SOME ISSUES CONCERNING SPECIFICATION AND INTERPRETATION OF OUTDOOR RECREATION DEMAND MODELS *

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Some currently popular procedures for analyzing the demand for outdoor recreation makes use of ancillary[1] travel and on-site expenditures of recreationists as proxy prices. It can yet regrettably be asked whether the estimates produced by those methods bear any resemblance to the market-equivalent price-quantity relationships they generally purport to quantify. To some unavoidable extent this results from the necessary reliance upon proxies, or surrogates, for both quantity and price data. The ultimate value of proxy variables and of estimated relationships between them lies in the extent to which they resemble useful concepts. Past research has been based largely on assumptions of the resemblance.

A noteworthy weakness of existing lore on this subject is the scarcity of accepted procedures for specifying a recreation demand model and interpreting (for purposes of practical application) the estimates of such a model. The purpose of this paper is to suggest some topics of needed research and discussion toward founding consensus on certain items of methodology which the writers deem worthy of standardization. The suggestions pertain to three issues: the choice of quantity proxies, the approximation of price proxy variables, and time constraints in recreation demand models. Also, a suggested model is presented to help resolve some apparent differences of opinion.

QUANTITY PROXIES

Choice of the recreation quantity unit is necessarily a choice among proxies. A unit of recreation is an intangible concept which can be handled only in terms of some quantifiable characteristics. Reflection inevitably reveals the available choices of proxy to be debatably representative of the outputs they purport to quantify. Obviously, they represent nonhomogeneous outputs. It is for reasons mainly to do with ease of measurement, as compared to other tangible evidence of recreation consumption, that the recreation produce-unit has been defined as some amount of time in which a visitor[2] engages in some "typical" set of activities at a given site.

Most outdoor recreation demand studies have used either number of visits or length of stay as the quantity variable. The most commonly employed approach is that based on the original contribution of Clawson [2]. Number of visits per population zone, and more recently, as suggested by Brown and Nawas [1], the number of visits per capita, represent the dominant choice of quantity proxy among economists using Clawson's ideas. This choice assumes variation in number of visits and none in the length of stay per visit. The assumption has elements of reality for certain unique recreational sites, where, e.g., the visit is a once-in-a-lifetime or yearly affair.

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[1] "Ancillary" costs, for purposes of this paper (and based on methods under review here), refer to all costs that can be associated with recreating on a given site. These consist of (1) travel costs, which are all costs incurred en route to a given site and home again, and (2) daily on-site costs net both of user charges and normal "at-home" daily subsistence costs. Daily on-site costs measure the value of a quantity of goods consumed on site regardless of where the goods were purchased. Day-use fees, campsite fees, entry fees, and any other user charges would normally be considered as composing the supply price, or own-price, of privately operated recreational facilities.

[2] The "visitor" in this quantum may refer to a single person, a family unit, or any other convenient decision-making unit of humanity.

The other quantity proxy, the number of days per visit, as advocated by Edwards, et al, [4], assumes the only variation among recreationists is in the length of stay and not the number of trips. Again, this may be realistic in selected instances, although realistic examples are more difficult to conceive.

In a majority of cases neither choice is correct, since recreationists react to costs by adjusting both number of visits and length of stay per visit. It is suggested that total quantity of recreation demanded per time period (yearly, or seasonally), D_s, be recognized in recreation demand studies. Total quantity demand can be defined as:

(1) $D_s \equiv V \cdot D_v$

where V refers to the number of visits per time period, and D_v the number of days per visit.[3]

This identity alone does not explain; it merely describes. It does point out that the recreationist's decision to take a certain quantity of recreation at a given site actually involves two decisions, one of how often to visit and the other of how long to tarry on a particular visit. A general analysis of recreation should explain both.

A GENERAL MODEL

A suggested demand model that incorporates both quantity variables is presented in general as:

(2) $D_v = D_v (E_t, E_s, I, E_e)$ and

(3) $V = V (E_t, E_e, I, E_e)$

where E_t is a recreationist's travel cost, E_s is on-site costs of a recreationist, I is annual income, E_e represents other socio-economic variables, the components of which should correspond to the focal point of any particular study, and D_v, V, and D_s are as previously defined.

Under the Clawsonian influence, equation (3) was utilized – with two differences: (1) variables were measured in terms of averages over distance zones, and (2) all travel and on-site costs were summed to represent one price variable, of which travel costs make up the largest part. Other studies have focused only on equation (2), utilizing daily on-site costs was the site-price proxy. Clearly, there can be no complete discussion of these apparent differences of opinion except through analysis of both equations.

The fact that two decisions are involved in the recreationist's planning might seem to indicate a simultaneous system of equations involving equations (2) and (3). Pursuing this, however, reveals that it is scarcely possible to conceive of an independent variable belonging to either equation (2) or (3) that does not also fit in the other. In this sense then, estimation of the two relationships separately will provide information concerning tradeoff between number of visits and the length of each visit.

For example, predicting the impact of an increase in travel cost on the mix of visits and days per visit can be accomplished by collating the corresponding travel cost coefficients in the two equations. It is hypothesized, for example, based on empirical evidence [4, 5], that travel costs are negatively correlated to number of visits and positively related to length of stay.

PRICE PROXIES

The price proxies are meant to reflect variation in the visitor's opportunity cost, or supply price, of recreation at a given site. They sometimes seem better indexes of other things, including even quantities taken of ancillary inputs.

On-Site Costs

The daily on-site expenditures of a recreationist reflect both prices and quantities taken of the things he buys. A change in daily expenditures due to a change in those prices moves him along his demand curve for on-site recreation. In this case the change in daily on-site expenditures would represent the effect of a true price change. On the other hand, the change in daily expenditures may be due to a change in quantities taken at given prices of goods consumed on site. In this case, the change in daily expenditures is not an index of daily on-site price; on the contrary, it can be more reasonably assumed a demand shifter reflecting changes in site quality, or tastes.[4]

The observations are specifically directed to previous treatments of daily on-site costs as the price of a day's recreational benefits, which in common practice means the price of a visitor day. Edwards', et al., study exemplifies one such treatment. The function sought would relate number of days at the site to daily on-site costs (among other relevant

[3] It is, perhaps, worth noting that, while time may be generally the most easily measured evidence of recreation consumption, where appropriate D_s, for example could be total ducks bagged, V the number of visits per season to a given hunting preserve, and D_v the number of ducks bagged per visit. In any case, D_s is a measure of use-intensity of recognized interest for planning and management of public facilities.

[4] Examples of site quality changes include those due to such things as insect pests (causing changes in purchases of repellants), and weather (causing changes in a gamut of things ranging from fish bait to strong drink).

variables), a reasonable facsimile of a price-quantity demand curve if differences in on-site costs reflect differences solely in unit prices of ancillary inputs, but not if they reflect differences in demands for ancillary inputs at given prices. In the latter case, the number of days taken could plausibly increase with an increase in daily on-site expenses, despite the apparent predominance of empirical evidence to the contrary.

A diagrammatic interpretation of the distinction is as follows:

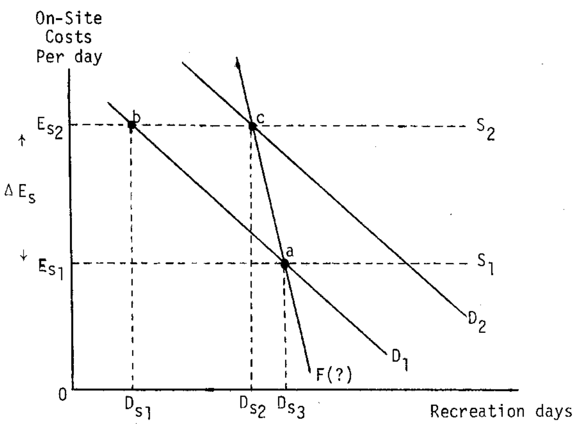

Figure 1.

In Figure 1 the curves labeled D_1 and D_2 depict hypothetical demand curves. They are demand curves by virtue of their showing the relationship, other things being equal, between daily on-site costs and total usage (quantity demanded) of a given facility.

An initial equilibrium, point a, is defined, with D_{S_3} visitor days being consumed at daily on-site costs of E_{S_1}. Next an increase in daily ancillary on-site costs, from E_{S_1} to E_{S_2}, is posited. The type of cost increase valid for treatment as a price proxy is completely independent of any shift in on-site-cost demand for the given site. For that type of price change the predicted decline in quantity demanded would be from D_{S_3} to D_{S_1} as read from demand curve D_1. If, however, some part of the same change in on-site costs were due to an improvement in site quality, for example, the quality improvement would also induce an upward shift of demand from D_1 to, say, D_2. Thus, instead of a movement to point b on D_1, the equilibrium would move to a point such as c on D_2 and on the curve labeled F(?).F(?) in this example would clearly underestimate the on-site-cost elasticity of demand.

By the same reasoning it can be shown that if a change in site quality induces a decline in daily on-site expenditures, the resulting F(?) would overestimate the true on-site elasticity of demand. The question, of course, is: Are ancillary on-site costs more or less in site-proxy than a site-quality demand shifter? The answer to that question is crucial to explaining or predicting recreationists' reactions to changes in daily on-site costs.

There are no doubt many types of study areas in which it would suffice merely to mention the absence of compelling reasons for suspecting that on-site costs reflect demand shifts instead of price differences. At the same time, some empirical evidence on the presence or absence of a relationship between on-site costs and other possible demand shifters would enhance the usefulness of on-site costs in their role as a price proxy.

Travel Costs

Travel costs constitute a tempting price proxy, both because of their prominence in the typical recreationist's budget and because data on them are so easily obtainable. It is not altogether certain, however, that travel costs are, in all cases, a better index of site price than of quantities purchased of ancillary travel inputs.

Moreover, only if the sole purpose of a trip is to recreate on a given site can costs of travel be considered a valid proxy price for recreational opportunities of that site. The appropriateness of the proxy price varies inversely with the strength of other reasons for the trip. It is not necessary to require the visitor to know precisely where he is going the moment he leaves his home. It is enough that he gets no utility from his trip apart from the on-site pleasures of that particular site. To assume so much should be done carefully.

There are suggestions as to how total travel costs might be adjusted to remove the influence of other benefits. One is to exclude from consideration the recreationist whose visit to the site is not the sole reward for his travels. A more typical approximation is to exclude from the sample of recreationists those whose visit is not the major reason for the trip. That might be rational, as approximations go, for visitors to a facility with such unique and unduplicatable facilities as those of a Grand Canyon or a Yellowstone, where for reasons of remoteness, as well as uniqueness, the typical visitor may well be enjoying the high point of his trip.[5]

Applying the same rule of sample selection to any campsite may, however, exclude the typical

[5] The subject matter of Clawson and many others does belong to this resource-based type of facility.

visitor from consideration. In such a case, he may be simply seeking a place to stay overnight on the way to major pleasures elsewhere. In any case, the bundle of recreational opportunities afforded by most public facilities have a formidable number of substitutes and complements in a relevant vicinity. With the recreationist who takes a bundle of those, along with the site of interest, is the traveler who enjoys traveling, itself, whether for the sight-seeing or just the "moving on."[6]

A technique that the writers [5] recommend involves the use of an adjustment to the recreationist's travel costs based on the time actually spent at a given site relative to his total time away from home. In other words, count only a fraction of his total travel cost as the travel expense of recreating on that site, that fraction being based on the proportion of his total time spent at the site while away from home. This admittedly arbitrary adjustment seems no more arbitrary than using unadjusted costs in estimating demand from a sample of recreationists that includes nondestination visitors.

LEISURE-TIME CONSTRAINTS

In conventional demand theory, the consumer's welfare-optimizing choice among alternative bundles of purchases is determined by his tastes and constrained by his income, the latter expressed as a monetary budget constraint at given prices of available goods. It follows that conventional predictions of consumer behavior rest on projections of tastes, income, and relative prices. It has been suggested [3, 6] that leisure-time availability may constitute a more binding constraint than income on the quantity purchased of recreation.

Surely, however, not everyone has all the time he would wish for all the recreation he could afford to buy. The implications of this for analysis of recreation demand at a given site need consideration only if because it has worried a lot of people.[7]

Three points seem worth raising. First, consumption of virtually all goods takes time,[8] thus recreation is not unique in this respect. Second, income and time constraints are inextricably interrelated for most people. Nearly everyone performs some kind of work that could be hired out in exchange for more leisure time; for example, people who do some of their own home maintenance work. Third, there is now some empirical evidence that the income constraint dominates the time constraint at least in the minds of a typical sample of state park campground patrons in Florida [5].

Of 357 campers queried as to whether it is the money cost of recreating or leisure time that primarily limit their recreation in the state parks, 279, or 78 percent, gave money cost as the answer. Thirty-five or just under 10 percent cited limited time. Most of the remaining 43, or 12 percent, could not make up their minds (a negligible few cited the two-week limit on state park campground use). In view of these points it can be suggested that the leisure time constraint is not as worrisome a problem as has been imagined.

KUDOS AND CHALLENGES

Having criticized past scholarship, it is time to rely on it for suggestions of where to go from here. The following hypotheses seem more or less confirmed by previous research:

1. Total quantity demanded (D_S), visits per period (V), and days per visit (D_V), are all inversely related to on-site costs and to on-site costs plus travel costs [2, 3, 4].
2. Total quantity demanded (D_S) and visits per period (V) are inversely related to travel costs [2, 3, 4].
3. Days per visit (D_V) are directly related to travel costs [4].
4. Statistically significant differences exist between estimated coefficients of travel and on-site costs when the two of them are specified as separate independent variables in any reasonable facsimile of a demand equation [4].

In view of findings 1, 2, and 3, it hardly can be doubted that the number of visits to and days spent per visit at a given site are both sensitive to variation in travel and on-site costs, and that estimates explaining variation in both components of total usage should be presented in a complete analysis of demand.

Findings 2, 3, and 4 caution against the summing of travel and on-site costs into a single price proxy. At the same time, having two price proxies for the

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[6] Apportioning travel costs among the myriad recreational motives for travel is about as easy as allocating fixed costs of a department store among every item of merchandise, the loss leaders included with the fair-traded goods.

[7] Wilson [6] presents a way to view the problem in terms of an extension of neo-classical demand theory, in which recreation is conceived as a produced activity, and draws the interesting, if somewhat implausible conclusion that the question of proxy prices for a facility may be irrelevant.

[8] Commodities and services for which there may be option demand constitute a seeming exception.

same thing leaves a rather messy situation. Which price is the variable of integration for deriving total benefit estimates? Which price should be used for estimating effects of changes in user fees?

If recreation can indeed be viewed as any other marketable product, then perhaps the logical choice is on-site costs, since user charges are after all, themselves, on-site costs. This argument might be strengthened considerably by some studies of facilities where user charges have actually varied significantly over the time period of analysis, which would enable comparison of actual events with those predicted by the on-site cost coefficient. Credulity might even be courted by evidence that actual variation in on-site costs is a matter mainly of genuine price differences for similar bundles of ancillary inputs. No such studies have been found by these writers.

Travel costs then would be identified as a price of some bundle of related goods, in the same way as the price of gasoline used in driving to the supermarket is generally viewed as the price of gasoline, and not of bacon and eggs. Travel costs, it also has been noted [6], are highly correlated with distance traveled and hence with travel time, and thus provide some allowance for the possible effectiveness of a time constraint. It may be appropriate in some cases to let them play only such roles as these.

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