Regional Impact Analysis and Recreation Multipliers#

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Water based recreation development projects such as lakes, marinas, and sportfishing facilities are one of the most difficult areas of project analysis. Evaluation is complicated by the nonmarket (quasi-public) nature of many of the services provided by the project and the appropriate time span for the benefits and costs. During the past two decades there has been increasing recognition of willingness to pay measures (principally the travel cost and contingent valuation methods) as the preferred indicator of primary economic benefits [7, p. 205]. These measures focus on efficiency gains from the provisions of nonmarket goods, but they offer little insight into the potential regional or 'secondary' impacts generated by new purchases of recreation related market goods and services.

With decreasing Federal funding for recreational resource development projects, state and local governments have assumed a larger role in developing recreation projects. While some consideration is given to the "primary benefits" of these projects, the principal concern of state and local governments is with overall changes in expenditures, employment, and income within the impacted region. Recreation projects are valued for their ability to increase tourism and generate changes in final demand for the region's goods and services.¹

Information on the regional impacts of recreation projects is useful for planning but the economic researcher faces two major barriers to estimating these impacts. First, without the benefit of demand curves for recreation facilities, some ad hoc method of projecting participation must be used. Second, recreation support industries are not sufficiently disaggregated and, in some cases, not separately defined in the Standard Industrial Classification system. As a result, there is no ready description of the linkages between recreation expenditures and the regional economy and no clearly defined multipliers for estimating indirect and induced changes due to an initial round of recreation expenditures. Several alternatives for

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#Partial support for this research was provided by the National Oceanic and Atmospheric Administration through the Florida Sea Grant College (NA80AA-D-00038).

estimating participation functions have appeared in the literature [e.g., 2, 16], but there has been relatively little discussion of appropriate methods for estimating recreation multipliers. The researcher faces the choice of adopting impact estimates from studies of existing recreation facilities or estimating recreation multipliers(s) for the region.

Without a full survey based input-output model available, the alternative methods for estimating recreation multipliers can be generally classified into 4 types:

- a) regional aggregate base multipliers,
- b) sector specific base multipliers,
- c) location quotient type multipliers derived from national input-output tables, and
- d) location quotient type multipliers augmented by survey data on recreation support sectors' transactions.

The objectives of this article are to evaluate the relative merits of these alternatives for estimating recreation impact multipliers (specifically, water based recreation) and to compare the multipliers estimated using these methods. The article is organized into three sections: 1) a description and discussion of the alternative methods, 2) a comparison of recreation impact multipliers estimated using the different methods, and 3) conclusions about the advantages of non-survey and survey estimation methods for recreation multipliers.

The region investigated in this analysis is the state of Florida. An interview survey of recreational boating support industries in Florida was conducted in 1982 for the year 1980. The information was used to identify five recreational boating sectors which, along with the four digit SICs included in each sector, are listed in Table 1. Complete details of the survey are available in [10]. In the following presentation, estimates of impact multipliers from the alternative methods will be compared for the five recreational boating sectors. Since some of these methods produce only multipliers, there is no discussion of differences in other regional measures of economic activity.

ALTERNATIVE METHODS FOR ESTIMATING RECREATION IMPACT MULTIPLIERS

The fundamental justification for a multiplier is that a direct injection of spending into a region creates additional economic activity beyond the initial round of direct spending. Assuming that some portion of the direct spending accrues to regional households as income and that some portion of that income is respent locally, it is fairly safe to conclude that the multiplier should be greater than 1.0. The difficulty, however, is that regional characteristics influence the reaction to this direct spending and detailed regional interindustry data are not readily available to evaluate the exact effect of further rounds of spending.

Despite these limitations, it is possible to achieve some precision in estimating a recreation multiplier for a region. The alternative methods for estimating recreation multipliers can be broadly classified as either aggre-

TABLE 1
FIVE RECREATIONAL BOATING SECTORS WITH PRIMARY PRODUCTS
AND STANDARD INDUSTRIAL CLASSIFICATIONS

Sector	Primary Products	Standard Industrial Classification
Boat and Trailer Manufacturing	Recreational Boats	3732-Boat Building and Repairing
	Boat Trailer	3799-Miscellaneous Transport Equipment
Boat Equipment Manufacturing	Hardware Accessories	3429-Miscellaneous Hardware
		3069-Miscellaneous Rubber Products
	Navigation Equipment	3079-Miscellaneous Plastics Products 3662-Transmitting and Detection Equipment
Marinas and Boatyards	Storage, Repairs, Fuel, and Supplies	4469-Miscellaneous Water Transportation
Marine Trade	Retail Sales of Boats and Boating Products	5551-Boat Dealers
		5311-Department Stores
Marine Services	Financing	6000-Banking
	Insurance	6300-Insurance
	Publishing	2721-Periodical Publishing
	Chartering	7999-Miscellaneous Recreation Services

gate base type multipliers or location quotient type multipliers. Both types can be defined in region wide or sector specific detail depending on the availability of data and the need for more precise estimates.

Aggregate Base Multipliers

The base theory concept begins with the premise that exogenous expenditures (including tourist expenditures) are the sole source of growth in a regional economy. Employment and income in basic industries which are generated through these exogenous expenditures lead to an expansion in the support activities of the nonbasic sector. The base multiplier indicates the total change in economic activity due to an initial change in exogenous expenditures in the basic industries.

The first application of the base theory concept for recreation analysis was by Clawson & Knetsch (CK) [4]. Their approach, which closely followed Tiebout's [13] earlier work, suggested an aggregate regional multiplier of the form

$$\frac{1}{1-(CL)(YL)} \quad (1)$$

where CL is the fraction of income that local consumers spend on goods and services produced in the region (the propensity to consume locally) and YL is the fraction of total income (direct, indirect and induced) in the region resulting from local consumption. Clearly, the larger the values of CL and YL, the greater the regional multiplier.

The major assumption required to use the CK multiplier for recreational expenditure impact analysis is that the pattern of consumption and income generation within the recreational sectors is not significantly different from the structure of consumption and income within the region as a whole. The greater the differences between the recreational sectors and the total regional economy the more likely it becomes that the CK multiplier will incorrectly estimate the true multiplier effects. As a general rule, it would be expected that regional economies with a larger portion of total economic activity attributable to recreation expenditures would have smaller differences between the CK multiplier and the true multiplier for the impacted sectors. It is unlikely, however, that the conditions for small differences prevail for most states in the U.S. They do become more plausible if the relevant regional unit is a municipality or multi-county region within a state.

One method of adjusting for the differences between a region's overall structure and the structure of the recreation sectors is to focus specifically on the relative importance of the recreation sectors in the regional economy. This approach, which follows the work of Burford and Katz (BK), [3], uses multipliers of the form,

$$1 + \left(\frac{1}{1 - \bar{p}} \right) p_i \quad (2)$$

where p_i is the intermediate inputs (purchases only) of sector j expressed as a percent of total regional output and $\bar{p}$ is the mean percent of intermediate inputs for all sectors in the region. While this method does require information about sector purchases, the necessary information is considerable less than that required for a full input-output table.

This sector specific approach to estimating base type multipliers reflects the effects of specialization within the region. Sectors which have above average intermediate inputs will have larger multipliers than the average sector. In general, regions with greater specialization in recreation related support industries would have larger multipliers than regions with little specialization. Both the BK and CK methods yield larger multipliers for regions which are more internally self-sufficient. The two methods, however, will not yield similar results unless the pattern of purchases and sales by the recreation sectors is the same as for the region as a whole.

Location Quotient Type Multipliers

The virtue of location quotient (LQ) type multipliers is that they allow sector specific analysis for a region. The precision gained depends on the level of sectoral data disaggregation and the validity of assumptions necessary to implement the location quotient approach. In its simplest form the location quotient multiplier begins with an estimate of a regional transactions table using the location quotients to adjust a set of national technical coefficients. The location quotient is defined as,

$$LQ_i = \frac{E_i^r / E^r}{E_i^n / E^n} \quad (3)$$

which represents the ratio of regional employment of sector i (E_i^r) to total regional employment (E^r) divided by the ratio of national employment for sector i (E_i^n) to total national employment (E^n). The estimated regional direct requirements matrix can then be used to derive the sectoral multipliers using the Leontief inverse method² (Schaffer and Chu [12]). This permits the inclusion of direct, indirect and induced effects due to iterative rounds of spending which cannot be fully captured by the base type methods.

The simplest method of obtaining a LQ multiplier for a regional recreation sector is to adopt one already estimated by the Water Resources Council (WRC) [14]. The WRC output multipliers are available at the 56 sector level of disaggregation for 173 regions throughout the U.S.³ The shortcomings of this method are: 1) the boundaries for the WRC regions may not be consistent with boundaries for the study area, and 2) the level of aggregation used may not provide accurate information about recreation related sectors.

A more costly alternative is to estimate LQ multipliers for the study region using either the 484 sector national I-O model or some aggregated version with fewer sectors. Since regional employment data are typically the limiting factor, the latter option has been the norm. This method has the advantage of being adaptable to different regional boundaries but the level of aggregation depends on data availability through secondary sources. To the extent that the aggregated sectors are different from the recreation sectors, the multipliers estimated using this method will misrepresent the true impacts of new recreational expenditures. Since many water based recreation support industries are not separately defined even at the four digit level (see Table 1), the recreation multipliers estimated using location quotients from aggregate data can only approximate the true multiplier.

One alternative to the standard location quotients method is to supplement the estimated regional transactions table with survey information on intermediate purchases and sales for the recreation support sectors.⁴ This allows more detailed specification of the regional recreation sectors and limits the survey effort to a smaller scale than that required to construct a complete transaction table. Since the relevant sectors are separately identified and the data are survey based, the resulting multipliers for the recreation sectors should be more consistent with the multipliers estimated using a full survey based table.⁵ Since a full survey based model is impractical for most applied studies, the limited survey method provides a less costly alternative. This method, however, is considerably more difficult and costly than the alternative multiplier methods discussed above. The critical question is whether there are significant differences between the survey augmented location quotient multipliers (ALQ) and multipliers estimated by the alternative methods.

EMPIRICAL APPLICATION

This study compares the results of alternative impact multiplier estimation methods for recreational boating related activities. Estimates were derived for the Florida economy based on 1980 data. The starting point for the analysis is a 52 sector delineation of economic activity based on major industries and secondary data availability. The data were used to construct a state transactions matrix by the Schaffer-Chu [12] location quotients technique using the 1972 national technical coefficients matrix and sector output totals for 1980.

The CK aggregate multiplier was estimated by assigning each of the 52 sectors to basic and nonbasic groups on the basis of each sector's location quotient. Sectors with location quotients greater than 1.0 were classified as basic and the resulting summation of basic sales was combined with total sales to calculate the aggregate multiplier.

The BK sector specific multipliers were estimated from the 52 sector model using the appropriate 2 digit classification for each of the five recreation sectors. The values of p_j and $\bar{p}$ for (2) were calculated from the state transactions matrix; these estimates will be referred to later as BK (LQ).

The LQ multipliers were also estimated from the 52 sector transactions matrix using the matrix inverse technique and the resulting total requirements table. Multiplier values for the five recreation sectors were then obtained by selecting the appropriate 2 digit industry classification.

Survey data on the five recreational boating sectors were used to expand the 52 sector location quotients model to a 57 sector model. Information on instate purchases and the distribution of sales were used to augment the state transactions matrix. Application of the inverse matrix method resulted in the ALQ multipliers for each recreation sector.

Since the survey data introduced more detailed information than that available in the 52 sector model, the BK multipliers were reestimated using the p_j 's and $\bar{p}$ from the 57 sector model. These multipliers will be referred to as BK(ALQ). In order to determine how sensitive the BK method was to estimates of $\bar{p}$, a third method, labelled BK(RS), was also estimated. This third method used the p_j 's calculated from the 57 sector model but instead substituted a value of $\bar{p}$ based on BK's original work. They suggest that their approach is useful because a restricted survey can be used to estimate the p_j 's and $\bar{p}$ can be assigned a value based on estimates of $\bar{p}$ from I/O models of other regions. BK suggest a value for $\bar{p}$ of .3-.4 (pp. 158). A value of .4 was used to calculate the BK(RS) multipliers because it was believed the Florida economy had a relatively high fraction of sector purchases within the region.

Finally, the WRC multipliers were selected at the appropriate 2 digit level for each recreation sector. The multipliers used in this analysis are an average value for Florida since the WRC regional breakdown splits the state into 6 separate areas.

The multipliers estimated by each of the alternative methods are reported in Table 2 for each recreation sector. The most apparent feature is the relative similarity of the estimates, but it is important to identify the

differences on some objective basis. Several statistical tests (chi square, regression, etc.) have been used recently in the literature to compare multiplier estimates. These tests, however, are of limited applicability due to problems of truncated distributions and limited degrees of freedom. Other tests do not yield desirable statistical information but they do provide useful data on relative differences. The most commonly used measure is the relative percentage difference or,

$$\frac{M_i - M_i^*}{M_i} \quad (4)$$

where M_i is a reference value for the multiplier in sector i and M_i^* is an estimated value of the multiplier. The average relative percentage difference can be calculated simply as,

$$\sum_{i=1}^m \left(\frac{M_i - M_i^*}{M_i} \right) / m \quad (5)$$

where m represents the number of sectors considered in the comparative analysis. An alternative measure is the mean proportional difference or,

$$\sum_{i=1}^m \left| \frac{M_i - M_i^*}{M_i} \right| / m \quad (6)$$

The advantage of this measure is that it negates the effects of large positive and negative differences which may effect the relative percentage difference calculation. One final measure is the similarity index or,

$$\sum_{i=1}^m \left(1 - \left| \frac{M_i - M_i^*}{M_i + M_i^*} \right| \right) / m. \quad (7)$$

This measure also adjusts for large negative differences and has the special property that the index ranges from 0 to 1. Index values close to 1 indicate little difference between the multiplier estimates.

In this analysis the reference value of the multiplier (M_i) is the estimate resulting from the augmented location quotient (ALQ) method. It is assumed that the 57 sector model accurately characterizes the recreational boating sectors and the Florida economy and that estimation by the inverse matrix technique is the most informationally complete alternative. While there are a number of shortcomings in augmenting a location quotient model and potential inconsistencies in partial survey methods [9], this alternative is the most representative of the economy's structure and the most acceptable in lieu of a full survey based I/O model for the state economy.

TABLE 2
 OUTPUT MULTIPLIERS FOR MARINE RECREATION SECTORS
 ESTIMATED BY ALTERNATIVE NON-SURVEY METHODS

Sector	ALQ	CK	WRC	LQ	BK(LQ)	BK(ALQ)	BK(RS)
Boat and Trailer Manufacturing	2.9631	2.4200	2.3774	2.8172	2.8039	2.9549	2.1466
Boat Equipment Manufacturing	2.3091	2.4200	2.3717	2.9454	2.9107	2.3269	1.7782
Marinas and Boatyards	3.3634	2.4200	2.3890	3.2370	3.1781	3.2647	2.3283
Marine Trade	2.6262	2.4200	2.9234	2.9339	2.9175	2.5822	1.9280
Marine Services	2.8997	2.4200	2.2407	3.3655	3.2352	2.7599	2.0322

TABLE 3
RELATIVE PERCENTAGE DIFFERENCES, AVERAGE PERCENTAGE DIFFERENCES,
MEAN PROPORTIONAL DIFFERENCES, AND SIMILARITY INDEX FOR AUGMENTED
LOCATION QUOTIENT (ALQ) MULTIPLIERS AND ALTERNATIVE METHODS

Sector	Relative percentage differences					
	CK	WRC	LQ	BK(LQ)	BK(ALQ)	BK(RS)
Boat and Trailer Manufacturing	-18.33%	- 19.77%	- 4.92%	- 5.37%	- 0.28%	- 27.56%
Boat Equipment Manufacturing	+ 4.80	+ 2.71	+ 27.56	+ 26.05	+ 0.77	- 22.99
Marinas and Boatyards	- 28.05	- 28.97	- 3.76	- 5.51	- 2.94	- 30.78
Marine Trade	- 7.85	+ 11.32	+ 11.72	+ 11.09	- 1.68	- 26.59
Marine Services	- 16.54	- 22.73	+ 16.06	+ 11.57	- 4.82	- 29.92
AVERAGE PERCENTAGE DIFFERENCE	- 13.19%	- 11.45%	+ 9.33%	+ 7.57%	- 1.79%	- 27.57%
MEAN PROPORTIONAL DIFFERENCE	15.11%	17.10%	+ 12.80%	+ 11.92%	+ 2.10%	+ 27.57%
SIMILARITY INDEX	.9163	.9051	.9410	.9443	.9894	.8398

Calculated values of the different comparative measures are presented in Table 3. The relative percentage differences using (4) are reported in the upper portion of the table and the comparative measures (5) (6) (7) are reported in the lower portion. The three measures generally indicate that the most informationally demanding methods produce the closest estimates to the ALQ multiplier. The BK(ALQ) method provides the best estimate but this is not surprising given that the values of p_i used in the estimation are based on survey data. Since the BK method is based solely on first round effects the close proximity indicates that further round multiplier effects are relatively minor in the Florida model. The BK(LQ) method is the second best estimating method but the results are very similar to the LQ method. Again this is expected since the p_i and $\bar{p}$ used to calculate the BK(LQ) multipliers are derived from the 52 sector transactions matrix used to compute the LQ multipliers. This indicates once again that the BK method provides close estimates when second round effects are small. The major disadvantage of the BK method is evident in the estimated multiplier values and comparative measures for BK(RS). While the values of p_i are based on survey data, it is clear that the multiplier values are more sensitive to the value of $\bar{p}$ than indicated in BK's article. The $\bar{p}$ estimate of .4 used to calculate the BK(RS) multipliers is far below the $\bar{p}$ value of .65 used in BK(ALQ). Clearly the BK method is highly dependent on good information about both the sector's purchases and the interindustry purchases for all industries in the region.

The results for the CK and WRC methods indicate that these methods can lead to relatively large errors for sector multipliers and these methods were inferior to other methods except for BK(RS). Given that the CK and WRC methods are not as informationally demanding as the others, however, the estimated multipliers are relatively good approximations of the ALQ multipliers. Since many applied regional studies do not have sufficient information or time to estimate a complete regional transactions matrix, these methods may provide a reasonably reliable and inexpensive alternative for estimating impact multipliers.

CONCLUSION

Returning to the issue of whether the choice of multiplier estimation method matters in regional recreation impact studies, the answer is ambiguous. Certainly there is no compelling theoretical justification for any single method and the empirical results suggest a tradeoff between precision and the cost of information about recreation sectors' intraregional purchases. The most informationally demanding methods (LQ, BK(LQ), BK(ALQ)) produced the closest estimates to the partial survey location quotient multipliers but these methods may be impractical for limited budget studies. The BK(RS) results also suggest that the BK "columns only" method is very sensitive to the estimated average interindustry purchases coefficient, $\bar{p}$.

The least expensive methods, CK & WRC, were not the most precise but do provide reasonable estimates for studies which are not concerned with

absolute precision. While the CK method does require some effort in calculating location quotients for each sector to identify the base sectors, this exercise is far less costly than construction of the regional transactions table necessary for the other methods. The WRC results suggest that previously calculated multipliers may lead to large errors for some sectors but the overall errors introduced by incorrect multipliers may be less than the errors due to other estimation techniques used in the impact study.

While this study offers no conclusive evidence on the merits of alternative multiplier estimation methods, it does suggest that the analyst can be relatively certain that each of the alternatives can produce reasonable estimates. The final decision on how much accuracy is desired must inevitably depend on the analyst's budget and the availability of transactions data for the region.

FOOTNOTES AND REFERENCES

¹This focus on changes in regional economic activity due to a recreation project is typically referred to as the gross expenditures method. While this approach is not generally accepted (or advocated by the authors) as the correct method of project evaluation, it does have an 'intuitive' appeal for politicians and administrators. Weingast, Shepsle, and Johnsen [15] argue that these gross expenditures are in fact the true maximand for project selection by elected representatives.

²The location quotient can also be estimated using regional and national output instead of employment. Disaggregated sector output data from secondary sources is more limited, however, and most users of the location quotient method adopt the employment approach.

³The method used to derive the WRC multipliers is a different approach to location quotient type multipliers than that described above. For complete details, see [14] especially pp. 98-118.

⁴Several methods for adjusting location quotients have been devised which allow the researcher to incorporate more detailed information about the study area. A review of these methods is provided in Morrison and Smith [11].

⁵It is not possible to demonstrate for this study that the limited survey approach produces multipliers which are equivalent to the full survey results. Many studies, however, have indicated that limited survey methods provide results which were closer to the full survey method and were superior to other methods based only on location quotient techniques [11].

⁶The formula actually used to compute the CK multiplier was:

$$\frac{1}{\frac{\text{Nonbasic Income}}{1 - \text{Total Income}}}$$

Bendavid [1, pp. 112-122] demonstrates that this formula is equivalent to (1).

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