Site Characteristics and Revealed Preferences for Outdoor Recreation

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Demand measurement for outdoor recreation has developed on a course that reflects trends in both theoretical economics and recreation policy. The early insights of Hotelling and Clawson and Knetsch express a dominant concern with estimating the demand for a single recreation site and the economic value of publicly provided, new recreation sites. Their theoretical framework was consistent with the emerging public goods theory which viewed recreation sites as homogeneous public goods demanded by homothetic consumers. In light of the emphasis on expanding leisure opportunities and public acquisition of recreational parkland in the national recreation policy of this period, their analysis was timely and an important benchmark for further refinements in measuring the economic value of recreation sites (Burt and Brewer; Cicchetti, Fisher and Smith).

In the past decade, the emphasis in recreation policy analysis has shifted from the provision of new recreation sites to evaluation of changes in the characteristics[1] of one or several existing recreation sites. Policy issues such as water quality management, the provision of site facilities, and stock density management for fish and game all require an understanding of the 'implicit' or partial value of these site characteristics. As Stoll has observed, recent insights in economic theory have provided a useful conceptual framework to consider recreational characteristics. Economists have an important role to play in providing information about the economic value of recreation site characteristics.

This article provides an overview of alternative approaches to estimate the value of site characteristics using the travel cost approach to recreation demand measurement. Particular emphasis is given to the hedonic travel cost model as developed by Mendelsohn and Brown. This review suggests that considerable theoretical and empirical research is necessary to develop a model of demand for site characteristics which is consistent with microeconomic theory and can be readily implemented.

Travel Costs and Site Characteristics

Following Hueth and Strong, the travel cost model can be viewed simply as a consumer maximization problem of the form

$$(1) \qquad U - U(v,z,y) \quad \text{s.t. } M = p_v v + y$$

where v is the number of visits to a particular recreation site, z represents characteristics of a site, y is all other consumption goods, M is income and p_v is the price per visit. This problem has been empirically evaluated using regression equations such as

$$(2) \qquad v = \beta_0 + \beta_1 p_v, + \beta_2 D$$

where D is a vector of demand shift variables (socioeconomic factors). In this format the travel cost model considers a site's characteristics or the availability of substitute sites only implicitly through the visitation rate for a single site. Incorporating site characteristics into the basic model can be accomplished with the addition of a site attractiveness index[2] (Cesario and Knetsch); the effect of substitute sites can be modelled in the multi-site frame-

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[1] 'Characteristics' is used as an eclectic term to represent observable, measurable features of a recreation site. Other terms such as attributes and amenities which have been used to describe recreation sites are included in the definition of characteristics.

[2] The travel cost model with an attractiveness index takes the form

$$v_1 = \beta_0 + {}_{\beta 1}p_1 + \beta_2 z_1 + \beta_3 D$$

where j refers to the jth recreation site and z is an index of relevant site characteristics. This approach assumes that a valid weighting system is known a priori by the analyst. Since characteristics are represented as an index, it is not possible to estimate a unique demand function for a single characteristic.

work proposed by Burt and Brewer.[3] Unfortunately both site characteristics and substitution effects cannot be explicitly modelled using these approaches. The generalized travel cost model used by Vaughn and Russell and Desvousges, Smith and McGivney attempts a reconciliation of site characteristics and cross-price substitutability in a single model[4] but, as Mendelsohn and Brown point out, the model fails to fully include cross-price effects. Therefore it is not possible to obtain an unbiased estimate of the demand (implicit price) for recreation site characteristics using the traditional travel cost framework.

The Hedonic Price Model for Site Characteristics

The hedonic pricing model developed by Rosen describes a competitive market in which buyers and sellers of heterogeneous commodities establish 'implicit prices' for the characteristics of a product. These implicit prices are a part of the total product price; equilibrium in the product market is characterized by simultaneous equilibrium in each of the implicit markets.

Mendelsohn and Brown's adaptation of the general hedonic pricing model suggests that the consumption of outdoor recreation can be modelled as a market for implicit site characteristics. The consumer's choice problem can be expressed as

(3) $$u = U(v, z_{lt}\ .\ .\ .\ , z_n, y)$$
$$\text{s.t. } M = p_v(z)\, v + y$$

where $z_{lf}\ .\ .\ .\ , z_n$ are characteristics of recreation sites and $p_v(z)$ is the total price (travel cost) of a visit to a recreation site with characteristics set z. This formulation of the recreation choice problem allows us to write the hedonic travel cost model as a two stage identification process

(4) $$p_v(Zi) = R(z)$$

(5) $$Pv^{l}(2i) = U(z, p_v, M)$$

where R denotes the set of site characteristics available, pvHzi) is the implicit price of characteristic i, and U is the consumer's utility (marginal rate of substitution) function.[5] The implicit prices for site characteristics revealed by (4) permit the identification of a demand curve for characteristics using the utility function given by (5). Value measures for a particular characteristic can then be computed by evaluating the integral under the demand curve for different levels of the characteristic.

While the hedonic travel cost methodology is intuitively appealing as a heuristic device, several problems have not yet been adequately considered. First, the analogy between 'markets' for publicly provided recreation goods and private markets for consumption goods is, at best, misleading. Public suppliers of recreation sites and facilities make production decisions in a bureaucratic, political setting and cannot be described as marginal maximizers in the same manner as private firms who can adjust product characteristics to implicit prices revealed by the market. The array of recreation site characteristics facing an individual consumer can be viewed as fixed, at least in the short run, but it is important to recognize that this 'short run equilibrium' is not the result of price-responsive production decisions.[6]

On the consumer side, there are no clear theoretical or practical guidelines about a) which consumers to include in the analysis?, b) whether individual consumers or aggregate 'travel zone consumers' should be modelled?, and c) what is the proper definition of travel costs in the hedonic framework? The delinea-

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[3] The multi-site travel cost model can be expressed as

vj * A + 2, &PJ + A-"0
j-i

where j again refers to the jth recreation site. The cross-price effects (dvj/dpi) i^j are revealed by the model and, in the case where the sites are perfect substitutes (symmetric cross-price effects), the multi-site model yields a unique estimate of the consumers' surplus for a site (Hof and King). The model, however, cannot explain differences in the demand for sites which are caused by characteristics of the site.

[4] The generalized travel cost model can be expressed as a two stage problem. The structural model can be represented by

Vj - £o + *PlPl* + ***faZtPi.***

The demand parameters are ft and & and can be expressed as functions of the site characteristics

$$£_0 = a_0 + «iZj$$
$$/3, = a_2 + a_3 z,$$

The varying parameter method used by Vaughan and Russell does yield estimates of demand for site characteristics. But, the method does not consider the cost of substitute sites and hence does not yield unbiased measures of consumers' surplus.

[5] In some related work on housing markets, McConnell and Phipps provide a justification for defining (5) as the consumer's utility (marginal rate of substitution) function. Quigley provides an empirical application for housing markets.

[6] This argument differs from the interpretation of the hedonic travel cost model given by Hueth and Strong. Their explanation accepts Mendelsohn and Brown's analogy on the supply of recre ation site characteristics and private markets for heterogeneous commodities.

tion of the study area for a travel cost model has traditionally been determined by visitation patterns at the relevant site(s). The hedonic travel cost framework cannot draw solely on the same data sources since it is necessary to include a sufficient number of sites to have variation in the characteristic set. Yet, the travel boundary must be truncated so that all other alternative sites are not also feasible substitutes. This restriction inherently imparts a downward bias to the value estimates for site characteristics. Another source of bias is the use of zonal aggregates in place of individual observations. While the hedonic travel cost framework is correctly described as a consumer maximization decision (see (3) above), the assumptions necessary for aggregation are not innocuous.[7] In effect, aggregating by travel zone in the hedonic travel cost model negates the "voting with your feet" framework for analyzing housing location decisions and assumes identical preferences across travel zones. The potential bias results from the relatively low price (travel costs) consumers in close proximity to a particular set of characteristics (site) would pay in comparison to consumers from more distant zones. While the individual's housing location decision may have originally been made to gain proximity to the site, these preferences are not revealed in the hedonic travel cost variable. This raises a third question about the proper measure of travel costs in the hedonic framework. If on-site costs (both time and out-of-pocket expenses) are not included then this would impart a downward bias to the implicit price of a particular characteristic. For example, the characteristic 'picnic facilities' could be evaluated in the hedonic travel cost framework and the effect of excluding on-site costs would be minimal. On the other hand, the value of a site characteristic such as 'boating facilities' could be significantly affected if ramp costs, boat rental charges, etc. are not part of the travel costs.

Finally, while equations (4) and (5) above offer a framework for valuing recreation site characteristics, the transition to an empirical application is not straightforward. The analyst must resolve the issue of which site characteristics to include and how to measure changes in the level of these characteristics. The specification of these variables and the selection of a functional form for the utility function in (5) have not been addressed in much detail in the literature.[8] The importance of identifying the value of recreation site characteristics for policy analysis suggests further research on these issues should be a high priority for recreation economists.

Conclusions

The analysis of implicit prices for heterogeneous commodities in private markets has made considerable progress in the past decade. The need for similar developments in nonmarket valuation for recreation goods is apparent from the growing awareness of the effect of changes in recreation site characteristics due to environmental policy and public expenditure decisions. This article identifies some of the major problems with alternative approaches to estimating implicit values for characteristics in the nonmarket good setting. The hedonic travel cost model offers one possible framework in which both site characteristics and substitution effects can be considered. A number of theoretical and practical ambiguities must be resolved before the basic model can be widely used for outdoor recreation valuation research.

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[7] The arguments developed by McConnell and Bockstael about the importance of error specification in zonal aggregation for traditional (single site) travel cost models are relevant here also. But, this issue is not discussed in this article.

[8] For two potentially useful approaches to specification of the utility function for site characteristics, see Greig and Morey.

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