4.6	2.4	1.5	.8	.5	321.9
20 EATING AND DRINKING	2.6	1.4	.8	.5	.3	432.5
21 FINANCE, INS., REAL ESTATE	10.0	5.6	3.3	1.9	1.1	328.7
22 HOTELS	.6	.3	.2	.1	.1	475.7
23 HEALTH AND PROFESSIONAL SERVICES	4.4	2.5	1.5	.8	.5	156.2
24 OTHER SERVICES	2.0	1.1	.7	.4	.2	151.5
25 GOVERNMENT SERVICES	.3	.2	.1	.1	.0	13.5
26 DUMMY INDUSTRY	.1	.1	.0	.0	.0	3.1
27 HOUSEHOLD INCOME	26.0	16.2	9.0	5.4	3.1	1148.7
28 TOTAL	62.0	36.3	21.0	12.2	7.1	3718.6

can ignore the redistributive costs on other regions of resource redirection. Thus, severe hardships caused by a shift of tourist expenditures from another region can be completely disregarded. But such is the competitive way.

This listing of limitations could continue on and on if self-flagellation were any fun at all. But it is not; we frequently catalogue our faults simply to note our awareness of them and to ward off critics who might cite the list without specific application to our particular study. Why do we continue to use input-output analysis? It remains the most popular tool for regional impact analysis simply because it is the most consistent and logical way to trace secondary benefits through a regional economy. Economic-base models and econometric models suffer from all of the noted deficiencies; in addition, they are grossly aggregated. Input-output analysis forces us to pay attention to detail; artfully used, it not only focuses on the issue of measurable secondary economic effects, but it also leads us to consider environmental and social effects.

REFERENCES

1. Research and Economic Analysis Division. The Hawaii input-output study, 1977. Honolulu: Department of Planning and Economic Development, State of Hawaii. (Draft) 1981.

2. Research and Economic Analysis Division. Tourism and Hawaii's economy: an input-output analysis. Honolulu: Department of Planning and Economic Development, State of Hawaii. 1980.

3. Schaffer, William A. The role of input-output models in regional impact analysis. In Saul Pleeter (ed.), Economic impact analysis: methodology and applications. Boston: Martinus Nijhoff, 1980.

4. Schaffer, William A., with the assistance of K. Scott Wood, Steven R. Stokes, and Doreen Liew. The Nova Scotia input-output study: 1979. Halifax: Institute of Public Affairs, Dalhousie University. 1982.

5. Stevens, Benjamin H., George I. Treyz, David J. Ehrlich, and James R. Bower. A new technique for the construction of non-survey regional input-output models and comparison with two survey-based models. International Regional Science Review 8(3): 271-86; 1983.

6. United Nations. Input-output tables and analysis. Studies in Methods, Series F, No. 14, Rev. 1. New York: United Nations. 1973.

Regional Input-Output Methods for Tourism Impact Analysis

Benjamin Stevens and Adam Rose[1]

INTRODUCTION

The recent availability of inexpensive, detailed, regional input-output (I-O) models has facilitated the use of the technique in analyzing the impacts of a variety of changes in a region's economy. At the same time, tourism has become an increasingly important portion of the economy of many states, in part due to the decline of more traditional industries and in part due to the relative increase in discretionary income.

Given these two factors, it is not surprising that there is an increasing literature on the impact of changes in amounts and types of tourism on state and regional economies, determined through the use of I-O models. This paper discusses some of the features of the I-O method that make it particularly suitable to tourism impact analysis, as well as some of the shortcomings of this approach. Because tourist expenditure data are used in conjunction with a highly structured model, this paper also deals with some of the requirements placed upon those who collect and analyze the data.

The review of both the models and of the tourism data is followed by recommendations for further research and for improvements in the models, the data to be used, and the types of data collection that would be most useful in model construction and the specification of tourist expenditures.

DELINEATION OF THE IMPACT REGION

The second-order impacts of recreation and tourism circulate through many phases of economic activity and extend outward to an area much broader than the recreation site. Just as a concept such as "speed" cannot be defined without reference to a specific time measurement, "economic impacts" cannot be defined without reference to a specific geographic area. The matter is complicated conceptually by the existence of several possible regional demarcations and complicated empirically by the difficulty of tracking commodity and factor flows across space.

The delineation of the impacted region depends greatly on the policy issues being examined and the hierarchical rank of the policy maker. For a public hearing on a land-use change in a given National Forest, the appropriate region might best be considered the local community. Although forest lands are in the general (national) public domain, the local community is likely to receive the most significant amount of second-order impacts, either positive (jobs, income, tax revenues, etc.) or negative (infrastructural capacity increase costs, disamenities, etc.). However, the impacts on adjacent communities and much broader areas may also be substantial, given the nature of recreation and tourism, and will be of interest to decision makers at higher levels.

A region is typically specified according to a single or a mix of major characteristics in the physical, political, or economic realm. In the case of a recreation area, for example, the smallest meaningful area of analysis, is the "recreation site," distinguished primarily on the basis of physical attributes (a lake, forest, ski slope, etc.). In many cases (e.g., sight seeing, hunting, sailing) there is little economic activity at the site because participating in the activity involves no formal production and is usually the consumption of a public good.

The direct economic impacts of recreation are the costs of travel to the site, food and lodging while preparing for or recovering from the activity, and the purchase of supplies and equipment necessary to engage in the recreation. Most of these expenditures take place in close proximity to the recreation site in what we term the "economic support area." Because the direct impacts into recreation and tourism are often interdependent with other activities in the local area, we view the economic support area as covering both direct and second-order impacts. However, many of the suppliers of inputs to recreational service industries are located a considerable distance from the recreation site and, in fact, we could consider the entire United States as a support area for each case. It is best to establish a meaningful cutoff point, however, and we suggest two possibilities. One is the concept of a "trading area," an area in which the majority of economic interaction takes place between any of its subareas (as opposed to between the subareas and the outside). Another useful delineator would be the "labor service area" an area in which the majority of the pertinent labor force, including commuters, resides. Both of these areas are usually closely related to common statistically measured units such as Metropolitan Statistical Areas (MSA's). Given the realities of data, the analyst is likely to have to settle for an approximation of the economic support area, delineated along political boundaries. For our purposes, a simple diagram (Figure 1) can depict the relationships among the various regions delineated in this section.

A third regional level of analysis is the set of "travel corridors." These extend from the "consumer residence area," to be discussed next, to the recreation site. At the outer reaches, these corridors are basically one-dimensional rays, but as the proximity to the site increases, their density increases, and they take on more of

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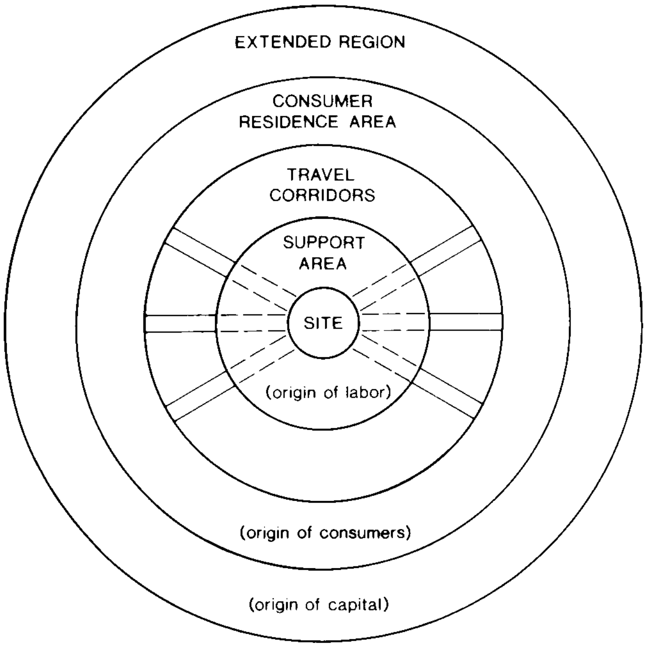

FIGURE 1. Regions Impacted by Recreation

the appearance of the typical two-dimensional spatial region. Again, given data limitations, political jurisdictions such as MSA's, counties, and states may have to serve as proxies for these areas. Taken as a whole, the travel corridors obviate the need to deal with one of the more difficult aspects of recreation analysis, i.e., the allocation of costs among the travel route. This is of obvious difficulty empirically and also a problem conceptually, as will be discussed in the following section.

The consumer residence area is the point of origin of recreationists. Typically, it is larger than the support area, but in the case of smaller sites, it need not be. Unlike the other areas of analysis, the impacts here may be negative. That is, expenditures made enroute to the recreation site or in the support area displace spending in the residence areas. The net impact here will be a combination of the effects of this negative stimulus and the positive stimulus from travel expenditures made in those residence areas that are also located in travel corridors, from interregional demands for goods, and from factor flows.

The final area of analysis is termed the "extended region" or national level. It is the ultimate source for all the goods imported into any of the other areas. It also is the most pertinent delineation for the source of capital for recreation sites and support areas of any significant size. For example, many summer homes are owned by absentee landlords and many companies involved in tourism have their home offices and stockholders located outside the support area. The net impact at this level is a combination of the negative stimulus from a capital outflow and the positive stimulus from returns to capital and the interregional demand for goods.

To accurately estimate recreation impacts, ideally the analyst would have available a set of different I-O models for each of the regional levels just discussed. An example would be:

Level	Regional I-O table
Recreation site	not applicable
Economic support area	Group of counties table
Travel corridors	State table
Consumer residence area	Group of states table
Extended region	U.S. national table

ESTIMATION OF DIRECT IMPACTS

Regional I-O models have traditionally been expensive to construct and insufficiently detailed for use in tourism studies due to the survey-based approach involved.

Recently, however, nonsurvey techniques have been developed that make it possible to construct highly detailed regional models at modest cost (see, e.g., Alward and Palmer 1983; Stevens and others 1983). This has made it feasible for a state or region to have a model or models devoted exclusively to tourism analysis. Such specialized models can include "tourism translators" that require the analyst to specify only the number of person-days or person-nights of tourism by type of tourist or type of accommodation without having to construct de novo a full set of tourist expenditures to be used as the change in final demands required for I-O analysis. Such translators require detailed data for their estimation, but once in place, they make tourism impact analysis extremely simple and quick, as long as the pattern of tourist expenditures does not change. Actually it is possible to design two types of translators, one of which takes tourist expenditures by gross categories such as accommodations, gasoline, groceries, amusements, retail purchases, and so forth, and spreads these totals among the detailed I-O sectors. The other type of translator simply converts the number of tourists by various specifications into these broad categories of expenditure. Thus the impact analysis may go through two stages before the I-O calculations, but both of these stages can be fully automated.

The advantage of very detailed I-O models is that they help to avoid aggregation error of the type that typically occurs when individual economic sectors are combined. The easiest way to view the aggregation problem is to think of the columns in an I-O matrix as they are definitionally intended; that is, as the production functions of the goods and services associated with the sectors associated with those columns. The more highly aggregated the I-O table, the more the potential variation among the production functions of the individual sectors that are combined into each aggregate sector. The I-O calculation that uses aggregated sectors will be based on a weighted average of the individual production functions which may not be properly representative of those sectors actually affected by a final demand disturbance--in this case, tourism.

Even more important from the point of view of regional analysis is the fact that there are much greater variations among goods and services in an aggregated sector on the purchase side within the region than there is in the production functions themselves. Thus for regional analysis, especially, the most highly disaggregated possible model is preferable. However, when regional I-O depended upon survey data, the tendency was to construct highly aggregated models in order to reduce the cost of data collection and analysis. The advent of highly detailed nonsurvey models has both reduced the cost of this kind of analysis and, in many, has improved its accuracy.

The problem posed by detailed I-O models is that the demand "disturbance" used as a measure of the direct regional impacts of some activity must be similarly detailed. If one is calculating the impacts of a new manufacturing industry, this may be no problem. The disturbance is then simply the output of the new business or industry which is then assigned to the proper sector, with all other sectors left undisturbed by any direct impacts. The I-O calculation will then determine the effects on all other sectors due to the indirect and induced effects of the direct disturbance.

Tourism by its nature does not generate simple direct impacts. Most I-O models do not include an economic sector called "tourism." Such an industry is not defined in the Standard Industrial Classification nor in the national I-O data on which most recent models are based. A tourist typically buys a wide range of goods and services on his trip to and through a region. In theory, one could take the expenditures on each good and service per tourism dollar and form an input column to be included in the I-O matrix. But in fact, a number of such columns would be needed because expenditure patterns vary widely between business and recreational tourists, those who stay in public accommodations and those who stay with friends and relatives or camp, those who arrive by public transportation and those who come by car, those who indulge in outdoor recreation in rural or seashore areas, and those who mainly visit large cities, and so forth. Although it would certainly be possible to integrate a tourist input column into the I-O table for each type of visitor, this would require additional effort to no particular end. Inclusion of an economic sector in an I-O model--in this case, a particular type of tourism makes sense only if the sector purchases goods and services from other sectors in the model, and vice versa. Since it is generally assumed that increases in other economic activity in a state or region do not increase tourism in that state or region, but only conversely, the inclusion of tourism input columns does not seem worth the effort. Possible exception to this are business visitors, who are more likely to visit the region if there is more business activity there, and visitors to attractions such as Disney World, which are economic activities included in the sectors covering "Amusements."

The estimation of each of the two levels of tourism translators can be done entirely with survey data if sufficient funds are available to collect the detailed information necessary to spread tourist expenditures across detailed sectors. Typically, however, such funds are lacking, at least on a regular basis.[2]

Generally, data are collected by state or local agencies on the number of tourists and on their expenditures, by major categories. Such data are also available, although often unsatisfactory in accuracy and detail, from the National Travel Data Survey associated with the Census of Transportation. These latter data became available only most recently for 1977; because the Census of Transportation was not done on schedule in 1982 and still has not been carried out, it will be some time before new data will be available for this source. The National Travel Data Center, however, does provide estimates of numbers of tourists and their expenditures by state. But these data, too, are inadequately detailed for various types of visitors, accommodations, and so forth, and, thus, most states and regions must rely on their own resources.

Therefore, some regular survey process is usually required and is carried out in the states. The experience of the senior author indicates that, at a minimum, such a survey should provide information on expenditures for accommodations, restaurants, gasoline and automobile repair; public transportation, including the transportation to and from the area, by mode; groceries (especially for campers and visitors to friends and relatives) and liquor store purchases; tickets and admissions to entertainment and amusements; expenditures on gifts, clothing, and other retail purchases; expenditures on personal services (e.g., beauty parlors) and professional services (e.g., doctors); and miscellaneous. For those visitors who are hunting or fishing, it is also useful to have expenditures on such items as equipment, equipment rental, guides, and related expenditures; however, many of the expenditures specific to hunting and fishing can be estimated from the survey data of the Fish and Wildlife Service, which will be discussed later in the paper.

Even if the level of detail outlined above is available from local surveys, the expenditures still need to be further disaggregated for use in the I-O analysis. For example, "groceries" covers a wide range of products supplied by a variety of food processors in the manufacturing sectors, distributed by several wholesalers, and sold to the final consumer by a variety of types of retail food outlets. This distribution can be based on the household consumption for the state or region, which provides full detail on all types of expenditures made by resident households.

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[2] The Commonwealth of Massachusetts has been operating a questionnaire survey for visitors to the State for more than 5 years and has accumulated close to 10,000 responses, many of which include remarkably detailed expenditure data. However, one cannot expect every state, much less smaller regions, to undertake such an elaborate and expensive series of surveys.

Even if the full set of total expenditures by major category per person-day or person-night of tourism are not available for any or all types of tourists or visitors, it is still possible to distribute those data that are available into the major categories for further distribution. Generally this has been done by using survey data from those places that provide the full set of summary measures. In the case of recent work by the senior author (see Stevens and others 1983), the summary data available from the continuing Massachusetts survey has been adapted for use in other states and regions. This process is not as inaccurate as it might appear to be, given the variation among types of tourism in various parts of the United States. Fortunately the Massachusetts data are available by county, and the counties vary widely in their types of tourism and hence in their distribution of tourist expenditures among the summary categories. For example, the Massachusetts seashore counties provide information on seashore visitors; the counties of the Boston Metropolitan area give a typical pattern for city visitors; the hill and lake counties in western Massachusetts provide typical data for visitors there, and so forth. It is therefore possible to simulate the expenditures of various types of visitors to other states in the region based on their similarity to individual counties or groups of counties in Massachusetts. In such cases, however, it is necessary to adjust for differences in the basic price level, especially for accommodations, restaurant meals, and interstate transportation expenditures for areas where most visitors arrive by plane, where costs tend to be much higher than they are in Massachusetts.

The allocation of travel expenditures between point of origin and destination region is further complicated since such expenditures can be a substantial proportion of total expenditures, especially for short-term visitors. Typically, travel by public carrier is allocated one-half to the origin and one-half to the destination. States such as Florida, however, receive more than half of the expenditure allocation because they have major airline repair and maintenance installations or are a major national or regional headquarters of the airline companies. The easiest approach often is to base the allocation on the employment per capita in air transportation in the two regions.

A group of travel-related expenditures take place in and around airports and other transportation centers. The portion that has to do with local travel (such as car rental) should be captured as part of expenditures by business travelers. Furthermore, use of local accommodations, eating and drinking places, and so forth, are generally part of regular tourist and business travel, and should be so reported.

There are also additional expenditures related to transient visitors that may be quite significant. For example, those who fly to Miami to take a cruise ship may stay in the area one or more days between the flight and their cruise. Such visitors may make significant local expenditures even though they may not be included in the class of "tourists" in the normal course of events. Collecting data on such short-term tourists, or even on short-visit business travelers, is often a problem because of their brief stay.

In addition, there are often major classes of "tourist" expenditures not usually properly allocated. One example is expenditures associated with summer vacation homes. There are substantial expenditures on local taxes, maintenance, utilities, and so forth, as well, of course, on food, recreation, and similar expenses ordinarily included in a column for tourists who are not staying in hotels or motels. These expenditures form a substantial portion of the economic base and the tax payments of the fiscal base of many vacation communities.

SECOND-ORDER FLOWS

Most economies of any significant size are characterized by a significant amount of interdependence among sectors. Thus a dollar of direct expenditure on tourism ultimately circulates through several rounds of transactions among intermediate sectors that provide it with "indirect" inputs (e.g., fuel stations for trucks used to ship camping gear to retail outlets, electric power to provide lighting for the service station, coal to provide steam for electric power generation, ad infinitum). Another set of secondary impacts are "induced" by income payments to primary factors (land, labor, and capital) and their eventual spending on consumer goods. These indirect and induced impacts are often as great or greater than the direct tourist expenditures in larger regions. The ratio of the "higher-order" effects and direct effects is the value of the multiplier often used in impact analysis.

Indirect impacts are straightforward conceptually and are discussed in greater depth in the papers by Bushnell and Schaeffer in this volume. We will confine our attention here to some neglected aspects of induced impacts that have special significance to our topic.

Induced effects begin with remuneration to primary factors that are represented by the "payments sector" of most I-O tables. Usually there is only a single coefficient or flow in each sector representing this transaction, though some tables have included four delineations: returns to labor (wages), returns to property income (interest, dividends, profits, rent, and royalties), depreciation, and indirect business taxes. A portion of the net (of depreciation) payments are then injected into the consumer spending stream in a closed version of an I-O model. That is, a payments row and personal consumption column are added to the structural table so that personal income determination can be calculated endogenously.

Almost universally, I-O tables have failed to make some important distinctions and have used some questionable proxies in place of income allocations. For example, the difference between income generated within the region and income retained within is rarely acknowledged. The difference between these two income totals is likely to be even larger in a tourist-based region than an ordinary region because of the increased liklihood of interregional factor flows in the case of the former. In the case of wage payments, the fact that the recreation site has typically only a sparse population from which to draw labor implies cross-regional movement (commuting) as does the seasonality of much of the tourist trade. Rental payments are also likely to drain out of the region given the prevalence of absentee ownership or summer-home ownership in this context. Payments to other types of property income are also likely to drain out of the tourist region in cases where retail stores, hotels, etc., are owned by chains rather than local residents. The calculation of displacement effects on other regions is likely to suffer similar difficulties, e.g., the allocation of an area solely to recreational use and the cessation of foresting or mining activity. These are also highly concentrated industries, meaning they are characterized by larger firms unlikely to be locally owned.

The problem is muted somewhat by the existence of two sets of control totals used to balance the transactions table when it is closed. Some sets of regional accounts are collected in terms of income earned by residents and there are also independent estimates or regional personal consumption expenditures. Two problems still exist. First, the income earned or personal consumption total includes income and spending flowing in from other regions and does not provide information on the gross outflow and inflow. Second, since they are totals, they provide no information on sectoral variations, one of the objectives of using an I-O table in the first place.

The sectoral allocation of income respent (a proxy for income retained) is usually based on the assumption that all wage income but only some portion of property-related income is channeled into consumption in the regions. The amount of property income rechanneled into the spending stream, however, is taken as a residual to balance the total income, total expenditure controls. Some modelers do not feel a balance is required, given interregional factor flows, and some simply invoke the assumption that all wage income is respent and no capital income is respent.

The situation is ironic considering the efforts in recent years to improve the accuracy of regional I-O coefficients. However, these efforts are confined almost exclusively to flows of goods and services and there has been little progress in identifying imports and exports of factor flows regionally. In all fairness, an absence of existing data has made such an analysis impossible. But the economic profession and government agencies should not collectively use this as an excuse in years to come because the appropriate data can be collected, as will be discussed later.

EXTENSIONS--DISTRIBUTIONAL ANALYSIS

An underlying theme for much of this paper is the need for a greater emphasis on a distributional approach to impact modeling, both within and across regions. The latter has been emphasized thus far, so we will now focus the discussion on aspects of intraregional analysis.

Another way to disaggregate the payments sector is by socioeconomic group (e.g., interest groups, income class, or occupation). This offers several additional impact capabilities, but the most important one is to determine who gains and loses by a given market shift or public policy. (It would be impossible to determine impacts for each individual, so the analysis has to link individuals to readily identifiable groups.) Individual impact is often ignored in policymaking based on conventional cost-benefit analysis, which yields a net dollar total. This approach has typically been viable when used by a single decisionmaker, but the context has been changed by recent increases in the degree of public participation in decisions on land-use policy in tourist and recreation areas. Such participation, via the Forest and Rangelands Renewable Resources Planning Act of 1974 and the National Forest Management Act of 1976, pertains primarily to public lands.

In order for individuals to participate, they want to know how a policy affects them. Informing them how it affects the community as a whole is not enough. Expecting a person to support a policy only because it yields positive net benefits for the Nation or the region implies a degree of altruism that cannot be supported theoretically or empirically. There is an urgent need for an operational methodology by which to calculate individual impacts and to interpret public reaction to the dissemination of this information in the decisionmaking process.

A general methodology for determining distributional impacts by using I-O has been developed by the junior author (Rose 1977) and successfully applied in several contexts (Rose and others 1981, 1982). More recently it has been extended by Stevens and Rose (1984) to derive three measures of impact and response relevant to the more recent shift to public participation:

1. Individual Impact Matrix--a probability distribution of potential impacts for each member of a given socioeconomic group.

2. Community Impact Index--a tally of how the majority of the public will be affected and the size of the majority.

3. Political Articulation Index---an indicator of the likely public response, taking into account intensity of preference, attitudes toward risk, political influence, and transaction costs.

The general distributional methodology is being computerized for general use by the USDA

Forest Service (Rose and others 1985). The empirical version of the methodology is only as accurate as currently available data but, as will be discussed, many improvements are possible if support is forthcoming. This endeavor is crucial to enabling policymakers to perform more accurate analyses addressing a broader set of questions.

FURTHER DATA NEEDS

Aside from the detailed data collected in Massachusetts and perhaps similar data in a few other states, a major potential source of direct tourism expenditures is the survey performed every 5 years by the U.S. Fish and Wildlife Service of the Department of the Interior. This extensive survey, based on a large sample of households, elicits information on expenditures for hunting and fishing trips during the preceding year. Analysis of these data for 1980 by the senior author indicates a number of problems with the data and the survey method.

The main problem is that the survey is performed after the fact. The respondents are asked to remember their expenditures from the previous year at a time that may be more than 6 months after the expenditures are actually made. In comparing the Fish and Wildlife Survey data with other data on tourism expenditures, the general impression is that the amount of reported expenditures in the Survey is systematically underestimated. This is not surprising, given that individuals are much more likely to forget miscellaneous retail purchases they made than to inflate expenditures, such as lodging accomodations, that they have a record of or remember.

Second, the data are quite specific concerning the home location of the traveler but much less specific concerning the destination of the hunting or fishing trip. For example, it is not possible to tell whether the destination was near a large metropolitan area where certain types of costs and expenditures might be expected to be high, or near a rural or isolated area where costs might be lower.

Third, an important component of the Fish and Wildlife Survey is the expenditure on hunting, fishing, and camping equipment. The data on type of equipment are extraordinarily detailed but do not report where the equipment was purchased. In the case of major items such as mobile homes or other types of camping vehicles, it is probably safe to assume that most of these purchases are made at the home location. This may also be true of expensive firearms and fishing equipment, although one would expect some of these purchases to be made at or near the destination of the trip, where specific equipment needs are better understood. Specialists in hunting and fishing equipment, clothing, and related items tend to be located in the destination area, the classic example being L. L. Bean.

In light of the foregoing, some preliminary recommendations can be made concerning the Fish and Wildlife Survey. First, it would be preferable to conduct the survey at the destination of trips, both to increase the probability that the respondent will be able to provide accurate estimates of expenditures (at least up to that point in the trip) and to provide accurate information on where the expenditures were made. This, of course, would be a major change in the method used by the Fish and Wildlife Service. Such a change may not be possible for the next survey, and might not be possible at all because of additional costs of collecting data at a large sample of trip destinations. On the other hand, the problem of cost might be solved or at least mitigated by collecting data from fewer respondents and perhaps asking for less detail in certain expenditure categories.

This brings us to the matter of obtaining data to improve the accuracy of second-order impacts of tourist expenditures. The key to clearly distinguishing income retained (and thus continuing to circulate within a region) and income "exported" is to identify the geographic origin of factor flows and hence the destination of factor payments. In general, data on the ownership of capital in the United States are difficult to obtain, and capital data that distinguish locations of owner and application have rarely been tabulated. Blume and others (1974) were able to gain access to data or the source of dividend income and various socioeconomic characteristics of individual taxpayers from the IRS within strict procedures to maintain confidentiality. Such data, though very costly to access, allow for the designation of "absentee" ownership of corporations; corresponding data could be used to make similar determinations for owners of partnerships and sole proprietorships. A minor modification of the biannual surveys by the New York Stock Exchange (1983) allows for a more direct and probably less-expensive determination. Data on summer homes or absentee landlords in tourist areas might be obtained by adding a single question to the Fish and Wildlife Survey.

On the labor side, the U.S. Bureau of Census (1981) does collect data on commuters. However, many workers directly involved in recreation and tourism are more properly classified as "seasonal," for which no data are collected on a widespread basis.

One important conclusion from the foregoing discussion is that most surveys address the consumers of recreation and tourism. Many of the data gaps might best be filled by increasing the surveys on the production side.

LITERATURE CITED

Alward, Gregory; Palmer, Charles. IMPLAN: An input-output analysis system for Forest Service Planning. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station; 1982. 16 pp.

Blume, Marshall; Crockett, Jean; and Friend, Irwin. Stockownership in the U.S.: Characteristics and trends. Survey of Current Business 54 (2): 16-40.

New York Stock Exchange. Shareownership, 1983. New York; 1984. 32 pp.

Rose, Adam. The economic impact of geothermal energy development. Riverside, CA: Dry Lands Research Institute, University of California; 1977. 105 pp.

Rose, Adam; Isenberg, Dorene; Kolk, David [and others]. Natural and human resource implications of industrial development. Riverside, CA: Dry Lands Research Institute, University of California; 1977. 203 pp.

Rose, Adam; Nakayama, Benjamin; Stevens, Brandt. Modern energy region development and income distribution. Journal of Environmental Economics and Management 9 (2): 149-164; 1982.

Rose, Adam; Stevens, Brandt; Davis, Gregg [and others]. Procedures for estimating distributional impacts of alternative land-use policies, final report to the U.S. Department of Agriculture, Forest Service, Morgantown, WV: Department of Mineral Resource Economics, West Virginia University; [forthcoming].

Stevens, Benjamin; Treyz, George; Ehrlich, David [and others]. A new technique for the construction of non-survey regional input-output models and comparisons with two survey-based Models. International Regional Science Review 8 (3): 271-286; 1983.

Stevens, Brandt; Rose, Adam. Positive measures of the disbtibutional impact of public land use policies. Working Pap. 74. Morgantown, WV: Department of Mineral Resource Economics, West Virginia University; 1984.

U.S. Bureau of the Census. Census of population: Population characteristics. Washington, DC: 1981.

Techniques for Assessing the Secondary Impacts of Recreation and Tourism

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Public resource agencies charged with husbandry of our natural resources encourage efficient and equitable allocation of the costs and benefits of alternative uses of those scarce resources. Resource agencies compete for public funds among themselves and with other demands on the public coffers. Therefore, for socially optimal uses of limited public funds, quantification of the benefits of resource allocation is necessary.

Benefits of development projects for recreation and tourism include primary, or direct impacts, and secondary, or indirect impacts. Indirect impacts include changes in employment, gross business volume or gross regional product, personal income, and government revenues. Assessment of the ex ante or anticipatory impacts of projects requires identification of impact units of analysis useful to the decision-making process and data sets available for analysis.

Since considerable literature exists on techniques to estimate the direct impact component, our focus will be to survey available techniques to assess the secondary or indirect impacts of recreation and tourism development projects. Specifically, the objective is to review the criteria of acceptable recreation and tourism impact assessment techniques and discuss selected techniques in light of those criteria.

CRITERIA

Foremost among selection criteria should be usefulness to decision making. Several characteristics that an assessment model should have are:

Expedient. Decision makers most often do not have the luxury of time, and turn to "quick and dirty" techniques.

Replicable. Structure and underlying assumptions of a model should be adequately explicit to facilitate spatial and temporal replication by individual analysts.

Credible. Assessment methods should be tested, state of the art, statistically correct, grounded in theory, appropriate to project size, reflect time impacts accurately, and be comprehensible to laypersons.

Complete/Comprehensive. Public sector decision making internalizes external costs and benefits as well as accounting for direct impacts. Whenever feasible, models should monetize external costs and benefits to reflect an accurate assessment of project impacts.

Tractable/Doable. The operational complexity of an impact assessment tool should be such that paraprofessionals with minimal technical background could conduct the analysis with available data. Additionally, resources commensurate to the task should be available.

Consistent with Purpose. Estimates of changes in economic activity should be consistent with the decision-making perspective. In other words, the assessment technique should be user friendly and a means to improved decision making (Berg 1982).

The ideal assessment tool would possess each of these characteristics. Yet, it is apparent that tradeoffs must be made; for example, between expediency and completeness. Those tradeoffs are the agency decision makers' bailiwick.

IMPACT ASSESSMENT TECHNIQUES

The typical approach to assessing secondary impacts of public sector development projects is input-output (I/O) analysis. I/O analysis has played a significant role in regional economic assessment. Reference to its structure and use abound in the literature. However, a basic shortcoming of primary I/O models is the extensive data requirement. Other regional interindustry models and shortcut I/O techniques have been developed when the costs of I/O modeling were too great. The Commerce-BEA Regional Industrial Multiplier System (RIMS) is one example (Cartwright and Beemiller 1980).

A taxonomy of assessment techniques could be drawn up according to one of several approaches: by intended use (descriptive, simulation, optimization), by subject matter (management, recreation, energy, policy), by how time is handled (static, dynamic), by closeness-of-fit to the real world (empirical, theoretical, experimental), or by construction technique (linear programming, econometric, mathematic). However, since "everything is related to everything" in public sector modeling, no approach is singularly appropriate.

The main purpose of this discussion is to identify techniques or models that will introduce consistent project evaluation structure, so that we do not come to cross purposes in recreation and tourism resource development or among agencies. Four general categories of techniques according to what the decision maker is provided are (1) multiplier development techniques, (2) matricies or accounts, (3) comparative situations, and (4) computer models.

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Multiplier Development

Input/output

Economic base

Regional econometric

Account Systems

Comparative Situations

Similar projects

Expert opinion (Delphi)

Brainstorming

Computer Models

Ouija Board

Multiplier techniques are quantitative, whereas accounting systems may be qualitative. Comparative situations may be the least intensive in data and time requirements. A recreation impact assessment method could incorporate elements of each of these generic techniques.

Multiplier Development

Multipliers are a tool for estimating secondary impacts from direct impacts. The multiplier effect is best described as the ratio of the total change to the change in the direct component of income, employment, or some other unit of regional economic analysis. Three techniques for developing multipliers are input-output models, economic base analyses, and regional econometric techniques. I/O modeling is discussed in detail in some of the other presentations.

Economic base analyses.--Economic base or export base theory, the simplest model of economic activity, postulates that an area's economy can be divided into two general types of economic units (Leistritz and Murdock 1981; Oppenheim 1980). The first unit, the basic sector, consists of those firms that sell goods and services (export) to markets outside the region. The other unit, the nonbasic sector, consists of those firms that supply goods and services to customers within the region. The key to export base theory is that the level of nonbasic activity in a region is determined through a functional relationship with basic activity. This relationship is known as the multiplier effect. The principle force determining the change in a region's economic activity is thus external or export demand.

The multiplier is expressed as the ratio of basic to total regional employment, population, or income (Bendavid-Val 1983):

$$\text{Base multiplier} = \frac{\text{total activity}}{\text{basic activity}}$$

If, for example, total employment in a region were 3,000 of which 1,000 employees worked in the basic or export sector, then the multiplier would be:

$$\text{Multiplier} = \frac{3,000}{1,000} = 3$$

Or, for every basic sector employee in the region, there is a total of three employees, one basic-sector employee plus two nonbasic-sector workers. Thus, the change in employment, income, or other analytical unit can be estimated by using the simple formula

$$\text{Change in total activity} = (\text{base multiplier})\ (\text{change in basic activity}).$$

Operational questions about the proper unit of analysis and delineation between basic and nonbasic components need to be addressed. The appropriate unit of measurement depends on the purpose of the analysis and data availability. The bifurcation technique can significantly affect the results and can be accomplished in a variety of ways, including survey approaches, by assumption or assignment, by using location quotients, by using a minimum requirements approach, or econometrically (Pleeter 1980; Schaffer 1979).

Bromley (1972) suggests developing an index of internal purchases and an index of internal sales that would yield adequate community development policy information at much less cost than traditional I/O. This suggested approach stems from economic base theory.

Economic base techniques have been criticized for being oversimplifications, both intra- and interregional; assuming fixed relationships; neglecting imports, savings, and the balance of payments; failing to explain exports or inadequately estimating exports; and neglecting excess capacity. However, "No other model can approach the export base technique in terms of inexpensiveness and simplicity" (Pfister 1976:104).

Economic base models are the simplest and least expensive of the multiplier models, with input-output models at the other extreme. There is a range of variants that adds rigor and precision but at the same time, adds to the amount of data, time, and expertise required to implement the analysis. The amount of available resources will determine how rudimentary or sophisticated an export base model will be. The simplest of economic base analyses can be accomplished with a minimum of resources and within a very short time frame. The simplest economic base analyses meet at least four of the six criteria established above, with the possible exceptions of not being credible or complete.

Regional econometric techniques.--As the name implies, these techniques involve statistically estimated equations that explain changes in units of analysis at the regional level. They are most commonly regression models patterned after models of the national economy. Frequently, econometric models are multiple-equation systems that describe a regional economy's structure and they can be used to forecast income, employment, and other indicators of output or economic activity. The primary operational difference between econometric models and economic base models is the way in which time is handled. Economic base models use a single period reference whereas econometric models employ time-series data (Pleeter 1980).

Regional econometric models patterned after national macro models emerged during the late 1960's (Richardson 1979). Most regional models are simply miniature versions of national forecasting models. Regional change is determined by comparison with national industrial composition, incorporating demand elasticities for regional exports.

Econometric approaches to multiplier estimation offer potential because they can accommodate a vast array of factors, both local and nonlocal. Three approaches for building ex ante models by using econometric techniques are (1) building upon information contained in input-output models, (2) building upon economic base concepts, and (3) constructing an econometric system of the local economy (Schaffer 1979).

Two serious shortcomings, which may be synergistic, exist with econometric techniques--data limitations and model specification. When many variables are involved over a short time period, estimation becomes difficult due to the loss of degrees of freedom. While both time series and cross-sectional data exist for national level models, similar data at regional levels are scarce but are becoming more available. Model specification problems involve a number of issues, from data availability and reliability to properly applying statistical and economic theory.

The use of econometric models to estimate regional multipliers has the advantages of rigor and sophistication, which can be disadvantages for widespread, consistent implementation by paraprofessionals. One added advantage is a sense of accuracy that the technique imputes with its ability to establish confidence limits on the estimates, which economic base analysis lacks.

Regional econometric approaches to estimating regional impacts receive passing marks on three of the six criteria. The approaches are credible, complete, and consistent. However, because of this, they are not expedient, often not replicable, and are unmanageable by laypersons. Even "quick and dirty" econometric analyses require advanced technical knowledge.

Account Systems

Various accounting systems based on the principle that every transaction flows in two equal but opposite directions have been developed for analyzing the economy (Bendavid-Val 1983). The amount of detail may range from rudimentary to highly complex. Input-output analysis is an example of a highly complex account, and economic base analysis involves a rudimentary account system.

Isard (1975) was a pioneer in incorporating regional account systems into an analytical framework. The Environmental Evaluation System (EES) developed by Battelle Labs (Bisset 1983) is an example of a quantitative/index/account method. It consists of a checklist of 74 environmental, social, and economic parameters which may be affected by a project. Another example is the Optimum Pathway Matrix Analysis devised to help assess alternative highway proposals by examining impacts on 56 environmental, social, and economic parameters (Bisset 1983). The U.S. Army Corps of Engineers examined 54 of these types of techniques before developing their own Water Resources Assessment Methodology (WRAM) (Solomon and others 1977). Canter (1982) reviews selected matrix and checklist techniques.

An account system complete enough to provide useful information to decision makers will frequently contain enough information to develop multiplier-type models of project impacts. Account systems may be most useful as supplements to other impact assessment techniques, where certain impacts cannot be adequately quantified yet are significant in the aggregate. Such systems are neither quickly accomplished nor easily replicable due to the nature of the technique. They are credible since they are generally positive rather than normative in nature. Account systems are complete by their nature, but may not be doable by paraprofessionals.

Another variation on the account system is the assessment manual, handbook, or guidebook, produced for the assessment of particular types of projects (Bisset 1983).

Comparative Situations

Similar projects.--The "quick and dirty" approach to estimates of change in regional units of analysis is to use multipliers estimated for a similar situation. For the estimate to be transferrable, the two areas must have similar labor force, residential patterns, labor force skills, propensities to consume locally, ratios of local income generated per dollar of local consumption, and existing business types (Schaffer 1979).

The direct application of borrowed multipliers meets all but the credibility criteria, assuming the multipliers were appropriately developed. And, depending on how well the two regions' economies match, justifying use of a "foreign" multiplier may be possible. In the case of assessing recreation and tourism impacts, where projects and impact areas may be somewhat homogeneous, this most serious shortcoming of comparative analysis may be insignificant relative to the problems of implementing more "sophisticated" analyses.

Expert opinion.--A modification of using comparative situations involves the use of pooled expert opinion, whereby experts familiar with similar projects and the regional economy under study are called upon to provide estimates of change. This is known as a Delphi study, where a group of experts make independent contributions through a systematic iterative survey (Linstone and Turoff, 1975). Delphi was specifically developed for instances where expert opinion is the only source of information about what might happen in the future. The technique has been successfully employed to predict impacts stemming from water resource development (Hitchcock and others 1982) and energy development (Mittleider and others 1983). Delphi has shortcomings (Sackman 1975) yet provides another potential "quick and dirty" impact assessment technique.

Brainstorming.--A variant of the Delphi panel of experts is to "brainstorm" with focus groups involved in the day-to-day use and operation of similar projects or potential projects. A typical session might include brainstorming with user group representatives.

Computer Models

An extensive literature exists on computer models of regional economies (Leistritz and Murdock 1981). Acronymns such as ATOM (Arizona Trade-Off Model), BREAM (Bureau of Reclamation Economic Assessment Model), CLIPS (Community Level Impact Project System), CPEIO (Colorado Population and Employment Model), and RED (REAP Economic-Demographic Model) are household words to socioeconomic impact analysts. These models employ one or more of the multiplier development techniques, commonly I/O, and are usually developed for a specific region. Three more general, nationwide models are IMPLAN (Alward and Palmer 1983), RIMS (Cartwright and Beemiller 1980), and RPIS (Stevens and others 1975).

Although many of the inherent problems of I/O, economic base analysis, and regionalized econometric models may be present, existing computer models of regional economies can provide "quick and dirty" impact estimates, especially when there is a model locally available.

DATA SOURCES AND REQUIREMENTS

Perhaps the greatest inhibitor to accurate, timely impact assessment is the unavailability of data and the unreliability of much of the data we have. This is especially true in rural areas with sparse populations and limited economic bases. The success we will have depends in large part on the degree to which we can successfully generalize from the poor data available. Even the most sophisticated mathematical models cannot make valid assessments with inadequate data.

Data can be found in as many different forms as there are assessment techniques. Data can be time series or cross sectional, empirical or experimental, primary or secondary, or some combination of these. Practitioners need data sets of sufficient depth and breadth to successfully yet expediently implement the selected assessment technique to provide decision makers with information. Expediency implies the use of secondary data--data collected and assembled by someone else--because primary data collection is costly both in time and money.

CONCLUSIONS AND RECOMMENDATIONS

No single assessment technique can be recommended as optimal for implementation across agencies, across time, and across space. An overall method of assessment should incorporate the tools necessary to get the job done and get it done in light of the criteria presented at the outset. Unavoidable tradeoffs exist between several of the criteria. Those tradeoffs should be identified by the analyst, with decisions made by those responsible for defending the outcome.

The impact assessment techniques discussed are as capricious and credible as the practitioner allows. A Ouija board, for example, fills the bill except for replication and credibility. Pfister (1976) allows that a cynic is justified in considering multipliers to be random numbers between one and five. Only through the careful design of assessment methods, careful selection of assessment techniques, and, most important, careful use of data bases, can we instill confidence and rigor in our analyses.

LITERATURE CITED

Alward, Gregory S.; Palmer, Charles J. IMPLAN: An input/output analysis system for forest service planning. In: Forest sector models. Proceedings, 1st North American conference on forest sector modeling, 30 Nov.-4 Dec., 1981, Williamsburg, VA, U.S. Forest Service. 1983:131-140.

Bendavid-Val, Avrom. 1983. Regional and local economic analysis for practitioners. New York: Praeger. 1983. 188 pp.

Berg, Mark R. Increasing the utility and utilization of assessment studies. Impact assessment bulletin 1(2):41-49, 1982.

Bisset, Ronald. 1983. A critical survey of methods for environmental impact assessment. In: O'Riordan, Timothy; Turner, R. Kerry. An annotated reader in environmental planning and management. New York: Pergamon Press, 1983:168-186.

Bromley, Daniel W. An alternative to input-output models: a methodological hypothesis. Land Economics 48(2):125-133, 1972.

Canter, L. W. Environmental impact assessment. Impact assessment bulletin 1(2):6-40, 1982.

Cartwright, Joseph V.; Beemiller, Richard M. The regional impact of military base spending. Washington, DC: Regional Economic Analysis Division, Bureau of Economic Analysis, U.S. Department of Commerce, 1980. 55 pp.

Hitchcock, Henry; Coates, Joseph; Nettles, M. Suzanne; [and others]. The future of water and the Bureau of Reclamation. Washington, DC: J. F. Coates Inc.; 1982, 36 pp.

Isard, Walter. Introduction to regional science. Englewood Cliffs, NJ: Prentice-Hall Inc.; 1975. 506 pp.

Leistritz, F. Larry; Murdock, Steven H. The socioeconomic impact of resource development: methods for assessment. Boulder, CO: Westview Press, 1981. 286 pp.

Linstone, H. A.; Turoff, M., eds. The Delphi method: techniques and applications. Reading, MA: Addison-Wesley Publishing Company, 1975. 620 pp.

Mittleider, J. F.; Leitch, J. A.; Leistritz, F. L. Oil and gas development impacts on township roads. AE 83015. Fargo, ND: North Dakota Agricultural Experiment Station, 1983. 53 pp.

Oppenheim, Norbert. Applied models in urban and regional analysis. Englewood Cliffs, NJ: Prentice-Hall, Inc., 1980. 356 pp.

Pfister, R. L. On improving export base studies. Regional Science Perspectives, 6:104-113, 1976.

Pleeter, Saul. 1980. Economic impact analysis: methodology and applications. Boston: Martinus Nijhoff Publishing, 1980. 196 pp.

Richardson, Harry W. ed. Regional economics. Chicago: University of Illinois Press, 1979. 325 pp.

Sackman, H. Delphi critique: expert opinion, forecasting, and group process. Lexington, MA: Lexington Books, 1975. 142 pp.

Schaffer, Ron. 1979. Estimating local income multipliers: A review and evaluation of the techniques for ex ante use. In: Proceedings of the ex ante growth impact models conference. March 6 and 7, 1979, Columbus, OH. Ames, IA: North Central Regional Center for Rural Development, 1979:45-73.

Solomon, R. C.; Colbert, B. A.; Hansen, W. O.; [and others]. Water resource assessment (WRAM)--Impact assessment and alternative evaluation. Tech. Rep. Y-77-1. Vicksburg, MS: U.S. Army Corps of Engineers, 1977.

Stevens, B. H. Fore River bridge reconstruction evaluation: Summary report. Boston: Commonwealth of Massachusetts. Office of Transportation Planning, Department of Public Works, 1975.

Measuring Supply-Side Economic Impacts on Tourism/Recreation Industries

Wilbur R. Maki [1]

INTRODUCTION

Supply-side economic impacts pertain to changes in sales, work force, and earnings of the providers of tourism/recreation (T/R) services, equipment, and facilities. Included among these providers are the manufacturers of recreational equipment, recreation vehicles, boats, and second homes.

Changes in the needs of tourists, and recreationists contribute to period-to-period changes in the number and type of sales among providers of recreation equipment and facilities. The central purpose of this paper is to address the measurement of these period-to-period changes and the corresponding changes in T/R activities.

Study Objectives and Tasks

This paper addresses (1) the delineation of T/R activities and providers, (2) the identification of appropriate indicators for measuring economic impact, (3) the preparation of alternate analytical frameworks for assessing national, regional, and local implications of supply-side economic impacts of T/R activities, and (4) the specification of the essential attributes of a public information system for servicing the decision information needs of recreation resource managers.

The objectives relate to the implementation of corresponding tasks: First, a literature search on the measurement of T/R activities and their effects on the economic condition of individual communities and industries. Much of this search was completed in a related study on targeting public and private investment in T/R facilities in northeast Minnesota (Blank and others 1982). The additional literature review in this study is focused on the supply-side effects of T/R facility development by public agencies, such as the U.S. Corps of Engineers or the USDA Forest Service.

The second task is the review of alternate economic indicators for measuring personal participation in various social and economic activities (Fox 1983). The two variables of critical importance in economic measurement are time and money. The quality and intensity of personal participation in activities such as boating, swimming, and hiking are measured by the amount of time and money allotted to each activity. These two variables, in turn, may serve as bases for public and private investment in activity-specific T/R facilities.

The third task is to review and select one or more alternate analytical frameworks for assessing the extent and importance of supply-side changes which are directly or indirectly associated with changes in area-specific T/R activities. The criteria of timeliness, accessibility, and cost, as well as analytical adequacy, are relevant to the selection. So-called quick-and-dirty methods are considered, along with complex and sophisticated computer simulation models of a regional economy in which recreation facility developments and their economic impacts are the focus of study.

The fourth task is to review management information systems which may have a bearing on the construction of a comparable system for recreation resource management. Existing information systems, like IMPLAN, will be examined as potentially integral parts of a locally accessible data base or information system for investment targeting and economic impact assessments (Alward and Palmer 1983).

Plan of Approach

The four tasks and their anticipated contributions are discussed in terms of analytical framework and T/R expenditures. The analytical framework, as described above, is the central purpose of this study. The T/R facilities refer to the measurement of activities and their related requirements; T/R expenditures refer to both user and provider expenditures associated with these activities. The number and type of activities supported--or made possible--are related to the availability of individual facilities. This availability is viewed as a necessary though not a sufficient condition for T/R activities: The scenic, cultural, and environmental attractions associated with a particular market area are essential requirements of a viable recreation focal area.

T/R expenditures are related not only to the construction and maintenance of facilities but also to the participation of both visitors and residents in the activities available. Participation expenditures, however, are usually intentionally specified in terms of total personal income and total time spent in away-from-home settings as a visitor participating in activities that differ from those engaged in by the local residents who are not in the role of recreationists (Wicker 1979).

ANALYTICAL FRAMEWORK

The analytical framework for assessing supply-side economic impacts on T/R industries addresses several questions posed by developers of the associated facilities. These questions deal with the economic value of particular facilities as represented by alternate measures of personal participation and business profitability. These questions have a decision focus: they pertain to specific information needs for economically-sound public and private facility development (Carrathurs and Maki 1971).

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Decision focus

The magnitude and incidence of economic impact arises in virtually every instance of public facility construction, particularly when the facility provides for large increases in traffic. For some local residents, the expected traffic growth means greater sales and income; for others, it translates into increases in noise, congestion, and reduced property values. Indeed, much, if not most, public facility development largely affects the incidence rather than the overall magnitude of regional or national economic activity.

Public facility development refers to the construction, maintenance, and operation of dams, docks, parks, campsites, trails, and other recreation-related facilities by Federal, State, or local government agencies. For study purposes, this development occurs within a recreation focal area like Lake Superior's North Shore in northeast Minnesota--a narrow, coastal zone extending from near Duluth northeastward to Grand Portage. Duluth is distinguished as a separate recreation focal area because of its primarily urban, rather than rural, orientation (Blank 1982).

An economically sound proposal for targeting public investment in T/R facilities in a particular area requires information on resident and nonresident participation in various recreation activities. Each activity depends upon the available facilities in a given focal area, and the degree of participation depends upon the capacity of the facilities. These capacities are measured by full-time equivalent participant days of facility use. Actual use is, of course, less intensive, and practical capacities are inherently lower than full-time equivalent capacities. Indeed, the efficient management of facility use depends on the timely application of various incentives and penalties to shift participation from peak to off-peak periods of the day, week, or season. Thus, optimal development requires accurate information on use patterns and strategies for increasing long-term facility use by shifting day-to-day participation from peak to off-peak periods.

An accurate measurement of economic impacts depends on a model of interindustry and interarea transactions. For a small, sparsely populated area with few internal transactions, but many external linkages, a minimally adequate economic model can be extremely rudimentary in its representation of (a) the basic, export-producing sectors and (b) the nonbasic, residentiary sectors. For a large, densely populated area with much interindustry connection and few, but critically important, interarea transactions, a minimally adequate economic model must provide a highly differentiated representation of all sectors--both export producing and residentiary including final demand sectors.

For either type of area, the measurement of economic impact is burdened by its twofold task of accounting for supply-side changes in both overall magnitude and spatial-economic incidence. Although much economic analysis focuses on supply-side effects as measured by changes in net value added, political decisions are importantly influenced by the distribution of gross changes in value added by all economic activity.

A critical economic question is the importance of redistributive gains and losses. Even though felt needs and financial resources of individuals of varying socio-economic status are likely to differ--differences that are extremely difficult, if not impossible, to measure--the role of economic analysis must include so-called opportunity costs of public facility development. Critically important, therefore, in supply-side impact analyses are the values assigned to benefits and costs of facility development for various socio-economic groups in (a) the local community, (b) the development region, and (c) the nation.

Very little economic research on T/R industry has dealt specifically with the socioeconomic status of the beneficiaries of public facility development as compared with the tax-paying population. Yet, both the beneficiaries and the general tax-paying population resort to the use of economic statistics to support their respective viewpoints. A sound economic analysis should relate to the economic interests of both the gainers and the losers in regional resource development.

Economic Models

The alternate economic models presented here focus on the relation of changes in T/R facility development to changes in T/R industries. Hence, each economic model differentiates producing sectors, by type of industry, and consuming sectors, by type of household Each model also differentiates industries and households by geographic location.

The principal components of a regional economic model for assessing the industry impacts are illustrated by a recently developed computer simulation model of northeast Minnesota (Maki 1982). Earlier versions of this model were used in studies of copper-nickel, taconite, and peatland development in northeast Minnesota. This current model has specially constructed T/R, government, and household modules for measuring supply-side effects of facility development. These modules were constructed for the purpose of addressing one or more aspects of the topics listed in figure 1.

The core module in the model links changes in focal area to corresponding industry changes in the multi-county impact area. Demand-side changes in the multi-state T/R market areas are introduced via the market and the T/R modules.

The minimal economic framework for supply-side impact assessments presented here includes the specification and estimation of (1) recreation demand multipliers, (2) total expenditures per recreation visitor day, (3) total recreation visitor days, and (4) total economic impact. The minimal capability is extended for increasingly differentiated and comprehensive impact assessments.

The specification and estimation of recreation demand multipliers is included in the economic

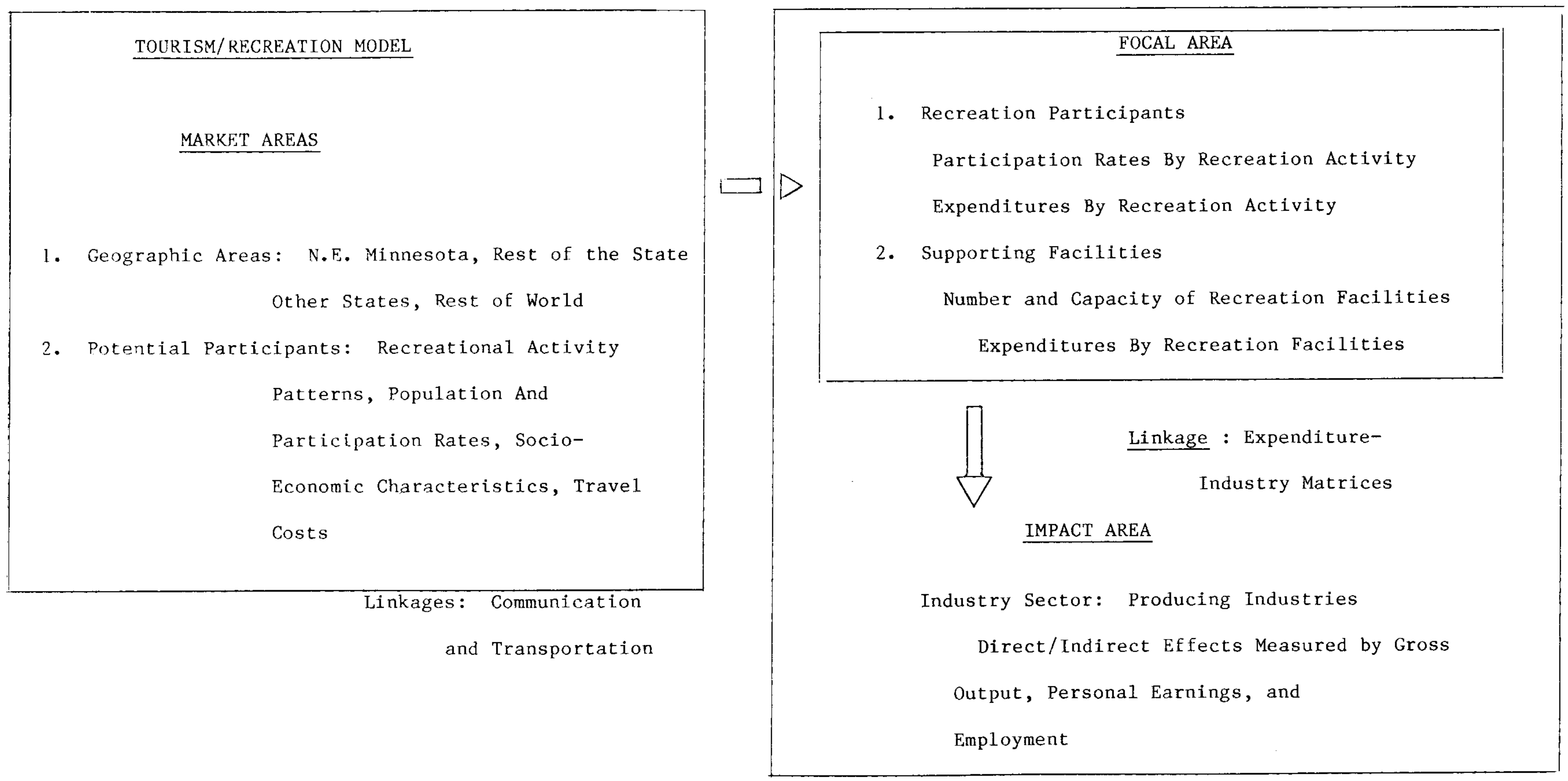

Figure 1.--Economic model of indicators and linkages for measuring supply-side economic impacts on tourism/recreation industries.

model presented earlier (Blank and others, 1982). These multipliers range from the highly aggregated ratios in the economic base version to the highly differentiated, industry-specific ratios in the interindustry transactions tables. Because of relative ease of compiling highly disaggregated interindustry transactions tables for small areas, shortcut methods for computing the aggregate ratios are hardly worth the loss of information on industry-specific direct and indirect effects.

Supply-side development effects in T/R industries are computed with the help of the recreation demand multipliers, once the recreation-related spending is linked to individual input-supplying industries in the economic impact region and the rest of the Nation. Several steps are involved, however, in linking recreation-related business, government, and household spending to local industries, beginning with public spending on facilities. Data requirements for implementing this task are illustrated by the distribution of activities and facilities. The relative importance of a activity is represented by the number of recreation occasions, that is, the total person-days of participation in each activity class (Minn. Dep. Nat. Resour. 1979).

All T/R occasions are summarized under 10 activity classes, which relate, in turn, to corresponding facility classes. Construction, operating, and maintenance expenditures are also summarized for each facility class and allocated to specific activities according to activity participation and utilization of each type of facility.

Another critical step in deriving recreation demand multipliers is estimation of recreation-related spending in each activity class. A summary of spending for personal consumption in the North Shore area illustrates the results of this step of the estimation procedures (table 1). Personal expenditure profiles for each activity class were derived from a 1981 North Shore visitor survey.

A third step in data preparation is the estimation of specific industry output requirements in each personal expenditures category (table 2). Each personal expenditure item includes one or more industry output, including various marketing margins. Industry output is represented in producers' prices; personal spending is represented in purchasers' prices.

Supply-side effects on changes in regional industries as related to local, individual recreation activities are shown in table 3. Economy wide effects are attributed to the industry output requirements of the recreation-related personal consumption expenditures summarized earlier.

The series of three tables and the facility-activity relationships cited earlier provide much of the essential data for deriving North Shore recreation demand multipliers. One approach is to use the data in conjunction with the multipliers derived from the northeast Minnesota interindustry tables to show changes in industry-specific output, incomes, and employment levels associated with given changes in T/R activity participation by (a) residents and (b) nonresidents. In this exercise, the facility-activity relationships would link new facility development to greater activity participation, which would result in expenditure increases in each final demand sector, including increases in:

1. Recreation-related personal expenditures of residents,
2. Recreation-related personal expenditures of nonresidents,
3. Private gross capital formation in recreation-related businesses;
4. Recreation facility development expenditures of government agencies, and
5. Recreation-related operating and maintenance expenditures of government agencies.

An alternative approach is based on the use of a new T/R module in the existing northeast Minnesota computer simulation model. In this exercise, new facility development begins with its construction activity, which is manifested in an initial round of public or private spending and subsequent rounds of indirect and induced spending triggered by the direct spending. Recreation-related operating and maintenance expenditures, along with the related personal spending, are introduced later, which also trigger repeated rounds of indirect and induced spending. Industry-specific effects, including supplying industries in the region (and, indeed, the nation too) are presented in computer simulation results.

TOURISM/RECREATION FACILITIES

The private sector accounts for much of the T/R facility development in northeast Minnesota. It provides the essential financial and personnel resources for new investment in the region's T/R economy. The public sector, as principal landowner and provider of water and wilderness access, serves in a supportive role. The decision focus in facility development is on new investment. In addition, some decisions deal with replacement or abandonment of existing facilities.

An activity classification system for facility planning is given in table 4. The individual elements in the 10 activity classes (table 1) are listed according to their facility requirements. Some activities, for example, canoeing, may require more than one facility. In most cases, however, a single activity is associated with a single facility.

Model Estimation

The facility component of the regional economic model is fitted to facility survey data compiled for a comprehensive outdoor recreation plan (Minn. Dept. Nat. Res. 1979). These data are summarized for nine facility classes, which correspond to the activity classes. The number of facility units in each facility class in northeast Minnesota were reported for 1978, as follows:

Facility	Number
Trail	8,690 40-acre parcels
Water access	1,322 water access facilities
Wildlife management	931 40-acre parcels
Streets and highways	16,710
Resort	4,762 units, including 4,622 rental
Park	10,023 units, including 6,718 campsites
Urban	500 units, including ice skating rinks, baseball fields, and theaters

Thus, by a simple count, public facilities far outnumber private facilities. Total private sector revenues, of course, far exceed total public service revenues.

The 1978 facility survey also shows the distribution of recreation occasions among the nine facilities, as follows:

Facility	Resident (million)	Nonresident
Trail	8.5	1.6
Water access		
Water activity	4.1	3.9
Licensed activity	3.3	4.5
Wildlife management (licensed)	0.4	0.5
Streets/highways	0.7	0.3
Resort	1.3	0.3
Park	1.3	2.5
Urban	2.4	0.5
Complementary		
Educational	0.3	1.4
Personal	0.3	0.8
Lodging (enroute)	0.0	2.5
Total	22.6	18.8

Because several recreation occasions are typically reported for each day of activity participation, the total number of occasions is much larger than the total number of person-activity days. Residents accounted for a larger share of the total number of recreation occasions than did non-residents, although licensed (e.g., fishing, hunting), park, educational, and personal activities were more popular with non-residents than residents. Clearly, the current procedures and definitions for reporting T/R activity participation lack the rigor and precision for useful quantitative analysis and comparison.

The next steps in model implementation involve the compilation of expenditures for maintenance and development of facilities and the preparation of their cost and use functions. Completion of these steps is likely to be delayed by the lack of appropriate economic accounts for sorting expenditures and revenue into functional categories, e.g., the activity and facility classes listed in table 4. Similarly, detailed data on private sector are lacking and facility operating and replacement costs for the additional surveys are needed. Private sector facility requirements are incorporated in the existing investment module of the regional economic model. Facility requirements of recreation-related activities in the private sector are not differential from other facility requirements. This differentiation occurs, however, in the private capital formation account.

Data Organization

The organization of a decision-focused data base for recreation resource management is prescribed by the arrangement of data elements in the regional economic model and, particularly, the T/R module. Two sets of data are used, namely, the base-year facility and user surveys and the annual, quarterly, and monthly time series for updating the base-year surveys.

Local and regional base-year surveys complement existing data series in the estimation of variables and parameters specified in the economic model and its auxiliary modules. The survey forms are precoded and ready for entry into microcomputer data files. Respondents represent varying proportions of selected populations of households, local governments, and recreation-related businesses.

The occasional surveys are an essential input in timely and effective private and public facility planning. In the context of the study framework, these surveys help monitor the status of existing facilities and their contribution to the growth and development of the region's T/R industry. Facility and site development is, in short, product development--the "product" being the T/R experience.

Formulation of product development strategies in the industry is essentially a public-private partnership in northeast Minnesota. It is part of Minnesota's market development strategy for promoting its T/R activities, particularly in northeast Minnesota. It is also one of the two critical variables (the other being distance from market to focal area) in accounting for northeast Minnesota's share of the market in the rest of Minnesota and in other states.

TOURISM/RECREATION EXPENDITURES

Expenditures are included in 14 of the 107 personal consumption expenditure categories in the National Income and Product Accounts. (See tables 1 and 2). Private investment categories also conform with corresponding NIPA classifications of new construction and producer durable equipment. In addition, recreation-related private capital expenditures are differentiated from other private capital investment.

Table 1.--Visitor expenditures for specified consumer items per $1 total expenditures, by type of tourism/recreation activity, northeast Minnesota, 1981 a/

Expenditure class	Destination activities: Trail 1	Water 2	Licensed 3	Driving 4	Resort 5	Park 6	Urban 7	Educational 8	Personal 9	Enroute activities 10	Total b/
	. . . .	. . .	. . .	. . .	. . .	.Dollars.	. . .	. . .	. . .	. . .	. . .
1. Food and beverage off premis consumption	0.116	0.153	0.036	0.019	0.070	0819	0.021	0	0.096	0.031	0.091
2. Purchased meals & beverages	0	0	0	0.287	0.425	0.098	0.308	0	0.145	0.188	0.272
3. Lodging	0	0	0.345	0.185	0.481	0	0.397	0	0	0.365	0.351
4. Repair, grease, rental	0	0	0	0.114	0	0	0	0	0	0.089	0.036
5. Gasoline & oil	0	0	0	0.338	0	0	0	0	0	0.259	0.107
6. Taxicab	0	0	0	0	0	0	0.025	0	0	0	0.002
7. Bus	0	0	0	0	0	0	0	0	0	0.005	0.001
8. Airline	0	0	0	0	0	0	0	0	0	0.041	0.012
9. Books, magazines	0	0	0	0.002	0.001	0.002	0.017	0.702	0.239	0.003	0.015
10. Nondurable sporting goods	0.114	0.150	0.381	0.019	0.009	0.032	0.020	0	0.094	0.006	0.035
11. Durable sporting goods	0.765	0.689	0.235	0.022	0.003	0.009	0.011	0	0.109	0.007	0.041
12. Administrative spectator amusement	0	0	0	0.002	0.004	0.013	0.104	0.132	0.015	0.002	0.014
13. Commercial participant amusment	0	0	0	0.007	0.004	0.023	0.036	0.095	0.272	0.001	0.013
14. Other	0.005	0.008	0.003	0.005	0.003	0.004	0.061	0.071	0.030	0.003	0.010
Total c/	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

a/ Based on Lake Superior North Shore 1981 total visitor expenditures, by item:

Item	Expenditure class	Total expenditure
Food and beverage	1,2	$11,393.000
Lodging	3	11,029,000
Transportation	4-8	4,998,000
Recreation	9-13	3,652,000
Other	14	304,000
TOTAL		$31,378,000

The National Income and Product Accounts; U.S. data were used to allocate survey.

b/ Visitor expenditure classes conform with listing in expenditure total, by item, to expenditure classes.

c/ Northeast Minnesota tourism/recreation activity participation rates were used to allocate total expenditures, by expenditure class, to individual activities which, in 1981, were as follows (in $1000): Trail, 470; Water, 353; Licensed, 1,581; Driving, 2,985; Resort, 11,463; Park, 1,740; Urban, 2,774; Educational, 336; Personal, 589; Enroute, 9087.

Table 2.--Visitor expenditures for specified consumer items per $1 total expenditures, by tourism recreation industry output northeast Minnesota, 1981 a/

Industry	Off-prem cons	Purch. meals & bev.	Lodg-ing	Repair, grease, rental	Gaso-line & oil	Taxi-cab	bus	Air-line	Books, mags.	Sprtg. nondur.	gds. dur.	Adm., Spect. amuse.	Commer. Part. amuse.	other
							Dollars							
1. Dairy & poultry products	0.023	0	0	0	0	0	0	0	0	0	0	0	0	0.034
2. Meat animal & products	0.001	0	0	0	0	0	0	0	0	0	0	0	0	0
3. Food, feed grain	0.001	0	0	0	0	0	0	0	0	0	0	0	0	0
4. Other crops	0.016	0	0	0	0	0	0	0	0	0	0	0	0	0
5. Forest, fish production	0.006	0	0	0	0	0	0	0	0	0.024	0	0	0	0.011
6. Agriculture forestry, fish service	0	0	0	0	0	0	0	0	0	0	0	0	0	0.023
15. Ordinance & Related	0	0	0	0	0	0	0	0	0	0.024	0.040	0	0	0
16. Meat products	0.235	0	0	0	0	0	0	0	0	0	0	0	0	0
17. Dairy products	0.119	0	0	0	0	0	0	0	0	0	0	0	0	0
18. Canned, frozen products	0.053	0	0	0	0	0	0	0	0	0	0	0	0	0
19. Grain milling products	0.003	0	0	0	0	0	0	0	0	0	0	0	0	0
20. Bakery products	0.078	0	0	0	0	0	0	0	0	0	0	0	0	0
21. Alcoholic beverage soft drink	0.077	0	0	0	0	0	0	0	0	0	0	0	0	0
22. Miscellaneous food tobacco	0.056	0	0	0	0	0	0	0	0	0	0	0	0	0
24. Apparel, fabric textiles	0	0	0	0	0	0	0	0	0	0	0.020	0	0	0
31. Printing & publications	0	0	0	0	0	0	0	0	0.615	0.013	0	0	0	0
33. Petroluem, refining & production	0	0	0	0	0.448	0	0	0	0	0	0	0	0	0
44. Other non-electrical	0	0	0	0	0	0	0	0	0	0	0.020	0	0	0
47. Electrical machinery	0	0	0	0	0	0	0	0	0	0.024	0	0	0	0
49. Other transportation equipment	0	0	0	0	0	0	0	0	0	0	0.384	0	0	0
51. Optical, Ophthical Photographical	0	0	0	0	0	0	0	0	0	0.096	0.071	0	0	0
52. Miscellaneous manufacturing	0	0	0	0	0	0	0	0	0	0.386	0.081	0	0	0
53. Railroad transportation	0.009	0	0	0	0.013	0.278	0.333	0.255	0.011	0	0	0	0.081	0
54. Local Transportation	0.006	0	0	0	0.008	0.167	0.167	0.157	0	0	0	0	0.054	0

55.	Truck transportation	0.010	0	0	0	0.013	0.278	0.334	0.275	0	0	0	0	0.081	0
56.	Air transportation	0.008	0	0	0	0.010	0.222	0.166	0.235	0	0	0	0	0.054	0
57.	Other transportation	0.003	0	0	0	0.005	0.055	0	0.078	0	0	0	0	0	0
58.	Communications	0	0	0	0	0	0	0	0	0	0	0	0	0	0.080
62.	Wholesale trade	0.064	0	0	0	0.110	0	0	0	0.077	0.096	0.081	0	0	0.014
63.	Retail trade	0.232	0	0	0	0.393	0	0	0	0.297	0.337	0.293	0	0	0.023
66.	Hotels, personal & repair services	0	0	1.000	0	0	0	0	0	0	0	0	0	0	0.241
67.	Business service	0	0	0	0	0	0	0	0	0	0	0.010	0	0	0.161
68.	Eating & drinking places	0	1.000	0	0	0	0	0	0	0	0	0	0	0	0
69.	Automobile repair	0	0	0	1.000	0	0	0	0	0	0	0	0	0	0
70.	Motion picture & recreation	0	0	0	0	0	0	0	0	0	0	0	1.000	0.730	0.253
71.	Health services	0	0	0	0	0	0	0	0	0	0	0	0	0	0.080
72.	Education, non-profit	0	0	0	0	0	0	0	0	0	0	0	0	0	0.034
74.	State and local enterprise	0	0	0	0	0	0	0	0	0	0	0	0	0	0.046
	TOTAL	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

a/ Based on allocation of specified industry inputs to expenditure class in: Ritz, Philip M., Eugene P. Roberts, and Paula G. Young, Dollar Value Tables for the 1972 Input-Output Study Summary of Current Business 5 (4): 51-72 1979.

Table 3.--Direct and indirect effects of specified North Shore visitor expenditures on northeast Minnesota gross ouput and related personal earnings and employment, 1981.

Industry	North Shore visitor Expenditures	Direct and indirect effects		
		Gross output	Personal earnings	Employ-memt
	....	$1,000	....	(number)
1. Dairy and poultry products	76	113	12	4.4
2. Meat, animal and products	3	4	0	0.1
3. Food, feed grain	3	4	0	0.2
4. Other crops	46	71	12	4.8
5. Forestry, fishery products	47	61	21	0.9
6. Agriculture, forestry, fishery services	7	10	3	0.2
15. Ordinance = military weapons	76	76	0	0
16. Meat products	669	1,081	98	8.4
17. Dairy products	339	505	39	3.9
18. Canned, frozen preserves	151	208	45	3.1
19. Grain mill products	9	12	2	0
20. Bakery products	222	272	77	3.4
21. Alcoholic beverages, soft drinks	219	264	62	2.9
22. Miscellaneous food, tobacco	159	187	34	1.6
24. Apparel, fabricated textiles	25	35	12	1.4
31. Printing and publishing	304	481	210	9.9
33. Petroleum refinery and products	1,506	1,790	93	3.3
44. Other nonelectric	25	37	4	0.3
47. Electrical machinery	26	35	5	0.3
49. Other transportation equipment	479	679	125	9.0
51. Scientific and controlling instruments	193	271	38	2.6
52. Miscellaneous manufacturing	552	846	116	9.0
53. Railroad transportation	237	327	127	6.1
54. Local transit	144	180	40	4.0
55. Truck transportation	242	315	132	7.2
56. Air transportation	189	262	83	3.3
57. Other transportation	58	94	37	1.5
58. Communications	24	29	11	0.5
62. Wholesale trade	798	987	385	22.6
63. Retail trade	2,862	3,478	1,620	195.1
66. Hotels, personnel, representatives	11,103	15,253	5,251	550.1
67. Business services	61	86	27	1.6
68. Eating and drinking places	8,547	12,813	2,493	337.4
69. Automobile repair	1,149	1,474	354	25.4
70. Motion pictures and recreation	809	1,062	415	33.7
71. Health services	24	30	14	.9
72. Education, nonprofit	10	13	5	.5
74. State and local entertainment	14	23	6	.4
Visitor Expenditures	31,378	43,470	12,007	1,259.9

Table 4.--Tourism/recreation activities and related facilities northeast Minnesota, 1984, by activity class

Activity	Facility
TRAIL	
Bicycling	Bicycle trails
Hiking	Hiking trails
Backpacking	Backpacking trails
Horseback riding	Horseback trails & stables
Cross-country skiing	Cross-country trails
Snowmobiling	Snowmobile trails
Sledding & tubing	Open space
Four wheeling	Four-wheel drive
WATER	
Canoeing	Canoe portage Water Access Minor docking facility
Swimming	Bathing beaches Swimming pools
Sail, motor boat/water ski	Boat dock, launching, mooring
LICENSED	
Ice fishing	Fishing, rental, bait
Fishing	Fishing, rental, bait
Hunting	Wildlife areas
DRIVING	
For pleasure	Streets, roads, waysides
RESORT	
Downhill skiing	Downhill ski areas
Golf	Golf courses
Tennis	Tennis courts
Archery, shooting range	Archery ranges
Lodging	Resorts
PARK	
Camping/wilderness	Campgrounds, wilderness
Camping/developed	Campgrounds, developed
Picnicking	Picnic grounds
Cooking	Complementary
URBAN	
Ice skating	Ice-skating rinks
Baseball/softball/foot ball	Baseball, football fields
Movies	Motion picture theaters
Live entertainment	Other entertainment
Dining for pleasure	Dining rooms
Shopping	Retail trade
EDUCATIONAL	
Visit historical sites	Museums, gardens, zoos, historical sites
Visit interpretive centers	Learning resource centers
Industry tours	Industry centers
PERSONAL	
Nature study	Complementary
Sun bathing	Complementary
Reading	Complementary bookstore
Jogging	Complementary sports stores
Picture taking	Complementary photo services
ENROUTE	
Lodging	Hotel, other lodging
Driving	State, federal highways

Model Estimation

Changes in expenditures in the study region are entered in the regional economic model as corresponding changes in final purchases. Extensive use of matrix methods helps translate market development scenarios into facility operation, maintenance and development outlays, and finally, into corresponding changes in activity participation and related expenditures. Thus, the direct, indirect, and induced expansion in total economic activity associated with the initial relaxation of T/R facility constraints results in corresponding increases in business and household earnings and state and local government revenues.

Effective use of matrix methods begins with the preparation of working tables, which are described as follows:

1. Total developmental and maintenance expenditures (in current and constant dollars) for specified facilities, including initial construction and annual operating expenditures, by year;
2. Total annual and average daily, weekly, and seasonal resident and nonresident participation (in hours) in specified activities, by year;
3. Capacity and expected daily, weekly, and seasonal activity utilization rates for specified facilities, by activity and year;
4. Total annual and average daily, weekly, and seasonal recreation-related expenditures (in current and constant dollars) of residents and nonresidents in specified activities, by type of expenditure and year;
5. Total private recreation-related capital expenditures in specified industry, by type of expenditure and year;
6. Total federal, state, and local government current and capital expenditures for specified industry output, by level of government, type of expenditure, and year; and
7. Total requirements of specified industry output, by economic unit, type of expenditure, and year.

Thus, recreation-related spending for each final demand sector--household, business, and government--is estimated and its distribution by type of facility, activity, and industry is derived.

Activity participation and facility utilization budgets are prepared from the statistical series. The budgets show the proportion of total personal time and money spent in each activity and total business and government spending for each type of facility. From these budgets, the spending coefficients are derived for use in the matrix transformations of recreation-related facility expenditures into corresponding industry output, employment, and earnings effects.

Thus, the use of matrix methods in relating recreation-related expenditures to changes in regional and national input-supplying industries circumvents the need to redefine industry structure. General purpose interindustry transactions tables are as effectively and economically used in T/R industry studies as very costly special-purpose interindustry transactions tables. The special-purpose tables require careful, but still an arbitrary, differentiation of a T/R industry clusters in each region.

In summary, the matrix methods approach in model estimation is implemented in a final series of steps, as follows:

1. Prepare vector of T/R public facility development expenditures [FG];
2. Prepare activity-facility [AFG] matrix of technical coefficients showing distribution of public facility development expenditures (based on activity use) by activity; post-multiply matrix by vector to obtain a new vector [AG] of public facility development expenditures, by activity;
3. Prepare additional activity expenditure vectors for public facility operation [AO], private facility development [AB], nonresident personal spending [AN], and resident recreation-related personal spending [AR];
4. Prepare expenditure-activity matrices of technical coefficients showing distribution of specified activity-related expenditure, by type of public capital goods expenditure [ECG], private capital goods expenditure [ECB] public operating expenditure [EOG], nonresident personal expenditure [EPN], and resident, recreation-related personal expenditure [EPR]; post-multiply matrix by corresponding vector in Step 3 to obtain new vectors [EG], [EB], [EO], [EN], and [ER], respectively;
5. Prepare industry-expenditure matrices of technical coefficients showing distribution of specified type of expenditure, by industry, for public capital goods [ICG], private capital goods [ICB], public operating expenditures [IOG], nonresident personal expenditure [IPN], and resident, recreation-related personal expenditure [IPR]; post-multiply by new vectors [IG], [IB], [IO], [IN], and [IR], respectively;
6. Prepare tables of industry-specific effects on output, employment, and earnings by pre-multiplying industry vectors in Step 5 with appropriate Type I or Type II multipliers;
7. Alternatively, use northeast Minnesota computer simulation model to obtain industry effects from specified T/R industry expenditures.

<u>Data Organization</u>

Organization of expenditure data is prescribed by (1) the data requirements of the economic model (s), and (2) the matrix method of implementing either the regional input-output approach or the regional computer simulation approach in economic impact assessment. Again, the overall structure of the study presented in figure 1 provides the conceptual framework for expenditure data organization.

The final demand sectors drive both the input-output and the computer simulation models. The exogenous demand is represented by the nonresident personal spending in the region. The endogeneous demands are represented by the resident, recreation-related, private capital, and government capital and operating expenditures while the total T/R demand is the sum of the exogenous and endogeneous demands. It is, in part, affected by the direct, indirect, and induced effects of its total demand, which are appropriately viewed as "feedback" effects. The computer simulation approach, as well as the Type II multipliers, include the induced effects of personal spending and incorporate their feedback effect in the final results.

Thus, the task of preparing expenditures matrices for use in the two economic models focuses on the multi-state T/R market and northeast Minnesota's share of each state and substate market. Each regional market, composed of individual states and the rest of Minnesota, is represented by its total recreation-related personal spending. The total spending is a function of total population per capita disposable income, and other variables. The distribution of total spending among recreation focal areas is a function of distance to each area and the perceived quality of each area's facilities (Sutherland 1982). State-sponsored tourism advertising and promotional campaigns are intended to enhance a focal area's image as a provider of unique and fulfilling recreation experiences. Without a quality product, however, the market development programs would fall short of promises.

The overall analytical framework integrates the evaluation of market and product strategies as a decision aid in both market promotion and facility development programs. Coordination of market development and facility development strategies is achieved already through trial and error efforts. As market promotion outpaces facility development, disappointed customers register their dissatisfaction by turning to competing recreation areas. When facility development outpaces market demand, the excess facilities burden both private business and public agencies with high unit costs. The northeast Minnesota study plan focuses on the use of accurate and timely economic information in exploring alternative approaches to recreation resource and market planning and demonstrates their implications for specific industries and sectors in the regional economy.

LITERATURE CITED

Alward, Gregory S.; Palmer, Charles J. IMPLAN: An input-output analysis system for Forest Service planning. IN: Forest Sector Models by Seppala, R.; Row, C.; Morgan, A.; eds. Proceedings of the first North American conference on forest sector modeling, 1981 30 November-4 December; Williamsburg, VA. 1983; 131-140.

Blank, Uel. Duluth Superior's tourism-travel economy. Staff Pap. Ser. P82-14. St. Paul, MN: Department of Agricultural and Applied Economics, University of Minnesota; 1982.

Blank, Uel; Maki, Wilbur R.; Novak, Kathleen. Decision systems research for the tourism/recreation industry. Staff Pap. Ser. P82-22. St. Paul, MN: Department of Agricultural and Applied Economics, University of Minnesota; 1982.

Carrathurs, Gerald E.; Maki, Wilbur R. Simulation of Iowa's public outdoor recreation sector: A decision-oriented research management model. Regional Science Perspectives; 1(1); 1-14; 1971.

Fox, Karl A. The behavioral view of human societies and its implications for systems science. International Journal Systems Science 14(8):895-914; 1983.

Maki, Wilbur R. Assessing economic development options in northeast Minnesota. Staff Pap. Ser. P82-26. St. Paul; MN; Department of Agricultural and Applied Economics, University of Minnesota; 1982.

Minnesota Department of Natural Resources. Minnesota state comprehensive outdoor recreation plan, SCORP. St. Paul, MN: Research and Policy Section, Bureau of Comprehensive Planning and Programming, 1979.

Sutherland, Ronald J. A regional approach to estimating recreation benefits of improved water quality. Journal of Environmental Economics and Management 9:229-247; 1982.

Wicker, Alan W. An Introduction to Ecological Psychology. Monterey, CA: Brooks/Cole Publishing Company; 1979.

Data Considerations in Assessing Economic Impacts of Recreation and Tourism

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The purpose of this paper is to summarize a few of the practical data considerations for estimation of final demand (in the sense of input-output) within the framework of some econometric ideas: the true model, unbiasedness, and minimum variance; and some sampling survey ideas: randomness, sample size, and nonresponse.

The paper begins with a description of recreation and tourism as an example of the household production model in which the household purchases a variety of goods and services (food, lodging, transportation, entertainment, etc.) which are used as inputs in the production of the commodity that provides ultimate satisfaction (recreation or tourism).

Traditional approaches to measuring final demand and secondary economic impacts of recreation and tourism use simple model structures. Most of these models can be identified either as demand related or supply related. Both types are characterized by a multiplicative form where average numbers of tourists or firms are multiplied by average expenditures or receipts, respectively. Because these models are oversimplified, they can easily create errors in estimating final demand.

The major section of the paper examines the problems with estimating final demand by using traditional models and data sources. This examination follows a modified outline of sources of errors in statistical survey work and includes numerical examples of the problems of adequate sample size and aggregation bias. The final section draws conclusions and offers some suggestions for researchers in the field.

RECREATION AND TOURISM AS COMMODITIES

If we wanted to measure the economic impact of the steel industry on a local community, it would probably be necessary to visit only one or a few sites (the mill or mills) to collect the data on total sales, wages, employment, and local tax revenue. If we wanted to measure the impact of the dairy industry on a region, we would probably need to visit a few more sites, but sales and secondary impact measures still could be relatively easily computed as the sum over individual firms. Another estimation approach might be to use the product of average local consumption and the number of residents, and then add the receipts from exports out of the region. In each case the single product that defines the industry is homogeneous and the use to which consumers put it is relatively well understood.

The industry referred to by the name "recreation and tourism" does not produce a single product or even a set of homogeneous products. Furthermore, the goods and services produced are used in a wide variety of ways in the production of recreation and tourism by households. The wide range of tastes and of technologies for recreation and tourism across households creates difficulties in estimating aggregate sales and impacts of the industry when using simple models. Many firms are involved in the industry but they may not produce goods exclusively for recreationists and tourists. The behavior of consumers cannot be characterized easily by their average consumption and, therefore, they are usually separated into a number of tourist categories (e.g., day tripper, overnight hotel visitor, camper, etc.). Consequently the research approaches taken for measuring sales and secondary economic impacts of the recreation and tourism industry need to be different from those taken for single good industries.

MODELS OF RECREATION AND TOURISM IMPLICIT IN TRADITIONAL STUDIES

The calculation of final demand in recreation and tourism economic impact studies traditionally takes one or both of two approaches: demand related (expenditures by consumers) or supply related (receipts by firms in the industry). The two approaches should give identical results. In practice, one approach may give a cross-check on the accuracy of the other or fill a gap in the data available for the other.

The demand related approach is to identify relatively homogeneous consumer groups (day trippers, campers, overnight hotel guests, etc.), estimate the number of consumers in each group (by attendance or registration records, if possible), and estimate average expenditures by members of each group (usually from survey data). Total expenditures on recreation and tourism are derived by multiplying the number of consumers by average expenditures and summing over groups:

$$\text{Final demand} = \sum_{i=1}^{\text{Consumer groups}} (\text{No. of consumers in group}_i)(\text{avg. expenditures}_i)$$

The supply-related approach to calculating final demand is to identify relatively homogeneous industry groups that serve recreationists and tourists, count the number of firms in each group, and estimate average sales to recreationists and tourists by firms in each group. By multiplying numbers of firms by average sales and summing over groups, we get another estimate of total sales by the recreation and tourism industry:

$$\text{Final demand} = \sum_{i=1}^{\text{Industry groups}} (\text{No. of firms in group}_i) \times (\text{avg. sales to tourists}_i)$$

Each approach produces a multiplicative model where the multiplicands are parameters that must be estimated from available data. Therefore the errors in estimation of each multiplicand as well as the product form of the model lead to errors in the estimation of final demand.

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It is easy to extend the ideas of multiplicative models and estimated multiplicands to the calculation of secondary impacts. The use of input-output or multiplier techniques also involve products of estimated parameters. A common example is the use of an average wage-to-salts ratio to estimate wage impacts from final demand.

TYPES AND SOURCES OF ERRORS

When a sample of data is used to generate an estimate of a parameter of the underlying population there is usually a sampling error. In the case where final demand by tourists is the population parameter, a common estimate is the product of the estimated number of tourists and their estimated average expenditures. The sampling error varies from sample to sample and, as the sample size increases and approaches the population size, the sampling error disappears. Therefore it is convenient to discuss an estimator's average behavior over many small samples. The two most common small sample properties are the bias and the variance of an estimator. The bias is the difference between the true parameter of a population (say, final demand) and the average value taken by the estimator over many samples. The variance is a measure of the spread of the values taken by the estimator around its own average in different samples. These properties are related to the sampling error through the average of its square. That is, the mean squared sampling error equals the sum of the variance and squared bias of the estimator. It is convenient to look at the bias and variance separately since an estimator may be unbiased with a large variance or biased with a small variance. To judge overall accuracy, the mean squared error criterion (if it can be calculated) is superior to either bias or variance criteria alone.

Errors Due to the Model

The errors made in estimating final demand by tourists are from two general sources: the multiplicative model, which relates the sample data to the population parameter, and the sample data used in estimation. The accuracy of a model which is the product of several estimated values depends on the properties of the individual estimates as well as the independence of the multiplicands. For example, when final demand is calculated as the product of the estimated number of tourists and the estimated expenditures by the average tourist, the bias and variance of each estimate is compounded in the final demand estimate. Both the bias and variance of their product depend on the independence of the number of tourists and the level of their expenditures. If the estimates of the number of tourists and their average expenditures are unbiased and the two variables they represent are independent, ther their product will be unbiased. Otherwise, the estimate of total tourist expenditures will be biased. For example, if weekend tourists spend less per day than weekday tourists and the former outnumber the latter, the two variables are not independent and the estimate of final demand based on the product of means from random samples will be biased downward.

The variance of the final demand estimate is more complicated; it is not merely the product of the variances. An unbiased estimate of the variance of a product of independent random variables is given by the sum of three terms: the variance of the first variable weighted by the squared sample mean of the second, the variance of the second variable weighted by the squared sample mean of the first, and the negative of the product of the two variances (Goodman 1960). When random variables are not independent, the variance of their product becomes even more complex.

The same properties are true for multiplicative supply-related models where, for example, average receipts are multiplied by the average number of firms. When models comprise products of three or more estimates, the compounding of errors continues.

To illustrate the bias caused by the multiplicative model, consider the case of an impact study of tourism in Westerly, Rhode Island (Tyrrell and others 1982a). In this study a preliminary model was used to estimate the wages paid to local residents by the 35 hotels in the town. Estimated seasonal hotel capacity was multiplied by an estimated occupancy rate to arrive at total occupant days. The latter was multiplied by estimated sales per occupant to arrive at total sales. This was multiplied by an estimated wage/sales ratio to arrive at total wages. Finally this was multiplied by the proportion of wages paid only to Westerly residents by the hotel industry. By the conclusion of the study, all hotels had been surveyed and the final impact and each of the intermediate figures were known. These data permitted us to compare the calculations of the preliminary multiplicative model by using very precise multiplicands (assumed to be unbiased with zero variance) to the exact intermediate and final values. The only errors that would be generated by this process would be those due to dependence among variables. Thus the bias caused by the form of the model could be examined independently of that caused by the data. It turned out that the 35 hotels of Westerly did not constitute a very homogeneous group and that a significant amount of bias was introduced because we had assumed that the variables were independent.

The results shown in table 1 reveal that the first two products were both biased downward; the computed value for occupant days was 7.2 percent below actual and the hotel sales estimate was 31.6 percent below actual. This was caused by a positive correlation between variables: larger hotels had higher occupancy rates and higher room rates (sales per occupant day). The accumulated estimate was 36.5 percent below actual from the two calculations. The third and fourth products were both biased upward: the incremental bias in total wages was +4.8 percent and the incremental bias in Westerly wages was +9.0 percent. The larger hotels had lower wage/sales ratios and lower Westerly/total wage ratios. The accumulated bias dropped to -33.5 percent by the third product and to -27.5 percent by the fourth product. This result illustrates the seriousness of the problem with the multiplicative model.

Table 1.--Bias in a model of local wages paid by the Westerly Hotel industry, Rhode Island

Computation	Actual	Accumulated estimate	Incremental % bias	Accumulated % bias
Hotel capacity	202,758	--	--	--
x Occupancy rate	0.7743	--	--	--
= Occupant days	169,206	156,996	-7.2	-7.2
x Sales per occupant day	$21.01	--	--	--
= Sales	$5,195,806.	$3,298,476.	-31.6	-36.5
x Wages/sales	0.0809	--	--	--
= Total wages	$401,064	$266,847	+4.8	-33.5
x Westerly wages/ total wages	0.9386	--	--	--
= Westerly wages	$345,424	$250,462	+9.0	-27.5

Even precise estimates of the multiplicands did not overcome the bias caused by the form of the model which, in this case, was an underestimate of wage impacts of more than 25 percent. If it was desirable to use the multiplicative model one would need to disaggregate the data into homogeneous groups for which the variables may be less dependent.

Errors Due to the Data and Their Use

The sources of error in estimating final demand related to the use and collection of data can be classified as follows:

- Errors due to the model
- Errors due to the data and their use
  - Sampling errors
  - Nonsampling errors
    - Survey design
      - Insufficient frame
      - Bias in sample selection
      - Inadequate sample size
    - Survey execution
      - Nonobservation bias
      - Measurement errors
    - Data analysis
      - Processing errors
      - Improper statistical methods
      - Faulty interpretations

The first category refers to the multiplicative model described previously. In the second category, little can be said about sampling errors except that if it were possible to interview every tourist and obtain accurate, relevant information from each, then results would have no error. Unfortunately, cost and feasibility usually limit surveys to small samples, and sampling errors will necessarily exist unless entire populations are surveyed.

Nonsampling errors, on the other hand, can be controlled and minimized to a considerable degree. The eight major sources of these errors result from the design and execution of the survey, and the analysis of the data. Sampling methodology and recommended strategies for overcoming the eight types of problems are thoroughly discussed elsewhere (Cochran 1977). However, it seems appropriate to comment on these nonsampling errors as they relate to some of the unique features of recreation and tourism surveys.

Insufficient frame.--It is obviously important to identify the population of recreationists, tourists, or firms in the industry, but a list or area description of the population is frequently inadequate. It is not a trivial matter, however, to design a sufficient frame. It is usually impossible to list tourist populations because of their size. Access to the population of tourists, for example, may be limited to times when they are participating in recreation or tourism activities. Since records of all individual participants usually are not kept, counting the same individual more than once during a season is unavoidable. Thus, attendance records cannot be translated directly into a frame. In addition, it is not advisable to treat an individual counted twice as two different individuals. Different behavior and expenditures may be associated with repeat visitors and one-time visitors.

Bias in sample selection.--Error occurs if the sample is chosen from the frame in such a way that the population is misrepresented. Simple random sampling or stratified random sampling may be sufficient to prevent biased sample selection but it is often difficult to ensure randomness across a season of visitors due to the expense of interviewing. Reweighting observations on the basis of known population characteristics from a second source can reduce some of this bias.

Inadequate sample size.--Often the desired precision of the estimates cannot be obtained from the number of observations in the sample. Increasing the size of a sample is one of the most commonly discussed methods of reducing errors when designing or conducting a survey. This is because the standard deviation of the mean of the sample has a simple inverse relationship to the square root of the sample size. This means that the cost of sampling is the only reason not to reduce errors in this way. It should be cautioned, however, that most biases cannot be overcome by increasing sample sizes.

To illustrate the relationship between sample size and the precision of an estimate, selected results from four tourist surveys conducted in Rhode Island over the past 2 years are given in table 2. Each survey had a slightly different purpose and was conducted in a slightly different manner. All of the survey instruments included a question asking for per capita daily food expenditures during a leisure trip or a vacation. The surveys were of southern Rhode Island beach users (Tyrrell and others 1982b), Westerly, Rhode Island's hotel guests (Tyrrell and others 1982a), Newport International Sailboat Show (NISS) patrons and the Newport Yachting Center's boat manufacturers' rendezvous events participants (Tyrrell 1984). It is convenient to refer to the four as the beach, hotel, boat show, and boating event surveys. By using the formula for the standard deviation of the mean, the four sets of results were used to compute sample sizes necessary for the same relative precision of a per capita food expenditure estimate.

The beach survey was conducted by a single interviewer who spent 15 to 30 minutes with each beach user to complete a multipurpose questionnaire. Considerable care was taken to ensure random sampling. The population of beach users was estimated to be 64,000, of which 352 were interviewed; the cost per observation of the 272 responses that could be used for estimating average food expenditures was $10.79 (including coding and keypunching).

The hotel survey depended on volunteer respondents to questionnaires handed out by hotel managers. There was no follow-up survey and observations were not reweighted to compensate for nonrespondents. The response rate was low and the results are believed to be biased. The population was estimated to be 25,500; 200 questionnaires were distributed to the hotels; 21 useful responses were received and the cost per observation was $3.81.

The boat show survey was conducted during 4 days of the NISS by 10 different interviewers who spent 5 to 10 minutes with each patron. Some measures were taken to ensure random sampling. The population was estimated to be 12,000, of which 492 were interviewed; the cost per observation was $3.00.

The boating event survey was conducted by mail from the list of event participants. No follow-up questionnaire was sent, but the response rate

Table Z.--Sample size and precision of four Rhode Island tourist surveys

Variable	Survey: Beach	Hotel	Boat show	Boating event
Population size (no.)	64,000	25,500	12,000	350
Sample size (no.)	352	21	492	126
Cost/observation ($)	10.79	3.81	3.00	2.67
Mean food expenditures/ capita/day ($)	9.86	16.05	16.69	16.86
Standard error ($)	10.28	9.38	19.38	16.88
Number of observations required for 95% CI of ±10% mean (no.)	417	131	518	78[a]
Total cost for CI ($)	4,500	500	1,550	208

CI = confidence interval.

[a]Because of the small population relative to the sample size, a finite population correction factor was used.

was very high. The population was 350; 126 responded and the cost per observation was $2.67.

It is not possible to compare the average responses to the food expenditure questions because of the difference in the populations surveyed. However, to examine the tradeoffs between sample size, precision, and the cost of sampling by different techniques, the estimated standard errors can be related to a ±10 percent interval around the respective means. A slight modification permits the surveys to be compared on the basis of the number of observations required for a 95 percent confidence interval (CI) of that size. Multiplying this number by the cost per observation gives an indication of the relative efficiency of the different surveys in producing an average per capita food expenditure estimate with the same relative precision.

The results of this comparison are that the boating event survey would require the fewest observations and cost the least to produce a 95 percent CI ±10 percent around the mean; the hotel survey ranked second in observations required and cost; the beach survey ranked third in observations required, but fourth in cost; and the boat show survey ranked fourth in observations required and third in cost.

The simple interpretation of these results is somewhat misleading since the results of the hotel survey were biased. In fact, from other data on Westerly hotel visitors, it was estimated that the bias in this survey was considerable, overwhelming its small variance in its mean squared error (MSE). The other survey estimates were believed to be relatively free from bias so that their MSE's are the same as their variances. Reranking the survey approaches on the basis of their MSE's put the hotel survey last and loft the others in their same relative positions. Because of the size and nature of the bias in the hotel survey estimate, it was estimated that even a sample of 1,000 hotel visitors would not have produced the desired level of precision.

The most successful survey was the one conducted at the boating event. Its advantage was the small population sampled and enthusiastic cooperation of the boaters. The response rate was 36 percent. The boat show survey was also relatively successful. Its advantages were the high response rate because of the interview approach and the brevity of the survey. The length of the questionnaire was the downfall of the beach survey, which took much time to conduct, code, keypunch, and analyze.

Non-observation bias.--A bias results from a lack of measurements for some of the individuals in the selected sample because of failure to locate thorn or from refusals to answer questions by those who were located. This was one of the problems with the hotel survey. It is also a problem with most mail surveys; the boating event survey was an exception. A successful strategy in cases known to the author has been to conduct a series of follow-up reminders, questionnaires, and telephone calls. Even if the respondent does not answer all the questions, it is usually possible to adjust results for biases based on some knowledge of the characteristics of nonrespondents.

Measurement errors.--The difference between accurate information and the response to a question leads to measurement errors. Such errors are commonly caused by a poorly worded question or the failure of a respondent to recall accurate information. Careful design and extensive testing of a questionnaire is the only solution.

Processing errors.--These errors occur in editing, coding, and tabulating results.

Improper statistical methods.--If incorrect assumptions about the distributions of variables are made and the statistical procedures are based on these assumptions, then there will be errors in the data analysis.

Faulty interpretations.--Errors in data analysis are made if the results from one sample of the population are incorrectly extrapolated to other samples, or when the meaning of survey responses are altered by erroneous induction or the careless use of words.

All of these errors are serious and most can be avoided by careful attention to details of the project.

CONCLUSIONS AND RECOMMENDATIONS

This paper has attempted to examine data collection and use in estimating final demand by tourists. The approach has been to review the implications of the traditional multiplicative model and the procedures by which the multiplicands are estimated. There has been no attempt to identify all possible sources of data for this typo of analysis, which is done elsewhere (Goeldner 1980; WV Univ. 1981). Furthermore, data availability is a problem that has no general solution but one that must be solved by local research. The focus here has been on two types of error, bias and variance, and on the general sources of these errors in traditional research efforts.

Four recommendations are offered:

1. On the choice of a model for final demand. Since tourism is a multigood, multiservice industry, a very complex model is implied. However, limitations of data will usually permit only the use of simple models. If the traditional multiplicative model is used, the biases caused by correlations between variables should be accounted for. The simplest way is to disaggregate and use a sum of products over the most homogeneous groups possible.

2. On sample size. The required sample size can be calculated from a desired degree of precision and a previous estimate of the standard error of a variable. This calculation does not, however, account for the bias which may be present in the estimate used. Also, a large sample size will not generally overcome biases in sampling procedures.

3. On the use of secondary data. Make use of all that is available since it is usually very inexpensive to obtain. However, select only data that can be related to final demand by a reasonable and relatively simple model. Also, do not neglect the need for measures of variance in these data.

4. On survey design and execution. Be as concise as possible in asking survey questions, and test questionnaires extensively. The cost of information sometimes increases more than proportionately to the length of a questionnaire. Finally, poor survey designs and executions are the major causes of biases. It helps to keep the mean squared error criterion in mind.

LITERATUKE CITED

Cochran, William G. Sampling techniques. New York: John Wiley & Sons; 1977. 400 pp.

Goeldner, Charles R. Data sources for travel and tourism research. In: Hawkins, Donald E.; Shafer, Elwood L.; Rovelstad, James M., eds. Tourism marketing and management issues. Washington, DC: George Washington University Press; 1980: 277-290.

Goodman, Leo A. On the exact variance of products. Journal of the American Statistical Association 55: 708-713; 1960.

Tyrrell, Timothy J. The economic impact of the boating events at the Newport Yachting Center in 1982 on the City of Newport, Rhode Island. Marine Technical Report 86. Kingston, RI: University of Rhode Island; 1984. 30 pp.

Tyrrell, Timothy J.; Emerson, William K.B.; Molzan, David E. The economic impact of tourism on Westerly, Rhode Island. Bull. 433. Kingston, RI: University of Rhode Island, Agricultural Experiment Station; 1982a.

Tyrrell, T.J.; Morris, D.M.; Alba, A. The 1981 Rhode Island beach use and value survey: survey design and preliminary results. Working Pap. 10. Kingston, RI: University of Rhode Island, Department of Resource Economics; 1982b.

West Virginia University. Creating economic growth and jobs through travel and tourism. Morgantown, WV: West Virginia University, Bureau of Business Research, College of Business and Economics; 1981. 317 pp. (Prepared for the U.S. Department of Commerce.)

Computerized Models for Assessing the Economic Impact of Recreation and Tourism

Robert C. Bushnell and Matthew Hyle [1]

INTRODUCTION

Many approaches to national economic modeling have been taken. When the word "impact" is used, it is generally true that it is the disaggregate interactions of the economic process that are being studied. Simulations and multiple-equation econometric models sometimes fill this role, but most often it is input-output analysis that is employed.

At the national level, the Bureau of Economic Analysis (BEA) of the U.S. Department of Commerce expends much time and painstaking effort in establishing the classification and flows of payments that make up the national input-output model. While a number of small area models have been constructed and utilized at the state and local level, the effort involved in compiling the data is usually more costly than the study area can afford. Hence, in recent years the attempt to develop regional or small-area input-output models by using so-called non-survey methods has increased. In the last 10 years, a number of systems have arisen which generate small area, state, or regional models from the technical coefficients matrix of the U.S. National Input-Output model. Three of these models will be discussed.

RIMS II Modeling System

The first such system is the so-called RIMS II, constructed and supported by the Regional Economic Analysis Division of the BEA.

RIMS II (Regional Input-Output Modeling System, version II) uses the 1972 BEA 496 input-output national model as the basis for the regional coefficients. The coefficients are modified by the use of the Regional Location Quotient (LQ) technique:

> the national direct-requirement-coefficients matrix is made region-specific by using 4-digit SIC location quotients. According to this mixed-LQ approach, BEA county personal income data, by place of residence, are used for the calculation of LQ's in the service sectors, while BEA earnings data, by place of work, are used for the LQ's in the non-service sectors. The LQ's are used to estimate the extent to which direct requirements are supplied by firms within the region. (Cartwright and others, 1981)

Simple location quotients are defined by the following relation:

$$LQ(i) = \frac{E(i,r)/E(*,r)}{E(i,n)/E(*,n)} \qquad (1)$$

where: $E(i,r)$ = Earnings in the ith industry in the rth region,
$*$ = the sum over all industries, and
n = the sum over all regions.

Hence the concept is the ratio of the proportion of industry i's earnings of all earnings in region r to the similar proportion of industry i's earnings in the nation as a whole. An industry in which the region specializes will have an LQ greater than 1; an industry in which the region does not specialize will have an LQ less than 1.

If

$a(i,j,r)$ is the proportion of the total output of the regional industry j that is accounted for by the purchases of inputs from regional industry i, and

$a(i,j,n)$ is the national direct-requirements coefficient,

the relationship is:

$$a(i,j,r) = LQ'(i) * a(i,j,n) \qquad (2)$$

where: $LQ'(i)$ is $LQ(i)$ if $LQ(i)$ is less than 1 or 1 if $LQ(i)$ is greater than 1.

This latter condition reflects the fact that the supplying industry will certainly not supply more than the demanding industry requires, even if the supplying industry is substantiai.

The household row is derived from the national row by assuming that the value added/gross output ratios from the national model hold for all regions. The household column is derived from the

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national vector. The national vector is scaled down by multiplication first by (1-T(r)), where T(r) is the average regional tax rate, and then by C(r), where C(r) is the national after-tax consumption rate as measuredby the ratio of National Personal Consumption Expenditures to National Disposable Personal Income. After these adjustments, each member of the vector is multiplied by the corresponding LQ(i,r) as was described previously for the industrial columns.

Since the regional A matrix has now been developed, no estimate of regional demand or gross output is needed since simply inverting the (I-A) matrix will provide the multipliers. If the A matrix does not include the household sector, the multipliers include the direct and indirect effects (Type I multipliers). If the A matrix includes the household sector, the multipliers include all of the direct, the indirect, and the induced effects (Type II multipliers).

The RIMS II system also includes some "shortcut" methods where persons wishing to develop overall impact or earnings multipliers may do so without undertaking the Inversion of the full (I-A) matrix.

The REMI Models

The second model to be considered is maintained by Regional Economic Models, Inc. (REMI). As is the case with RIMS, the REMI model is based on the latest available national Lnput-output model furnished by the BEA. It, too, relies on multiplying each of the national coefficients by a factor in order to downscale the multiplier from national impacts to figures appropriate for the smaller region.

The REMI approach, however, is different; it uses a concept termed "Regional Purchase Coefficients" (RPC's). The RPC is the proportion of a used commodity purchased by a using industry from within its own region. Unlike the LQ's which are applied to the Lnverted technical coefficient matrix, the RPC's are applied to the technical coefficients directly, after which the technical coefficient matrix is inverted in the normal way. In general, the data required to estimate the RPC's directly are not available, therefore they are estimated by REMI from a regression equation.

The basic idea behind the regression estimation is that regional purchases should be a function of relative delivered costs where deliveredcosts are the sum of production and transportion costs. Relative production costs should be a function of relative wages, relative other costs, and a relative scale of production and transportation costs, which is a function of relative average shipment distances for local versus nonlocal purchases. Average shipment distance is posited as being a function of the proportion of shipper-to-users Ln the region to shippers-to-users Ln the nation, and the proportlon of land area In the region to land area in the nation.

Using this theoretical structure, a regression relation was developed for estimating the log of the RPC for each of 19 industry groups as a linear function of the ratio of industry per-worker wages in the region to the nation, the ratio of industry employment in the region to the nation, the ratio of industry national output tonnage to industry total wages, the location coefficient LQ, (as defined for the RIMS model), and the ratio of the land area of the local area to the land area of the nation.

Since the independent variables, the RPC's themselves, are not directly measureable, it was also necessary to infer values for some of these in order to estimate the coefficients of the model. This was accomplished by REMI through knowledge of the output of each commodity in the local region.

$$RPC(i,r) = P(i,r) * \frac{Q(i,r)}{D(i,r)} \qquad (3)$$

where: Q(i,r) = amount of the commodity i produced in r,
D(i,r) = total use of i in r, and
P(i,r) = proportion of i produced and used in r

The Q's can be measured; the D's are obtained by applying the technical coefficients to the Q's and then adding other use as by households, governments, capital expenditures, foreign exports, etc. The limiting factors were the P's. 293 P's for 19 commodities could be calculated from the information in the Census of Transportation. Thus 293 P's were measured to calculated 293 observations of the RPC's. An equation to estimate the RPC for any region based on relative wages, relative employment, the LQ, the weight to wage-bill ratio, and relative land area was calculated. In addition, 6 of the 19 comodities have non-zero dummy variable weights that are utilized. This equation is then used to calculate the RPC for any region for any of the 500 commodities in the full model (for more detail, see Stevens and others, 1980).

The IMPLAN Models

The third set of models to be considered, called IMPLAN, were directed and funded by the USDA Forest Service and produced by Engineering Economics Associates, Inc. Like the other models, this set also depends on a national model. As part of the effort, however, the Forest Service had the 1972 national model updated to 1977 for this project. The Forest service is continuing this effort and since the 1977 National Input-Output model was released by the BEA in 1984, the 1977 model is being updated to 1982 in the same manner.

IMPLAN is different from other models, however, because the Forest Service wished to have a model for every U.S. county (or parrish) which would aggregate into state models which, in turn, would aggregate into the original U.S. model. Hence this system produces a flow or a transactions table for each county (or aggregation of counties) which is then converted into a transaction matrix and then inverted to form the multipliers. As with the other systems, both direct-and-indirect (Type I) and direct-and-indirect-and-induced (Type II) multipliers may be produced.

With this goal, the task of Engineering Economic Associates was to find justifiable proxies by which to break down the components of demand to estimate final demand vectors for:

- Personal consumption expenditures
- Gross private domestic investment
- Foreign exports
- Inventory change
- Federal government expenditures
- State & local government expenditures

In addition the following other elements must be estimated for each sector for each county:

- Gross domestic output
- Employment
- Components of value added
  - Employee compensation
  - Property type income
  - Indirect busines taxes

The task is complicated by the fact that. at the state and county level, most of the economic data sets provided by government agencies are characterized by having certain elements deleted. This is due to the legal restrictions on the release of data gathered by government agencies in surveys of individual firms. Therefore, techniques that generate proxy series were employed. These proxies could be balanced to known totals; for example, for the sum of all the states at the national level, and for the sum of all the counties in a state.

An advantage of this process is that the flow table is generated for the local area. It may be inspected and altered, if desired, before processing into technical and inverse form. A model for any multicounty area (standard metropolitan statistical area - SMSA, BEA region, other aggregation) may be constructed simply by aggregating the county data before applying it to the national coefficient matrix. (Further information can be obtained from Engineering Economic Associates, Inc., 1700 Solano Avenue, Berkley, CA 94701.)

ASSESSING THE ECONOMIC IMPACTS

All of these models are, in theory, equipped to assess the economic impacts of tourism and recreation. In practice, however, each model was designed with different goals in mind so that the appropriateness of a model will, in part, depend on how well the model can meet the various demands placed on it by the specific problem or user. While the criteria for evaluating a model will be shaped by the particular problem that is under scrutiny, there are five issues that should he considered in any application of a regional Input-output system: (1) the level of regional disaggregation, (2) the level of sectoral disaggregation, (3) the definitional basis of the sectors (commodity versus industry classifications), (4) the relation of the direct requirements matrix to the region(s) under scrutiny, and (5) the measurement of final demand. One should note that these five issues arise quite naturally out of the modeling process and therefore cannot he avoided. Consequently, the following discussion should not he construed as a criticism of any particular model or technique but only as an aid in the evaluation of a model's suitability in the use of measuring economic Impacts.

To relate and clarify the issues and to give a review of the basic input-output relationships, take the following hypothetical situation. A family from Windsor, Ontario, takes a week's vacation in the Detroit metropolitan area. They drive their car through the Detroit-Windsor tunnel and stay in a hotel in downtown Detroit. Each day they drive around the area visiting landmarks and parks. Their budget of $2,000 (American) is spent on lodging, gasoline, parking fees, admission fees, boa: rentals, and food (purchased either at restaurants or at grocery stores). A natural question to ask is "What is this family's economic impact on the Detroit metropolitan area? What will the changes be in total output and where?"

In theory, an input-output model can trace the effects of this family's expenditures and their repercussions throughout the Detroit area's economy by employing a basic input-output identity. Within an input-output table or model, the total dollar sales (or output) for each sector must equal the sales to all sectors (including itself) for use as inputs into their production process (intermediate use) and sales to all final consumers (final demand). Using algebraic notation, this basic definition is written as:

$$q = Aq + f \qquad (4)$$

where: q = a vector of sectoral output in dollars,
A = a matrix relating the input requirements per dollar of output, and
f = a vector of sectoral final demand in dollars.

Combining similar terms yields a solution imbedded in all input-output models:

$$q = (I-A)^{-1} \qquad (5)$$

where: I = the identity matrix.

The importance of equatton (5) is not the mathematics but that it shows, in theory, that only final demands and the direct requirements (A) matrix are needed to measure total production. (See Mierynk, 1965 or Richardson, 1972 for a more detailed explanatlon.) In practice, equation (5) shows that if final demands are measured correctly, and Lf the direct requirements matrix accurately portrays the interrelationships within the economy, and if the matrix corresponds to the definitions and conventions used in measuring the final demands, then total production can be measured.

These conditions may seem to be quite obvious and harmless because each one of the input-output models discussed in the first section do give answers to many types of questions similar in nature to the example. Yet, the reliability and accuracy of those answers will depend on how well the chosen model adapts to the five generic issues. The first issue (regional disaggregation) provides a straightforward example of the problem.

Regional Disaggregation

Ideally, one would hope to have the most disaggregated model possihle in order to minimize any errors due to aggregation problems. However, many practical considerations conspire to restrain the manageable level of disaggregation. Regardless of those considerations, the model to be chosen should, as closely as possible, resemble in its level of regional disaggregation the requirements of the problem to be examined. For this example the model that has, among other features, input-output relationships for the city of Detroit (or at least Wayne and Oakland Counties) should give the most reliable measurement of the economic impact. Any model that has the State of Michigan as its lowest level of disaggregation should be avoided in this case since it will require substantial adjustment in order to yield reasonable estimates of the economic impact on the Detroit area.

Sectoral Disaggregation

This issue is very similar to that of regional disaggregation. Given the spending pattern of the hypothetical tourist family, the ideal model should have among its different sectors Hotel - Standard Industrial Code (SIC) 7011, Retail gasoline (SIC 5541), Parking lots (SIC 7523), Restaurants (SIC 58), and Grocery stores (SIC 5411).

In practice, the retail trade sector (any SIC of 5000-5800) presents two special problems. First, although there is a wide diversity in the types of retail establishments, most models have only a few retail trade sectors (mainly due to data restrictions). This aggregation may impose some measurement bias with the extent of the bias depending on how differently the various types of retail stores use their various inputs. Second, within the framework of input-output analysis, a retail store does not produce any commodities but only a service by acting as a conduit between the actual producers and final consumers. Consequently, any commodity purchased at a retail establishment should be "stripped" of the "service" component and counted in the commodity's production sector. For our example, if the Canadian family purchased a hamburger from a restaurant, then the value of the restaurant service would be subtracted from the dollar value of the hamburger and then the final demands of Meat (SIC 2010) would be increased (see the discussion on the measurement of final demand).

Definitional Basis

The third issue is the commodity versus industry definition of a sector. Input-output models can use either a commodity definition, which groups products or services with similar SIC codes into a sector, or an industry definition, which groups establishments into a sector on the basis of similar primary product. Establishments can produce more than one commodity, but only one commodity can be the establishment's primary product (typically determined by the product or service which has the largest dollar volume). A common example of the multicommodity establishment is the local Sears store. This store may be offering, under one roof, Auto repair services (SIC 7500), Appliance repair services (SIC 7600), Optometrist's services (SIC 8042), Upholstery cleaning (SIC 7217), Real Estate brokering (SIC 6531 and 6610), Insurance brokering (SIC 6400), and Security brokering (SIC 6200) along with its traditional retail operatlons. If the largest dollar volume of sales is in auto repair, then this particular establishment would be counted under the auto repair industry instead of the department store (SIC 5800) industry. (See ten Raa and others, 1984, for a discussion of secondary products in a broader context.)

As a result, a user should be aware of the consequences of misapplying the sectoral definitions. If the user wishes to estimate the economic impact caused by the change in demand for a commodity but is using a model with an industry definition of a sector, the estimate could be inflated if that industry has inputs that are used in the production of other dissimilar commodities. From our example, if the Canadian visitors purchased cheese from a grocery store and one placed that cheese purchase in the cheese industry final demand sector, then one will find an increase in the use of milk, enzymes, and sugar since many cheese establishments also produce ice cream.

Fortunately, the errors stemming from this definitional problem are likely to be small when estimating the economic impacts of tourism and recreation. The multiproduct establishment is most. commonly found in the manufacturing sectors while the service sectors (with the exception of department stores) tend to provide a single service. Because the tourism and recreation industry is largely composed of the service sectors (or at least in most policy questions this is true), this problem may not arise. In addition, most of the models have a "make" table (which shows the distribution of commodities that. each industry makes for the nation) available to transform data from one definition to another. Still, one is better off being aware of the potential complications in order to assess possible errors in the estimates.

Direct Requirements (A) Matrix

The fourth issue revolves around the applicability of a model's direct requirements matrix to the regional area under question. Every model in this paper uses the direct requirements matrix for the national economy as a starting point (see U.S. Department of Commerce, 1984 for the latest update). This matrix based on national averages is then imposed on a region and, in effect, split into a local matrix (in order to capture local impacts) and an "import" matrix, but the overall requirements always equal the control imposed by the national average. Consequently, the regional input m-lx (regardless of the Lnput's geographical origin) for a dollar's worth of a sector's output is assumed to equal the national average for that sector.

The assumption of identical input requiremens among different regions may not be completely desirable, but it is certainly not unreasonable in the absence of any additional information. Yet, this assumption results in some mismeasurements, with the extent depending on how much the regional use differs from the national average. (One suspects that as the region increases in size this difference grows smaller.) For example, the electric utility sector in the national matrix combines nuclear power plants, dams, and coal-fired plants, but a region (especially a county or group of counties) will use electricity from only one type of plant. Thus the use of a national average may misrepresent the economic impact. One may argue that in the tourism and recreation industry, which is dominated by services, this effect can be neglected because service sectors generally use the same technologies. This is open to question, however, because some regions with relatively high labor costs may substitute capital equipment for labor, which should change the overall input requirements for those sectors.

If a user has additional Lnformation about the structure of a region's economy, then the estimates of an economic impact could be improved if that information could be incorporated into the model. Consequently, another feature of a prospective model to keep in mind is that model's capability of incorporating any additional information about the target. region's economy. Not only should the capability for incorporation of new data be present but the process should he relatively easy.

Measurement of Final Demand

In order for an input-output model to estimate economic impacts, the categories of final demand (f vector in equation (2)) should correspond as closely to the sectoral definitions as those of the direct requirements matrix to ensure a more accurate measurement of the economic impact. In general, the closer the correspondence of the two, the more reliable is the final measure.

As mentioned, a slight technical problem occurs with purchases from retail establishments. The most desirable outcome is to have a large amount of detailed information concerning these purchases. Prom the Canadian visitor example this would mean that, ideally, one would have an accounting for each meal by item -- Monday's breakfast was two eggs, three bowls of corn flakes, etc., and each retail purchase by item. However, that detail is not always available. If it is not, then the model or modeler should have some well-defined method to "break-up" these types of purchases.

SUMMARY

The discussion has focused on a few potential pitfalls or issues that should be addressed by any researcher using regional input-output models. Becoming aware of the issues allows the user to more carefully assess the suitability of a particular model to the demands of the analysis. However, these are simply guidelines and cannot help unless the problem to be analyzed has been clearly stated in terms that an input-output model can handle. There can be no substitute for careful consideration on the part of the user in structuring the research problem. Part of that careful consideration should include the limitations and strengths of the user's particular model, not only in light of these few guidelines but of the entire structure of the model.

LITERATURE CITED

Cartwright, Joseph V.; Beemiller, Richard M.; Gustely, Richard D. Regional input-output modelling system. Washington, DC: U.S. Department of Commerce, Bureau of Economic Analysis, 1981. 139 pages.

Mierynk, William H. Elements of input-output economics. New York: Random House, 1965. 157 pages.

Richardson, Harry W. Input-output and regional economics. New York: John Wiley & Sons, 1972. 294 pages.

Stevens, Benajmin H.; Erlich, David; Bower, James. Estimation of regional purchase coefficients and their use in the construction of non-survey input-output impact models. Reg. Sci. Res. Inst. Discuss. Pap. 119. Amherst, MA: Regional Science Research Institute, 1980. 49 pages.

ten Raa, Thijs; Chakraboly, Debesh; Small, Anthony. An alternative treatment of secondary products in input-output analysis. Review of Economics and Statistics 66(1):88-97, 1984.

U.S. Department of Commerce. The input-output structure of the U.S. economy. Survey of Current Business 64(5):42-84, 1984.

Assessing the Secondary Economic Impacts of Recreation and Tourism: Work Team Recommendations

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The U.S. Forest Service and U.S. Army Corps of Engineers are major providers of leisure opportunities. The approximately 91 million acres of public land in the National Forest System include more than 25 million acres of Wilderness, 640 miles of Wild and Scenic Rivers, and 24,000 developed and dispersed recreation sites. Similar figures for the Corps of engineers include 11 million acres of land and water, 442 lakes and other project areas, and over 3,800 recreation areas. The amount of public consumption generated by this enormous federal supply of recreation opportunities is substantial: Forest Service--233 million visitor days (fiscal year 1983); Corps of Engineers--469 million recreation days of annual use.

Although the Forest Service and the Corps are Integral parts of the leisure industry, little is known about the secondary impacts of the federal supply on community, regional, and national economic development. To clarify that statement, it is necessary to distinguish between primary and secondary impacts that result from federal investment in providing leisure opportunities.

Primary or direct impacts include benefits to recreation users and costs to the providers. These are the measures needed to derive benefit-cost ratios, which guide investment decisions. A great deal of research since the mid-60's has been directed toward determining the direct benefits of recreation developments. Travel cost and contingent valuation methods are the two most widely used and recommended procedures (Dwyer et al ., 1977; Walsh, 1984).

A similar effort has not been aimed at developing concepts and procedures for examining secondary or indirect economic impacts of supplying recreational services and facilities. Secondary impacts include benefits and costs beyond those to users and providers. Secondary impacts accrue to communities, regions, and the nation in the form of income, employment, retail sales, taxes, and development of related industries (recreational equipment, information, service, and development industries, such as second homes, condominiums, and resorts).

Agencies like the Forest Service and Corps of Engineers require information on secondany economic impacts to make financial allocation decisions. In addition, demonstration of the important role that such agencies play in local, regional, and national economic development would likely provide more impetus for private and nonfederal provision of recreation opportunities on or near Corps projects and National Forests.

STATEMENT OF THE PROBLEM

A system for deriving estimates of the secondary economic impacts of recreation is currently lacking, primarily because available methods are costly. Ideally, the researcher would want to generate a unique multiplier for each economic sector in which first-round recreation spending occurs. The methodology to derive unique multipliers exists, but the large data requirements make this procedure expensive and time-consuming (Marino and Chappelle, 1978; Leistritz and Murdock, 1981). The alternative to collecting a large amount of data over time is to use input/output (I/O) models developed by government agencies and assume that their multipliers are accurate. However, existing I/O models generally are not based on sufficiently detailed breakdowns of the sectors impacted by recreation and tourism (e.g., marinas, recreational equipment). Thus, the reliability of such multipliers is unknown (Gartner and Holecek, 1982; Stynes and Holecek, 1982). To restate the problem, the secondary impact assessment process for other U.S. industries (e.g., manufacturing) is reasonably clear and well-developed, but (a) the appropriate economic impact assessment procedures for recreation are unclear, and (b) the necessary data for conducting such assessments are often missing.

OBJECTIVES

To help solve the problem stated above, the following objectives were pursued:

1. To evaluate the state of the art in determining the secondary economic impacts of federal recreation facilities and services at local, regional , and national level;
2. To prepare a detailed economic impact assessment procedure and data collection methodology to be employed by the Forest Service and Corps of Engineers in determining the impacts stated in Objective 1.

SCOPE

A range of methods was needed to achieve these objectives. Computerized literature searches, personal communications, and library research were the primary means of achieving the first objective. Objective 2 was achieved through contacts with key government agency, university, and industry professionals. These contacts were

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necessary in order to synthesize a tremendous amount of information into recommendations for the appropriate variables, models, procedures, data sources, and economic sectors to be employed in the economic impact assessment of recreation. Some of these contacts were made by telephone and letters. A majority of the information obtained for achieving Objective 2, however, emanated from a technical meeting on assessing the secondary economic impacts of recreation and tourism held at Michigan State University in May of 1984. The goal of this meeting was to bring together a few key professionals to identify the best available technology and data for economic impact assessment of recreation and tourism. This paper reports the methodology employed during the meeting to meet study objectives as well as the results of the meeting. The meeting's methodology was highly successful in transfering technology and in identifying important considerations for economic assessment of recreation. The full report (Propst and Gavrilia, 1984) contains the results of all methods used to satisfy the two study objectives.

PROCEDURES

The technical meeting on assessing the secondary economic impacts of recreation included both presentations by invited speakers and a workshop. A series of steps was followed inorder to select the invited speakers. During the fall of 1983, a master list of regional economics professionals was compiled through personal communications with resource and agricultural economics faculty at numerous U.S. universities. At the same time, Forest Service and Corps of Engineers researchers, planners, and administrators, were contacted to compile a list of issues that both agencies wanted to resolve. Potential speakers were sent a letter explaining the purpose of the meeting, listing the identified issues, and seeking their interest. In addition, potential speakers were asked to indicate from the list of issues the top three on which they would be willing to prepare a presentation. Potential speakers were told that the presentations of the invited speakers would be published and all travel expenses paid. A list of invited speakers emerged from this initial wave of correspondence (see Appendix A). The issues covered in papers and formal presentations by the eight invited speakers are listed in Table 1. The formal presentations took approximately 1 day and provided the necessary background for-the workshop portion of the meeting.

The workshop portion of the meeting lasted 2 days. During this time, participating Forest Service and Corps of Engineers researchers with economics backgrounds became actively involved in discussions. These participants are also listed in Appendix A. For 2 days, all meeting participants were divided into work teams of four to five members and asked to complete the tasks stated in Table 2. These tasks were written to be more specific reiterations of the issues covered the previous day by the invited speakers. Work teams were arranged so as to contain both university and agency representation. All teams worked on the same tasks, one at a time, after being given the following instructions:

"There is a specific environment or mood we would like to create in each group in order to be most efficient in satisfying meeting objectives. This mood can result if you keep the following points in mind:

a. we have a series of specific problems to solve;
b. all of you have ideas for how to solve these problems;
c. the goal for the work teams is not necessarily to reach a consensus but to discover new ways to solve these problems; how can this be done?

- carefully listen to what others have to say:
- feel free to respond in an open, spontaneous way (the aim is to have an exciting exchange of ideas;
- discuss ideas, do not debate them because we want to encourage divergent

Table 1.-- General issues covered in formal presentations during the "Technical Meeting on Assessing Secondary Economic Impacts of Recreation and Tourism," Michigan State University, 14-16 May, 1984.

1. What is the state of the art in developing multiplier for assessing the secondary economic impacts of recreation and tourism?

2. What methods besides I/O analysis are available for assessing the secondary economic impacts of recreation and tourism?

3. How should regions be defined and sectors disaggregated in existing I/O models to account for the secondary economic impacts of recreation and tourism?

4. What are the data requirements and appropriate sources of data for assessing the secondary economic impacts of recreation and tourism?

5. What are the strengths and weaknesses of using I/O analysis to assess the secondary economic impacts of recreation and tourism?

6. What computerized models for assessing the secondary economic impacts of recreation and tourism are currently available and what are their strengths and weaknesses?

7. What are the data requirements and sources of data for measuring the economic impacts of the Forest Service and the Corps of Engineers supply on leisure/tourism industries, such as recreational equipment, second homes, recreational vehicles, and boatinq?

points of view and keep ideas flowing, not cut them off;

d. the purpose of the work teams is not necessarily to change anyone's mind;
e. everyone has useful ideas and information--we're here to combine all this into new ideas.

Thus, the environment just described is a problem solving mode. In this mode, consensus is not necessary. I will converge all of your ideas and recommendations after you leave here. Then, I will mail what I converge from your recommendations to you for comment. This divergence and convergence of ideas will become part of the proceedings.

So, what you do in these work teams is not the end but only the beginning of the work that needs to be done in the economic impact assessment of recreation and tourism."

After they discussed a task, work teams were given 1 to 1 1/2 hours to develop solutions. Groups were asked to designate someone to jot down their recommendations on large sheets of paper and someone to be the spokesperson. At the end of the allotted time, the spokesperson of each team (four teams in all) took 5 to 10 minutes to present the team's recommendations to the entire audience. A question and discussion period followed each team's presentation of the six task solutions. The large sheets of paper containing the recommendations remained posted around the room for the duration of the meeting.

The same process was followed for each of the six tasks, but the composition of the teams was changed after each task to give each participant the opportunity to interact with all others. All work team recommendations and discussions were taped. Synthesis of the material contained in the tapes, teams notes (from the large sheets of paper) and reviews of this synthesis by meeting participants provide the results that follow.

The method utilized in bringing together a group of professionals and eliciting solutions to specific problems was a creative problem solving process fashioned after Noller et al. (1976, 1981) and Hare (1982).

RESULTS

Table 2 contains full descriptions of the six tasks the work teams were asked to complete. The tasks are restated in abbreviated form in this section along with specific recommendations of the work teams for accomplishing the tasks.

Task 1: Short Cut Methods

Work teams were asked to describe "short cut" methods (methods other than I/O analysis) which the Forest Service and Corps of Engineers could use to obtain reasonable estimates of the economic impacts of recreation. The four work

Table 2.-- Tasks completed by work teams in the "Technical Meeting on Assessing Secondary Economic Impacts of Recreation and Tourism," Michigan State University, 14-16 May, 1984.

1. Describe and provide reference to other methods besides I/O analysis for assessing the economic impacts of recreation and tourism. Are there one or two "quick and dirty" methods that Forest Service and Corps personnel could use to obtain a fairly reasonable estimate of such impacts?

2. Recommend appropriate ways for the Forest Service and Corps of Engineers to define regions and disaggregate sectors in I/O models to account for economic impacts of recreation and tourism. That is, list the sectors impacted and recommend ways to separate them from commonly used sectors. Also, describe the problems associated with measuring these impacts at the local vs. state vs. regional vs. national levels. Recommend areas for future research.

3. Indicate the means (research, funding, administrative changes, etc.) by which the Forest Service economic impact model, IMPLAN, may be modified to account for recreation and tourism impacts. Describe the cost/accuracy trade-offs of making such modifications. Recommend other I/O models that may be modified in this fashion.

4. Provide a list of variables that should be assessed and questions that should be added to nationwide federal estate recreation surveys (mailback and personal on-site interviews) relative to economic impacts. The goal here is to create consistency in data collection and analyses that federal agencies routinely perform to evaluate the economic impacts of recreation and tourism.

5. Describe the role of the prfvate sector in providing data tha would satisfy the goals of the Forest Service and Corps of Engineers in determining the economic impacts of recreation and tourism. To perform this task, you should answer the following questions: Are data from the private sector necessary? What types of data? What strategies should be followed to obtain such data given that some of it is proprietary in nature?

6. Articulate the changes that need to be made to the data collection and analysis procedures of the Bureau of Economic Analysis to account for the economic impacts of recreation and tourism. Also, indicate the pros and cons of a "Census of Tourism ," similar to the Census of Manufacturing or Agriculture.

teams described six such methods: response coefficients, minimum requirements, use of existing multipliers, brainstorming, Delphi process, and similar sites.

Response Coefficienct Method

Response coefficients (RC's) are the same as traditional multipliers except that RC's are reported in different units of analysis to ease interpretation (personal communications with Adam Rose, West Virginia University, 1984). For example , a new industry in a region may generate 500 new jobs in direct employment in that industry. An I/O analysis may reveal an employment multiplier of 2 indicating that the total employment impact (direct, indirect and induced) of the new industry is 1,000 new jobs (500 x 2). Response coefficients merely transform the 1,000 jobs figure into number of jobs per $ expended on an activity. Thus, if 1,000 new jobs were generated and $1 million of goods were produced, the RC would be 1,000 jobs/$ million or 1 job/$1,000 output. Nothing has been done to the multiplier; the only change occurs in the manner in which the employment impact is reported. The RC transformation may be applied to Type I, II, or III multipliers.

The big advantage of RC's over multipliers is relative ease of interpretation. Since multiplier are, in effect, partial derivatives, they are sometimes ambiguous to interpret and provide the opportunity for misleading conclusions. This is because it is not necessarily true that sectors with high multipliers have the highest impacts in a region. For example, Rose et al. (1981), using I/O analysis, derived multipliers to determine which alternative solar energy technology would have the greatest employment impact on the City of Los Angeles. The employment multiplier for solar energy was much higher than that of weatherization. However, standardizing employment impacts by translating them into RC's (number of jobs created per million dollars spent) revealed just the opposite finding: more jobs created by weatherization than by solar energy. The authors explain this discrepancy by noting that traditional employment multipliers for solar energy are high partially because solar energy is expensive to produce and thus requires more production than weatherization. However, the respending effects of weatherization generate more employment than the production effects of solar energy.

A general mathematical expression of how to calculate regional impacts using RC's is:

Total regional impact = total expenditures X RC for income or employment; where RC = the direct, indirect, and induced effect per amount spent in dollars.

The conventional multiplier is defined as total effects (direct, indirect, and induced) throughout an economy divided by direct effects in a given sector or the proportion by which total effects exceed direct effects. By definition, then, a large multiplier may result because of a small denominator (direct effects). In other words, the multiplier may represent a large multiple of a small base. Furthermore, the relationship between total effects and direct effects will vary greatly among sectors, meaning that there is no standard for comparison of multipliers by sector. The RC is simply the numerator of the conventional multiplier equation (total effects). The RC permits a standard for comparison across sectors, removes the ambiguity in multipliers, and maintains the basic meaning of the multiplier concept.

Archer (1977) also provides evidence for and formulates the response coefficient concept. Instead of the term "response coefficient ," however, Archer uses "normal multipliers" noting that multipliers expressed as partial derivatives are valueless as planning tools without additional information which relates endongenous income (or employment) to units of exogenous spending.

The advantage of RC's over traditional multipliers has already been discussed. There are also two major drawbacks to the RC method: (a) total expenditures must be collected as primary data or taken from secondary sources, and (b) RC's must be calculated by a central research unit with access to a computer and I/O model. Both drawbacks also apply to I/O analysis in general. Overall, the RC method is not a separate impact assessment procedure at all, but a useful way of reporting impacts derived by traditional procedures. In light of its ability to avoid misleading results, the calculation of RC's may be worth the minimal extra effort required.

Minimum Requirements Method

Under this method, the analyst determines the minimum level of all services (not just recreation) for prototypical areas or counties needed to sustain a local economy (resident population). That is, the analyst determines the economic base of an area. Any economic activity above this minimum level would be attributed to basic income (e.g., expenditures by nonresidents). In this manner, an economic base multiplier may be established (see Leistritz and Murdock, 1981; Bendavid-Val, 1983; and Propst and Gavrilis, 1984 for further discussions of the derivation of economic base multipliers).

A variant of this approach would involve a two step procedure. First, plot certain economic indicators such as income or sales tax over time. Second, compare the sales tax collected in a month (March, say) when tourism is low with those in a month during the peak tourist season.

Multiplier "Given" Method

In this method, expenditures by recreationists must be determined, but previously computed multipliers are accepted. This method is best explained by two relationships:

1. Total Area Economic Impact = Multiplier (given) X Total Direct Expenditures;

2. Total Direct Expenditures = Expenditures per Recreation Visitor Day (EXP/RVD) X Total Recreation Visitor Days (RVD) per Activity.

Measures of participation other than RVD's may be equally valid. However, a method for separating resident and nonresident expenditures per RVD must be devised because nonresident purchases represnet new money to the region while resident purchases do not. If necessary, the variable, EXP/RVD, may later be adjust by using participation and supply (quantity and quality of facilities) as independent variables in regression analyses.

One word of caution is needed here. If not already available (usually the case), expenditure data mist be collected directly from recreationists. This task is not for the unskilled or the feint of heart. Thus, in many cases, the multiplier "given" method may only give the appearance of being a short cut procedure. Yet, the point is well taken that instead of spending a great deal of effort on developing new multipliers, the planner should be gathering quality expenditure data and enumerating the costs and direct benefits of future developments.

"Brainstorming"

In this procedure, experts, user groups (i.e., the recreationists or tourists themselves), and business leaders are assembled and asked to estimate participation, spending, and leakages. We do not mean to imply, however, that all of these groups should be assembled at one place at one time. This may not be feasible. Rather, these groups (and individuals in some cases) may have to be contacted at their convenience over an extended period.

Delphi Process

The Delphi technique is a means of creting a consensus of opinion concerning future likely events from the insights of experts rather than from a theoretical body of knowledge. Moeller and Schafer (1983) fully describe the Delphi technique, the steps in carrying out the technique, and the applications in recreation.

In terms of economic impacts, the Delphi process would involve having a group of experts predict the multiplier effects of current or future tourism and recreation developments in an area. Moeller and Schafer state that the Delphi technique can provide general estimates where no other techniques are available or appropriate. However, they warn that the process may require more effort (time and money) than the analyst might initially expect. Thus, it may not be a short cut method in all cases.

Similar Sites

When economic impacts must be computed for a certain site. it would be extremely useful to know the results of computations for similar sites elsewhere. If another site were sufficiently similar, little or no additional computation might be required. Unfortunately, few high quality analyses have been completed at present, but as experience is gained and analyses are completed, it is recommended that they be catalogued for future use. This catalog would contain surrogate multipliers and spending profiles with full descriptions of the site conditions. The development of such a catalog would be a major undertaking, but once done, it would make future analyses quite easy.

Task 2: Defining Regions and Disaggregating Sectors

The teams of meeting participants were next asked to make recommendations concerning how to define regions and disaggregate sectors in I/O models to account for the economic impacts of recreation and tourism.

Defining Regions

All teams felt that, initially, the region of interest should be the unit of the decision maker (members of Congress, governors, state legislators, etc.) or determined by the specific problem being addressed. After these initial considerations, subreeions should be defined as spatial economic units (counties, SMSA's, BEA units, etc.) according to the following general scheme of increasing regional size:

1. Individual sites--physical attributes (lake, forest, etc.) where recreational activities and direct economic impacts occur.

2. Recreation focal area (trade area)--one or more counties (SMSA's, etc.) surrounding the site or facility development which may be considered a "local" impact zone; likely to be the source of most direct recreation employment.

3. Travel corridors--from the consumer residence area to the site and define location of impacts along the travel route.

4. Substate or multistate regions--portions of several states or large group of counties surrounding the site where both direct and indirect impacts occur; may also be defined as the site's market area by inspection of of visitation data.

5. Consumer residence areas--origins of the recreationists.

6. Extended region-- national in scope; the source of all goods imported into any of the above 5 regions; capital input to recreation at a given site likely to extend over the entire nation.

Once the market area (no. 4 above) is established, the internal boundaries may be delineated by further analysis of population and visitation data. This hierarchy of regions is not intended to result in concentric circles around individual sites.

Maki (1985) and Stevens and Rose (1985) describe these regions and define their data requirements in more detail. In general, any attempts at regional delineation and aggregation must consider the additivity problem. That is, there are sometimes differences between impacts derived from summing over numerous small areas versus an overall large area impact (the whole may not be the sum of its parts). This is primarily a methodological problem which may be overcome by clearly defining export expenditures as being outside the region of which the counties surrounding the site are a part.

Sector Disaggregation

To discuss this topic properly, an important distinction must be made between intermediate and final purchases. Final purchases are the sectors in which consumer expenditures occur (e.g., tourist spending on food and beverages, angler purchase of fishing bait). In the accounting system of an I/O table, final purchases are enumerated. in the final demand vector. Intermediate purchases occur when firms within sectors that produce recreation goods and services buy from or sell to each other (e.g., canoe manufacturer's sales to a canoe livery). Intermediate purchases are represented in the interindustry matrix of an I/O table.

Intermediate purchases.--For intermediate purchases, meeting participants agreed that the existing level of aggregation in RIMS, the national 500-sector I/O model, was appropriate for all but the retail, wholesale, and service sectors. For example , there is already a detailed breakdown of manufacturing at the 4-digit SIC level. Since capital expenditures for recreation or tourism go into manufacturing, sufficient disaggregation exists. Such is not the case for the retail, wholesale, and service sectors. For example , marinas do not have a separate 4-digit code and are completely dominated and subsumed by the boating dealers sector. Certain manufacturing sectors have their problems as well. This is especially true for boat building (i.e., small boats) which is hidden within the ship building sector. Yet, boat building and marinas are important elements in the recreation/tourism industry and have different input structures that ship building and boat dealers per se. An example of the aggregation problem in the service sector is commercial amusements. This sector is so highly aggregated that it contains everything from bowling alleys to ski lifts. In recreation and tourism, retailing and services are major components of the economic activity of many local areas. Thus, being wrong in these sectors can create more errors in multiplier development than would be the case for large metropolitan areas or other areas with diverse economies.

REIS, the national I/O model developed by the Regional Science Research Institute (Stevens et al., 1975) overcomes some of these aggregation problems by providing 34 wholesale and 40 retail sectors. The 40 retail sectors include RV's (recreation vehicles like motor homes and camping trailers) and most of the categories that appear in the Census of Retail Trade. However, REIS does not solve the aggregation problems in the service sector.

In light of the above discussion, work teams recommended that existing I/O categories be used except for wholesale, retail, and service sectors. These sectors should be disaggregated further into 2-digit SIC sectors, perhaps using REIS as a starting point.

Final Purchases.--One recommendation was to use the 84 consumer expenditure categories from the National Income and Product Accounts (NIPA), differentiating between local and nonlocal expenditures for each sector for each recreation activity. These 84 categories would become the sectors in the final demand vector. Under this recommendation, the NIPA categories would also serve as the basis for gross private capital formation, government expenditures, and exports. For gross private capital formation (construction of new facilities), one would need to distinguish between private, recreation-related construction and other construction. For federal, state, and local government spending, it would be necessary to differentiate between recreation-related spending (both construction, and operations and maintenance activities) and spending for other purposes. For exports, expenditures of visitors from outside the region of concern would have to be separated from the expenditures of other visitors. The 84 consumer expenditure categories from NIPA can also be used to transform direct expenditures into I/O categories. Such a transformation becomes a movement from purchaser to producer prices.

There are other ways of transforming one expenditure system to another. One way is to survey visitors to obtain expenditure information and then transform the expenditures into I/O categories through the use of the Survey of Current Business "Commodity Composition of Personal Consumption Expenditures ." This is the procedure currently being followed by the Forest Service's IMPLAN system.

Both the NIPA and the Survey of Current Business approaches call for the collection of expenditure data directly from visitors. An alternative to primary data collection would be to pay someone to identify and publish an index of existing sources of visitor expenditure data. The point is that there are databases and publications not widely circulated that contain expenditure information necessary to estimate the economic impacts of recreation and tourism. Assembly of these sources might sometimes preclude the need to collect primary data and would be an important contribution. Nonetheless, noncomparability of many databases would likely be so troublesome that only general expenditure profiles could be published in such an index. In terms of accuracy, primary data collection holds a strong advantage over procedures involving secondary data.

Task 3: Variables to be Assessed

To complete this task, work teams provided a list of variables that should be measured in nationwide surveys of the economic impacts of recreation and tourism. There was general agreement among work teams on the variables that should be assessed. Differences were based on ways of categorizing or organizing the variables. One way to organize the variables is to divide them into those that may be asked of an entire sample of visitors and those that may be asked of a subsample on-site or at home after a trip:

1. General variables to be assessed of entire sample (necessary for visitor segmentation purposes):

--origin and destination
--purpose of trip
--type of accomodations where staying overnight
--length of stay
--mode of transportation
--phone number and address to recontact (recontacting critical to obtaining accurate assessment of trip home expenses)
--day trip vs. multiday, single destination trip vs. multiday, multiple destination trip
--number in party and party composition (family, friends, etc.)
--equipment type (because, for example, those with RV's may have different expenditure patterns than those in family auto)
--demographics
--some expenditure data according to distance from site (most useful would be food and beverage, lodging, fees and charges, gasoline, equipment): exercise caution with equipment expenditures because some equipment purchases would be made regardless of existence of a particular site

2. Specific expenditure data to collect from a subsample of visitors (collect according to distance from site); list not intended to be comprehensive (may opt to use some subset of the 84 NIPA expenditure categories):

--public accomodations
--eating and dining out
--groceries
--liquor stores
--gasoline and related services
--incidental sporting goods (bait, clothing, etc.)
--car rental
--boat rental
--equipment rental
--public transportation
--personal services
--professional services
--hospital services
--finance services
--camping fees
--licenses
--outfitters and guides
--marinas
--movies
--amusements
--others

Depending on the objectives of a particular study, there are other ways of classifying these variables. For example , agencies may want to measure all the above variables in a given sample. Subsampling for detailed expenditure data is meant to minimize survey cost and respondent burden; its applicability depends on the goal of the survey. The primary goal of a nationwide expenditure survey might be to develop a general model from a sample of visitors at different sites. In that case, the samples would too small to determine spending patterns at any given site. Through a relatively small increase in effort, the national sample could be segmented by geographic region and other variables as listed in (1) above. The national spending patterns could then be applied to any site in the U.S. given some knowledge of that site's visitation characteristics (numbers of visitors, origin, activities, etc.). Thus, a fairly large sample to obtain the data listed in (1) above plus a relatively small subsample to obtain the detailed expenditure information listed in (2) would meet the goal of establishing a nationwide recreation expenditure database.

The use to which the survey data will be put must be clearly specified before a methodology or survey instrument can be properly developed. For example , do the potential users want measures of a few key variables from a large sample in order to reduce sampling errors or do they want detailed expenditure data from a relatively small sample? The more detail that is required of respondents, the greater the liklihood of increased sampling error.

Due to time constraints, discussion of methodological details (i.e., specific wording of survey items, sampling procedures) was superficial . Nonetheless, an important point for consideration was that listing the variables should not necessarily be the first step in collecting quality expenditure data. Instead, the first steps should be the specification of goals as stated above and the development of a data collection methodology. This methodology will then point out the key variables to be measured and specific survey items will follow.

There was a divergence of opinion as to the most appropriate methodology to employ. Recommendations included the following:

1. Personal, on-site interviews to increase accuracy by reducing recall -problems.

2. Pay people to keep an expenditure diary of their trip as is done in states like Massachusetts.

3. Have respondents keep a log of their expenditures during all trips for 1 year.

4. Conduct mailback surveys especially for the purpose of obtaining estimates of trip home expenses.

Since there was no consensus concerning the most appropriate method, the suggestion was made to employ a variety of methods and allow the results so derived to serve as checks of reliability and validity.

There was consensus on two important points:

1. Federal agencies, states, and private interests should work together (pool resources) to develop a methodology and collect quality expenditure data on a national basis.

2. A proper database will attract researchers to do the needed analyses because quality databases of this nature are difficult and expensive to obtain.

Task 4: Yodif ying IMPLAN

Work teams were asked to recommend modifications in the Forest Service economic impact model, IMPLAN, to account explicitly for recreation and tourism impacts. The general recommendation was to tailor IMPLAN to meet recreation and tourism needs. Specific ways to perform such tailoring follow.

One recommendation was to encourage the Bureau of Economic Analysis (BEA) to collect data more appropriate to recreation and tourism therehy making the national I/O model more realistic in terms of this industry. Since IMPLAN is a subset of the national model, necessary improvements in IMPLAN would follow suit. The results presented under Task 6 to follow provide further detail on this point.

Another recommendation was to develop or improve certain intermediate purchase sectors in IMPLAN relative to recreation and tourism. Tourist expenditures currently are not well represented in the sectoring of IMPLAN. The key sectors related to the forest and grazing industries have already been identified. The same could be done for recreation by specifying the appropriate retailing and service sectors (see also previous discussion under Task 2 - disaggregation of sectors). Much of this specification of recreation sectors could he done immediately. Other tasks, such as placing the hoating industry in the model correctly, could take much longer.

In terms of final demand modifications, it is again necessary to differentiate expenditures specific to recreation and tourism, including private capital formation and government expenditures. In other words, retail trade and services should he disaggregated in the final demand sectors. 4s a starting point, this disaggregation might he based on NIPA categories, which are closer to consumer spending categories than those currently in IMPLAN. An alternative for disaggregation is to establish standard tourist expenditure vectors on a total purchase basis (i.e., for now, do not worry. about where purchases are made or by whom but establish standard vectors on a per person per day basis by activity). The next step would be to regionalize the tourist vectors. IMPLAN currently allows this without additional work hy using implicit regional response coefficients generated hy the supply-demand pooling approach. Possible improvements would he to adjust these implicit response coefficients by regional experts or by regression estimates of these coefficients using additional exploratory variables.

The purpose of disaggregating final demand sectors is to transform final demand categories into intermediate purchase categories (usually SIC codes). The NIPA approach would require respondents to allocate their purchases into categories that are already very similar to many I/O sectors but may not he specific to recreation and tourism. The tourist vector approach would require respondents to state how much they spent in various categories specific to recreation and tourism. This latter approach has the advantage of couching expenditures in terms relative to the respondent, not the I/O model. The analyst would still be required to transform expenditures, via NIPA or other categories, into I/O sectors. These transformations could he developed based on several case studies employing the procedures recommended in Task 3. Once the expenditure vectors and transformations are specified, it would not he necessary to collect new expenditure data for every situation. Instead, one could predict spending based on data previously collected and gather new data only on visitor days of use by activity. Whichever approach is used, it will still be necessary to differentiate the region of impact according to resident versus nonresident spending (i.e., have separate vectors for residents and nonresidents.

Once the sectors are disaggregated or specified, IMPLAN's output relative to recreation can and should be simplified. That is, the full model may be reduced to just those sectors impacted by recreation. This is especially important for the IMPLAN user because confusion with irrelevant sectors is avoided.

One of the most serious gaps in the current capability of IMPLAN relative to recreation is in the payments sector. That is, there is nothing now in IMPLAN to specify the location of employees, or owners of capital. Overall, this problem is related to the lack of adequate data on income generated versus income retained in region (i.e., in the payments sector). This problem is important in recreation and tourism because of the seasonality of employment and business ownership. For example, how much do college student employees spend in an area? How much do they save for, say, tuition spent elsewhere? This is a critical issue because the induced portion of the income multiplier comes from income respent in the region. By overestimating income retained in a region, the income multiplier is prohahly biased upward. Usual methods of adjusting for income generated versus income retained in a region (e.g., residence adjustments from BEA, commutation data from the Census) are probably inadequate due to the transient seasonal employees in recreation and tourism sectors.

Task 5: Private Sector Data

This task required the work teams to describe the potential role of the private sector in providing data useful in determining the economic impacts of recreation and tourism. Work teams suggested types, sources, and means of obtaining such data at the local (individual firm), state, and national levels. An initial question raised was whether data from the private sector were even necessary. The response was that these data were useful at least as a supplement and method of cross-checking public expenditure data. Also, a closer working relationship with the private sector may reveal more efficient economic impact assessment methods than are in current usage in the puhl ic sector.

The types of private sector data most needed in economic impact assessment of recreation and tourism are:

1. total sales
2. employment
3. payroll
4. tourist clientele sales as a percentage of total sal es
5. percent of business purchases locally versus outside an area
6. tourist expenditures (e.g., in private campground stores)
7. industry inventories (e.g., when and what are the sizes of boat inventories?)

In regards to the last data type, the point was raised that industry inventories are often estimated in I/O tables, a practice that may lead to inaccurate resul ts. During downward cycl es in an industry, inventories can accumulate and cushion the response of increases in an activity. For exampl e, an increase in boating production may be misleading if there is no accounting for inventories. That is, a 15% increase in hoating activity may result in a 5-10% increase in production because of accumulation of inventory. The difference may be insignificant if projections are for a relatively short period of time (5 years, say).

Important sources of private sector data include:

1. Industry associations representing RV's, skiing, hoats, marinas, sports equipment, lodging, sport fishing, and so on; most of these possess visitor and capital expenditure data.

2. The American Recreation Coalition (perhaps as a lead into the various industry associations), the Travel. and Tourism Research Association's National Data Center, the U.S. Travel Data Center, chambers of commerce, utilities, transportation agencies, American Automobile Association -- all may at least provide some purchaser characteristic data;

3. A new Bureau of Lahor Statistics quarterly survey will include a section on leisure/recreation purchases, hut it is uncertain when these data will he available.

4. Special industry studies (may be proprietary in nature).

5. Consul ting firms that conduct market surveys.

6. Sal es Management Magazine's annual survey of buying power.

7. New York Stock Exchange (NYSE) shareowner survey. The usefulness of the NYSE data would he to track where profits go and to include an income distribution analysis in IMPLAN (who wins and who loses within and across regions). That is, what income is generated within versus what flows out of a region? Is *income* in the hands of a few or spread out among many? Often much of the income that is generated in a region flows away and is therefore no longer a benefit. The NYSE shareowner survey provides data on which to estimate the origin sector and recipient income class for one portion of proprietary income -- dividends and payments. The distribution of the other major income component--wages and salaries--can he ohtained hy refining "manpower requirements matrices" published by the U.S. Bureau of Labor Statistics and Bureau of Economic Analysis (see Rose, et al ., 1982). The income mul tiplier in IMPLAN is for total income. This may be an inaccurate indicator of well-being in a region because wages generated may remain while dividends and royalties may leak out. Thus, there is often the need to disaggregate income into appropriate categories before a multiplier is applied. In the example where wages remain but all other forms of income flow out of a region, the proper analysis would he to apply the income multiplier to household income alone.

In order to obtain private sector data, two considerations are mandatory. First, there must he an assurance of confidentiality. Second, mutual benefits must he identified (i.e., what are the advantages to individual firms?). Because of these two important considerations, a nongovernmental data collector (university or consulting firm) was recommended.

Task 6: Changes Needed in BEA System

In the final task, work teams recommended changes needed in data collection and analysis procedures of the Bureau of Economic Analysis (BEA). Team members identified five needed modifications.

First, it was recommended that tourism and recreation professionals, not BEA staff, disaggregate the tourism/recreation industry into finer sectors as per the suggestions made in Tasks 2 and 4. One of these earlier suggestions was to develop 2-digit classifications for services and retail trade instead of the current combinations of categories. For example , efforts should be aimed at: (1) aggregating the no longer appropriate manufacturing sectors; (2) identifying new manufacturing sectors (genetics, robotics, etc.); (3) disaggregating some manufacturing sectors (e.g., boat manufacturing from ship building); and (4) disaggregating (eliminating the noise) the amusements sector into major amusement categories, such as major amusement centers, marinas, ski areas, gol f courses, tennis complexes , and fitness centers.

Second, it was recommended that the BEA present employment data in full-time equivalents (FTE's) instead of the current practice of mixing full-time and part-time employment. This change is especially critical to the tourism industry hecause of the high degree of part-time employment in many sectors.

Third there is need for more consistency in definition of sectors and employment categories among the BEA system, County Business Patterns, and other national models. The current BEA I/O tahl e is inconsistent with County Business Patterns because different rules are used to categorize certain husinesses and these rules are not clearly articulated. Furthermore, other national models (e.g., REIS) use different classification rules than either County Business Patterns or the BEA. For example, County Business Patterns uses unemployment insurance figures to develop employment data. As a result, many small firms not covered by unemployment insurance are omitted in the analysis. REIS, using different rules and data, is able to include very small firms in its analysis; however, these rules and data are not clearly specified.

Fourth, the BEA should conduct a periodic "Census of Special Services" adjusting for seasonal fluctuations in such industries as tourism and recreation. This census is needed because the current Census of Services is for selected services only, not special ones like tourism. Such a census, especially done in conjunction with transportation and manufacturing censuses, would overcome many of the problems associated with estimating the economic impacts of recreation and tourism.

The fifth recommendation concerns better interagency cooperation. The BEA should be represented on tourist association statistical committees and research branches of recreation management agencies.

SUMMARY AND CONCLUSIONS

The results represent a convergence of sometimes diverse opinions from regional economics experts regarding six key issues which any agency must face when involved in assessing the economic impacts of recreation and tourism. Work team participants were encouraged to present divergent points of view on the assigned tasks. Before preparing this paper's resul t, we wrote a draft of work team recommendations and mailed it to participants for further comment. We then integrated the participants' comments with an extensive literature review concurrently performed under contract with the U.S. Forest Service and Corps of Engineers (Propst and Gavrilis, 1984). Our paper, therefore, is the product of this synthesis of professional experience and literature.

There are several important conclusions to be drawn from the results presented herein. First, "short cut" methods (methods other than I/O analysis) are appropriate only when the expertise or resources (i.e., computer and access to an I/O model) for performing an T/O analysis are not availahle. These so-called short cut methods are likely not "short" in the sense of time or money. Four of the six methods discussed (response coefficient , minimum requi rements, mul tiplier given, and similar sites) require the expertise of a regional economist and/or the collection and analysis of primary or secondary visitor expenditure data. The two remaining methods (hrainstorming and Delphi) require a relatively large investment in time in contacting and ohtaining the appropriate information from individuals and groups. We do not mean that these methods should never he empl oyed. We merely wish to point out that the term "short cut" may be mi sl eadi ng.

4 second conclusion is that I/O analysis represents the most rigorous, accurate method of economic impact assessment. Thi s conclus i on emanates from the long-term experience of the meeting participants with I/O analysis, the availability of I/O models, and the existence of computers capable of handling the data and mat hemat i cal requi rements of such models . Yowever, the rigor of I/O analysis can become an important drawback. That is, a great deal of experience and training is required before analysts can understand how to perform an I/O analysis and interpret its results properly. The jargon that comes as baggage with any body of knowledge is particularly voluminous and confusing. Thus, to the uninitiated, I/O analysis may appear to he a black box with volumes of data entering one side and results (usually mulipliers) exiting the other. This communication prohlem may be overcome to some extent by employing one or more of the alternative methods discussed above. These alternative methods may be less rigorous than I/O analysis but more readily comprehended by decisionmakers untrained in quantitative economic analysis. These alternative methods may al so serve as a useful check on the results of an I/O analysis.

Despite their complexity, I/O analysis gives the most complete picture of the sophisticated interactions in an economy and they accurately provide much of the information being requested by decisionmakers (impacts on income, johs, etc.). However, a third conclusion to be drawn from the results is that the Forest Service's IMPLAN, or any other I/O model, requires certain key modifications to estimate precisely and accurately the economic impacts of recreation and t ouri sm. The first modification required is the disaggregation of the retail and whol esal e trade and services sectors into categories that accurately reflect the sellers and the producers of recreation goods and services. Second, the payments sector should he modified to reflect the amount of income generated versus the amount retained in a region. Thi rd, instead of expressing mul tipliers as partial derivatives (the usual procedure), analysts should express them in units that relate endogenous income or employment to exogenous spending, such as total employment generated per $1 ,000 of lodging expenditures in a region. The result is otherwise known as a response coefficient (Rose et. al., 1981) or normal multipl ier (Archer, 1977). The fourth modification is to develop a matrix of transformation indices that convert final purchases (visitor expenditures) into producer prices. Either National Income and Product Accounts or Survey of Current Business data may be used to develop this matrix. Visitor expenditure data may be obtained directly from consumers or from a compendium of results from previous studies. Once vi si tor expenditure profiles and a transformation matrix are specified, it will no longer he necessary to collect new spending data for every site or situation. Fifth, for any economic impact met hod, not just I/O analysis, resident spending within a region must clear1 y be separated from nonresident spending wi thin the same region. Such separation requires careful del ineation of regional houndaries according to study objectives.

Regardless of the method chosen, perhaps the overriding concern of all meeting participants was the establishment of a reliable and valid visitor expenditure database from a nationwide sample. Input/output specialists can make the aforementioned structural changes in IMPLAN or other models relatively easily. However, the results obtained (e.g., multipliers) will only be as accurate as the expenditure data entering the models. Currently, this high quality expenditure database is lacking. Its development should proceed in the following sequence: (1) determine objectives and uses of data, (2) establish detailed methodology, (3) specify variables to be measured, (4) specify the measurement instrument and items, (5) pretest the procedure and instrument, and (6) revise methodology and instrument. Agreement on methodology is lacking at this time due to the absence of data comparing the reliability and validity of such methods as personal interviews, mail back surveys, and expenditure diaries. Because opinions on appropriate methods vary, we conclude that, wherever possible, a variety of procedures should be used on subsamples of the population and results compared and made available to the academic community for critical review. The work teams developed an initial list of variables (both visitor segmentation and expenditure variables) for consideration.

Using the above model for developing a quality expenditure data base, the U.S. Forest Service, Corps of Engineers, and National Park Service have launched a nationwide effort at collecting such data. The Public Area Recreation Visitor Survey (PARVS) will be conducted in 1985 at hundreds of federal resource agency and state park sites across the U.S. A combination on-site and mailback survey, the PARVS has as a major objective the collection of detailed trip and annual expenditures for recreation and tourism. The end product will be the only national expenditure data base of its kind. A strong recommendation made by meeting participants was an interagency cooperative effort (pooling of resources) to establish the heretofore missing national expenditure database. PARVS is such an effort. However, there is no implied continuity to the PARVS. That is, there is no guarantee that the same data will be collected 5 or 10 years from now. Therefore, another recommendation of the meeting participants is that the Bureau of Economic Analysis establish a periodic "Census of Special Services" with recreation and tourism as one of the special services highlighted.

A fifth conclusion from the results presented herein is related to the usefulness and availability of data from the private sector. Such data are needed to check some of the estimates derived from public data (Census, PARVS, etc.) and to fill in some large gaps in public databases (e.g., percentage of tourist sales in selected firms, inventory data, and nonproprietary income generated and retained in a region). Furthermore, such data must be collected in a highly professional manner with extreme care given to confidentiality and benefits to private interests of making this information available.

A final conclusion concerns the method for obtaining the results-- the small work team/creative problem solving format. The method seems to hold much promise for technology transfer. We brought together a group of regional economics professionals representing well over a hundred years of training and experience and were able to apply their talents to a specific problem area in a nonconfrontational manner. Numerous investigations of the economic impacts of specific recreation and tourism events and developments have been conducted. Never before, however, has there been a concerted effort at accurately assessing the secondary economic impacts on a nationwide basis. The approach used transferred vital technology to federal resource management agencies, providing the basis for creating a national expenditure database for recreation and tourism. At least two of these agencies have plans to transfer this technology one step further to their field planning offices. The method also allowed those with less experience in economic impact assessment to learn much from those with more. Thus, as a training tool, the method was also successful.

There are always improvements that can be made in any methodological approach. We feel only minor improvements are needed in the protocol and format of the work team portion of the meeting. However, we feel we should have been more diligent in obtaining comments on the work team recommendations from the participants after the meeting ended. In sum, we recommend the method followed herein as an efficient approach for transferring knowledge from one field to another.

LITERATURE CITED

Archer, B.H. Tourism multipliers: the state-of-the-art. Bangor Occasional Papers in Economics No. 11. Bangor, Wales: University of Wales Press; 1977. 44 pp.

Bendavid-Val, A. Regional and local economic analysis for practitioners. New York: Praeger; 1983. 195 pp.

Dwyer, J.F., J.R. Kelly, and M.D. Bowes. Improved procedures for valuation of the contribution of recreation to national economic development. Research Report No. 128. Urbana-Champaign, IL: Univ. of Illinois Water Resources Center; 1977. 218 pp.

Gartner, W.C. and D.F. Holecek. The economic impact of a short-term tourism industry exposition. Research Report 436. East Lansing, MI: Michigan State Univ. Agric. Exp. Stn.; 1982. 8 pp.

Hare, P.A. Creativity in small groups. Beverly Hills, CA: Sage Publications; 1982. 199 pp.

Leistritz, F.L. and S.H. Murdock. The socioeconomic impact of resource development: methods for assessment. Boulder, CO: Westview Press; 1981. 289 pp.

Maki , W.R. Measuring supply side economic impacts of tourism and recreation industries. In: Assessing the economic impacts of recreation and tourism. 1984 May 14-16; East Lansing, MI: Michigan State Univ. Published in this report; 1985.

Marino, M.L. and D.E. Chappelle. Lodging and restaurant establishment spending patterns in northwest lower Michigan. Research Report 346. East Lansing, MI: Michigan State Univ. Agric. Exp. Stn.; 1978. 32 pp.

Moeller, G.H. and E.L. Shafer. The use and misuse of Del phi forecasting. In: Lieber, S.R.; Fesenmaier, D.R., eds. Recreation planning and management. State College, PA: Venture Publishing; 1983:96-104.

Noller, R.B., S.J. Parnes, and A.M. Biondi. Creative actionbook. New York: Charles Scrihner's Sons; 1976. 399 pp.

Koberg, D. and J. Bagnall. The universal traveler. Revised Ed. Los Altos, CA: William Kaufmann, Inc.; 1981. 128 pp.

Propst, D.B. and D.G. Gavrilis. Evaluation of methods and models for determining the economic impacts of public recreation services and facilities: final report. East Lansing, MI: Michigan State University Department of Park and Recreation Resources; 1984. 77 pp.

Rose, A., D. Kolk, and M. Brady. Energy development and urban employment creation: the case of the city of Los Angeles. Energy 6(10):1041-1052; 1981.

______, B. Nakayama and B. Stevens. Modern energy region development and income distribution. Journal of Environmental Economics and Management 9(2): 149-164; 1982.

Stevens, B.H., G.I. Treyz, D.J. Ehrlich, and J .R. Bower. State input-output models for transportation impact analysis. Discussion Paper Series No. 128. Amherst, MA: Regional Science Research Institute; 1981. 23 pp.

______, and A. Rose. Regional input-output methods for tourism impact analysis. In: Assessing the economic impacts of recreation and tourism. 1984 May 14-16; East Lansing, MI: Michigan State Univ. Published in this report; 1985.

Stynes, D.J. and D.F. Holecek. Michigan Great Lakes recreational boating: a synthesis of current information. Michigan Sea Grant Report MICHU-SG-82-203. Ann Arbor, MI: Michigan Sea Grant Publications; 1982. 86pp.

Wal sh, R.G. The intelligent consumers and managers guide to recreation economic decisions. Preliminary bound draft for classroom use. Ft. Collins, CO: Colorado State Univ. Department of Agricultural and Natural Resource Economics; 1984. 609 pp.

APPENDIX

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A collection of eight papers that explore and assess the best available technology to evaluate the economic impact on recreation and tourism. Research strategies for meeting methodological and data needs are recommended.

KEYWORDS: Technology transfer, problem-solving process, computer models, input-output analysis.

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