CHAPTER VIII- TN 31: THE ECONOMIC VALUE OF RECREATION AREAS: THE CASE OF SASKATCHEWAN PARKS

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ABSTRACT

Contrary to what many have believed, outdoor recreation is amenable to economic analysis and is quantifiable. The expression of the economic value ascribed to the use of a park is the visitors' willingness to pay for this use. More operationally, this can be measured as the area under the aggregate demand curve or the recreation services provided by such use of resources, over a period of time. To yield a net figure, the variable costs (usually of operation and maintenance expenses associated with the use) would need to be subtracted and any external values, such as preserving scientifically valuable artifacts, would need to be added. For most areas, the major problem centers on establishing a reasonable estimate of the demand schedule.

The paper describes a method whereby a meaningful estimate of economic value for a park can be derived. Data from a series of parks in Saskatchewan and a hypothetical proposed area are used to illustrate the method. The initial procedure is to estimate a relationship between use of parks and the various factors that influence this, such as population proximities, attractivity of the parks, and competitive facilities. From this use relationship a demand schedule can be imputed for a park by hypothesizing increasing costs of visits and estimating the consequent expected decrease in use totals. Then, it is possible to calculate the economic value of the park by measuring the total area under the demand curve obtained.

INTRODUCTION

Substantial sums are devoted to the provision of public outdoor recreation facilities and far larger ones are in prospect over the coming years. Presumably judgments of comparative worth of alternative proposals or of benefits and costs could be improved with some reasonable estimates of expected demand for alternative sites and meaningful measures of the value of such use of resources. This is not to suggest that such estimates should be the sole determinant; other factors such as the distribution of sites, availability to all segments of the community, and provision of a wide range of types of facilities should also be considered. Predictions of the use expected at a new facility can usefully be based on experience at similar existing sites, by casually noting similarities and drawing analogies or by establishing more formal statistically derived relationships. The expression of the economic value ascribed to the use of a park can, for the most part, be taken to be the willingness to pay for this use on the part of visitors to a park. More operationally this can be measured as the area under the aggregate demand curve for the recreation services provided by such use of resources. To yield a net figure the variable costs, usually of operation and maintenance expenses, associated with the use would need to be subtracted; and any external values, such as preserving scientifically valuable artifacts or preserving future options for use, would need to be added. For most areas, the major problem centers on establishing a reasonable estimate of the demand schedule.

The intent here is to establish demand relationships and to derive a meaningful estimate of economic value for a park, using data from a series of parks in Saskatchewan to illustrate the methods. Parameters estimated on the basis of visit patterns to these parks are used to project the demand for a hypothetical proposed area and for the economic value of the expected recreation use. The initial procedure is to estimate a relationship between use of parks and the various factors that influence this, such as population proximities, attractivity of the parks, or competitive facilities. From this a demand schedule can be imputed by hypothesizing increasing costs to visits and estimating the consequent expected decrease in use totals from the visit estimation model.

PARK VISIT MODEL

Visitor patterns for eleven provincial parks and one national park in Saskatchewan were studied.

Multiple regression of the visit rates from the origin areas to the twelve parks, and the four independent variables, resulted in the equation:

(1) $V(i,j) = -2.7 - (667+ 581P+ 16.6(T(j)- 179(P(i)A(i))/D(i,j)^{3/2}$

where V(i,j) is the number of vehicles, in hundreds, travelling to park j and from origin i; D(i,j) the road distance in miles between i and j;

P(i) the population, in thousands, in the origin areas;

A(i) the measure used to determine the accessibility of alternative parks for people at each of the origins; and

T(j) the factor used as an index of the attractivity of each of the parks.

Each of the coefficients was found to be significantly different from zero at the 5 percent level, and 90 percent of total variance among the observations was found to be explained by these terms. While each of the four independent variables was found to be significant, the term $P(i)/D(i,j)/D(i,j)^{3/2}$ alone accounted for the major proportion of the variation, reflecting the very strong dependence of Saskatchewan day-use recreation activity on proximity of population centers to the areas. A series of different exponents on the distance term ranging from 0.5 to 3, were tested with 3/2 and 2 being equally satisfactory and superior to the others in terms of the explained variations (TN 1). The relationship implied by the equation seemed plausible in terms of what is known about recreation visit patterns, especially in its accounting for the expected interactions among the variables and the strong influence which proximity exerts on visit totals.

The use estimating equation should provide a reasonable basis for predicting, for example, the expected use of a new or proposed site in the region. As such it should be a useful tool to deal with a common planning problem. However, beyond this it can also serve as the basis for estimating the value of such a proposed recreation area.

VALUE ESTIMATION

An estimate of the probable use of any proposed site in the region, similar to the parks included in the original surveys, and a demand schedule associated with this use, can be derived from the recreation visit model.

Given a proposed location, values for the distance, population and alternative attraction variables can be calculated just as they were for the existing parks used in the original analysis and as they were in TN 1. The numbers of miles to each origin resident area and the size of the population are either known or can be easily looked up or measured. Similarly, the alternative factor values can be computed for each park. The attractivity or facility index of the proposed site must be based on an assumed development or provision of facilities. Given the values for the independent variables, an estimate of attendance for the new area is obtained by substituting in the equation to obtain the number from each origin area, and summing over all of them to reach the total.

For the present purpose a hypothetical proposal is used for a park that might be located a little over 100 miles southwest of Saskatoon and not very close to any sizeable population centers, and having a fairly typical complement of facilities and attractions. For this set of assumed conditions the TN 1 model can be used to predict a yearly total of 13,420 vehicle parties that would visit the site. This is slightly below the average of 14,404 vehicles that went to the twelve parks used to generate the estimating parameters. The 13,420 estimate can be taken as one point on the demand curve to be imputed for the purpose of value determination; the quantity at zero price for the use of the services of the site. Estimating other points requires the further calculations of expected use but at what can be taken to be various increases in the cost of entering the park. This can be done through the use of the distance term in the equation. Distance is in effect a proxy for price in the sense that increases in distance from origins to parks serve as a deterrent to visits. Initially, it can be assumed that the cause of fewer trips is the increased cost of travel associated with increasing distances. The original suggestion for this procedure was by Cesario and Knetsch (1970). As the present case deals only with day-users, or those without expenditures connected with overnight stays, the variable costs of vehicle operation can by and large be taken to represent the cost constraint. For 1973 this was assumed to be $0.07 per mile, or $0.14 for the two way distance.

Successive points on the demand curve can be imputed by summing the estimated visits from each origin under assumptions of successive added travel costs in the form of added distance. For example, the visit total corresponding to a "price" of $4.20 per vehicle is found by adding 30 miles (30 miles at $0.14 per mile is $4.20) to each of the original mileages for each of the origin areas. An estimate of use can then be made for each and the result summed to give the total visits. In this instance the calculations yield an estimate of 5,450 vehicle parties. That is, 13,420 parties would be expected at no increase in travel cost, but this would fall to 5,450 if each were faced with an added outlay of $4.20. Other points can be derived in analogous manner to impute the relevant demand curve for the site; and the area under the curve can be measured to yield an estimate of the value. In the present case the demand curve calculated in this manner indicates a value of about $90,000 for the season.

TIME BIAS

The model is used to develop an estimate of the demand curve is essentially based on observed behaviour of visitors. That is, the empirical relationship between distance and visit numbers is estimated from actual use response of visits to Saskatchewan parks. It therefore avoids one source of arbitrariness of presumed response to proposed circumstances. However, the resulting estimate is subject to a serious bias. This is caused by the implicit assumption that the only reason that visit rates vary between origin centers of varying distances to a park is the difference in money outlay necessary to travel the added distance. This is certainly not likely to be the case. In particular it would be expected that the time required to travel greater distances would be a major reason for the observed variation in visit rates. Thus, when the model implies how much visiting will fall with increased money costs, the decrease is consistently over-estimated. The visit rate for any origin will decrease, but not to the extent indicated by the observed distance decay function, for only money costs are assumed to have increased with the travel time remaining constant (when the simple TN 1 model is used.) For instance, if money costs equal to an added distance of 30 miles were added to an original distance of an origin from a park of 20 miles, the visit total could not realistically be expected to be that of an origin 50 miles from the park. The money outlay is that of 50 miles, but the time cost is still that of the original 20 miles. The demand curve is then conservatively biased for all of the points except the zero "price" point. More visits would in fact be expected for each assumed money cost increase, than would be calculated directly from the model.

A CORRECTION

The bias problem resulting from a lack of an accounting of the effect of time could be overcome if it were possible to estimate parameters for a model that would have both travel time and money costs as separate variables. The money costs could then be incremented for each origin with travel time held constant in the same way that the factor measuring alternative or substitute areas is now maintained at a constant level for each origin. However, this is usually impossible owing to the high correlation between travel time and money costs among trips of varying lengths - longer journeys cost more and take more time (see TN 33). Toll roads, for instance, could introduce some variance but in the main it is impossible to establish meaningful estimates of the independent effect of each.

An alternative procedure can be used to make a correction for the present omission. This is to imply a trade-off between time costs and money costs by replacing the distance term in the model with a "composite" variable encompassing both time distance and money distance (Cesario & Knetsch 1970). Instead of the term D(i,j), a substitute combining "money miles" (D(C)) and "time miles" (D(T)) can be substituted.

The specific form of such a composite variable will reflect the presumed shape of the money-time trade-off expected to prevail. For example, if a linear trade-off is judged to be appropriate and if it is assumed that the time it takes to travel a mile is of equal importance in restraining visits to the money necessary to travel the same mile, then a variable (D(C) + D(T)/2) might be used. Thus for an observation or origin having an original distance value of say 20 miles, this would be replaced by ((20 + 20)/2); which equals the original 20. However, to calculate the demand schedule, increments are made to the D(C) term while holding D(T) constant. The resulting calculations yield a correction for the time bias, in that an accounting is made for effect of travel time. It is, of course, explicitly dependent on the form of the distance-time variable. An additive form will imply a linear trade-off. But different weights can be used to reflect the relative importance of travel time and money costs as impediments to travelling greater distances. For example, if it is hypothesized that the effect of the money it costs is twice as important as time, this can be reflected by the use of a variable (2/3 D(C) + 1/3 D(T)). Any weights can be used, with a zero weight for time being the original formulation which took no account of the time bias problem.

A curvilinear trade-off could be reflected in a variable such as $(D(C)\,D(T))^{1/2}$, with differing shapes requiring differing weightings. A form convex to the origin might be rationalized on the presumption of an observed strong tendency for the marginal effect of either an added minute or an added dollar to have a diminishing effect on decreasing visits the longer the trip - an added increment has less effect on trips of 100 miles than on ones of 10 miles. (The convex notion is similar to supposing convex indifference curves from generally observed diminishing utilities.) A more definitive choice of variable form and weightings should in time be amenable to empirical verification. Some evidence is provided by Mansfield which suggests that the weight or importance of time in overcoming greater distances to recreation sites is perhaps of greater importance than the money costs involved (Mansfield 1971). As he notes, the issue is the disutility of time traveling to a recreation facility and not that of traveling, say, within a park. By the same token, it might well be expected that the average impediment of time might well vary, for example, with the nature of the scenery or local amenity. Travel time would be less of a burden for a journey through semi-spectacular landscapes than one through more drab countryside, and the weights for the composite variable could, in principle at least, reflect this. At present, alternatives that appear to encompass reasonable assumptions can be used.

Another attraction of the time-bias type of formulation is that it provides a more consistent rationale for cutting off a demand curve that is asymptotic to the vertical axis, for purposes of counting of benefits (i.e. measuring in dollars the area under the curve). This asymptotic property can arise, for example, when a model is estimated in logs, or when a constant term in other forms is positive. If it is known from the original data that about the farthest source of visits is, say, 200 miles, then when the total value of D(T) and DC equals 200 this can be taken as the cut off. This is, however, quite different from having D(C) alone be 200. For example, if (D(C) + D(T))/2 is used, an observation starting at 20 miles (i.e. both D(C) and D(T) being 20 and with (D(C) + D(T))/2 being similarly equal to 20) can allow D(C) to be incremented to 380 before the total value of (D(C) + D(T))/2 reaches 200. This reflects the more realistic possibility that it is not just the money cost of travelling 200 miles that has cut off the visits, but a combination of both the time and the money involved; and consequently, if the time is less than that needed to go 200 miles, then the money outlay could probably be significantly higher before the combination forces the visits to zero. And, of course, the point at which this occurs is given by, and is thereby consistent with, the 1 to 1, or 2 to 1 or whatever combination of weights that is used in the formulation of the variable.

RESULTS

Without more evidence on the shape of the trade-off function between time and money, the more conservative linear form was pursued here. While any number of relative weights might be used, two were selected to carry through the analysis. The first assumes that the effect of time and money on visit rate decreases are equal, with the variable (D(C) + D(T))/2 consequently used. The second, assumes that money is twice as important as time with the variable (2/3 D(C) - 1/3 D(T) used. As the resultant demand curve does not reach an intersection with the price axis, a value of 200 miles for the composite variable was taken as a cut off. (As the curve was close to the axis, the resulting value estimate was not very sensitive to this particular choice of 200.)

Several points on the demand curves were calculated by incrementing D(C) while holding D(T) constant for each contributing origin area for the hypothetically proposed park. The area under the curves might then be taken as an expression of the present or initial year's economic worth of the recreation services that would be afforded by the park. In this case the estimates were approximately $159,000 and $125,000 for the equal time-money weights and the double money weighting respectively. Some projections over time would need to be made, the variable costs subtracted and an allowance added for non-user benefits, to arrive at a more complete evaluation of the total net value. However, the method appears to yield reasonably defensible estimates.