Travel Cost Literature


This paper uses Monte Carlo analysis to compare the variance of consumer's surplus for several functional forms for demand. Although the semilog and linear forms fit the data well by statistical criteria, the coefficients of variation for consumer's surplus generated by these forms were substantially larger than for the double-log and linear-log forms. While this paper is framed in the travel cost approach to recreational demand, there are implications for the choice of functional form whenever the measure of interest is a nonlinear transformation of the estimated parameters.


This paper develops a model in which the choice of a discrete number of sequentially chosen trips to a given site is specified as a function of site-specific variables and variables realized on previous trips. This model specifies discrete, nonnegative integer values for the number of trips and allows intraseasonal effects to determine the probability of taking each additional trip.


This paper uses a rational dynamic model to incorporate previous experience with a recreation site in a model of the choice of a site. The data used in this study were obtained from a survey of recreational anglers in Alberta, Canada in 1990.


This technical paper combines stated preference data with observed (revealed preference) data from the same individuals to characterize recreationist choice of sites in the Highwood and Little Bow rivers in southwestern Alberta, Canada.

This paper employs a varying parameter travel cost model to determine the economic valuation of fishing trips and catch for a sample of Long Island anglers. Substitution measures in the model are characterized in terms of the number and the quality of proximate alternative sites. This treatment of substitution as a site rather than an individual characteristic helps to define a site's uniqueness and in addition provides a feasible means of capturing substitution effects when measures of substitution at an individual level are not available. Per trip consumer surplus and changes in consumer surplus due to catch changes are computed and distinguished by controls for the availability and quality of substitute sites. Consumer surplus and the valuation of changes in catch are found to be substantially lower when controlling for substitution effects which is in agreement with most previous studies.


This analysis deals with tourists that come from significant distances to use principally beach resources. As Smith and Kipp (1980) have argued, those that use the conventional travel cost methods (TCM) do not recognize its potential spatial limitations. One day trips as used by the TCM are certainly inapplicable to those coming from significant distances, such as tourists to Florida. The empirical data are consistent with the thesis that annual consumer demand by individual tourists for Florida beach days is positively related to travel cost per trip and inversely related to on-site cost per day. There are compelling reasons for treating recreational decision-making for what we call tourists differently than for residents or those traveling relatively short distances. Employing the on-site cost demand curve for tourists using Florida's beaches, we find the daily consumer surplus to be nearly $34.00.


This study examines per trip consumer surplus associated with guided whitewater rafting on two southern rivers. First, household recreation demand functions are estimated based on the individual travel cost model using truncated count data regression methods and alternative price specifications. Findings show mean per trip consumer surplus point estimates between $89 and $286, depending on modeling assumptions and river quality. Magnitudes of these surpluses are very dependent on assumptions about the opportunity cost of time.


Lottery-rationed permit systems are used to allocate hunting opportunities where demand
for permits exceeds the ability of the animal populations to sustain hunting harvest levels. Attempts to estimate the values of lottery-rationed hunting use a zonal travel cost model where applications per capita formed the dependent variable and expected travel costs represent the price variable. This paper reexamines this analysis using a discrete choice travel cost model which incorporates the expectation of receiving a permit. This model is developed for lottery-rationed antelope hunting in Alberta. Choice in the lottery-rationed hunting context involves selecting one site from a set defined through management regulations. The discrete choice travel cost model is proposed as superior to the early models because it better represents this behavioral process.


The hedonic travel cost method is a technique that reveals how much users are willing to pay for the individual characteristics of outdoor recreation sites. The prices of recreation attributes are estimated by regressing travel costs on the bundles of characteristics associated with each of several potential destination sites. The demand for site characteristics on site quality is then revealed by comparing the site selection of users facing different attribute prices. The technique is applied to value steelhead fish density in Washington State streams.


The trip/visit variable in the individual travel cost method is often regarded as discrete. Furthermore, it is often reported in surveys as a grouped variable (the number of visits reported falling into one of several classes). This paper develops a travel cost model that takes account of discreteness and grouping in both demand and benefit estimation. A case study and associated simulations are then reported, which indicate the potential extent of bias that may arise from ignoring discreteness/grouping in demand and benefit estimation. The information loss involved in varying the size of visit classes is also examined.

In this analysis we develop a two equation structural model of a count travel cost model of recreational angling demand and angling success. By modeling the two equations jointly we avoid the difficulties associated with the usual approach which estimates the demand for recreational fishing sites assuming the existence of an exogenous measure of fishing quality. Our analysis explicitly develops the joint log likelihood function that combines the two processes. We estimate our model using full information maximum likelihood methods. (c) 1997 Academic Press


An important issue in the application of travel cost models is the construction of a travel cost variable. This paper develops an econometric approach that views travel costs as an unobserved latent variable. The latent variable approach utilizes indicators to capture the role of individual travel costs in recreational demand models. The latent variables approach has at least two advantages over conventional approaches. One, the indicators can include both traditional components such as time and distance and non-traditional components such as the scenic beauty. Second, the estimation procedure results in each indicator being valued in dollar terms. (c) 1995 Academic Press, Inc.


One benefit of managing forests is that one can alter the qualities of sites. The value of changing site qualities, however, is generally not known. This paper develops a formal hedonic travel cost model which can be used to estimate the value of both marginal and non-marginal changes to sites. The approach accommodates multiple simultaneous changes in site characteristics. Estimating this model using a set of permits from wilderness areas leads to revealed preference estimates of the recreational value of clear-cuts, old-growth, and nine other wilderness attributes.

Englin, Jeffrey; J.S. Shonkwiler. 1994. “A Latent Variables Approach to the Travel Cost Model.” Department of Agricultural Economics, University of Nevada, August 1994. Keywords: travel costs, latent variables.


This technical article provides an overview of selected theoretical and empirical issues in the economics literature on the travel cost model of recreation demand. Issues are identified and
some solutions are discussed. Research results from related disciplines that may have applications to travel cost models are also discussed.


In order to control for censoring and the integer nature of trip demand, the use of count data models in travel cost analysis is attractive. Two such models, the Poisson and negative binomial, are discussed. Robust estimation techniques that loosen potentially stringent distributional assumptions are also reviewed. For illustrative purposes, several count data models are used to estimate a county-level travel cost model using permit data from the Boundary Waters Canoe Area.


The paper develops a theoretical foundation for using count data models in travel cost analysis: a restricted choice model and a repeated discrete model. Both models lead to identical welfare measures.


A travel cost demand model is derived from a utility function that postulates that individuals choose the optimal total number of site recreation days given by the product of the number of length of their recreation trips. By relaxing the assumption that on-site time is constant across recreationists, the applicability of the travel cost method is extended. The model is estimated using a maximum likelihood procedure appropriate for the truncated sample data that is characteristic of most user specific recreation data. Failure to do so would result in overestimating the value of Great Lakes fishing by 3.5 times.

This paper extends the standard travel cost method to develop estimates of the economic value of recreational chinook salmon fishing on the Gulkana River, Alaska, under existing and hypothetical fishery management conditions. Respondents were asked to state how the number of trips that they took to the study area would change if alternative fishery management practices were imposed. Three hypothetical management conditions were considered: a doubled 1992 sport fish harvest, a doubled daily bag limit, and a season bag limit of five. Each of the hypothetical fishery management conditions provides increased economic returns to anglers.


Part of the special issue on benefit transfer applications.


This travel cost demand study included prices for closely related goods such as money and time costs of on-site time, on-site purchases, and other trip activities. A disequilibrium labor market model was estimated. The sample was mainly composed of persons who did not substitute earned income for leisure time. The few persons who had the capability to substitute time for money were excluded from the sample. Consumer surplus was estimated to be $69.00 per trip using the expanded model. A model using only the conventional travel cost variables resulted in estimated surplus per trip of $45.00.


This paper extends the work by P. P. Caulkins, R. C. Bishop, and N. W. Bouwes (1985) on the bias in site value measurement created when alternative site prices are omitted from the travel cost demand specification. Caulkins, Bishop, and Bouwes's analysis does not treat the issue of bias in the intercept since they adopt R. L. Gum and W. E. Martin's (1975) procedure that discards the intercept estimate. The procedure limits the applicability of Caulkins, Bishop, and Bouwes's findings. This paper reexamines bias in both the intercept and demand slope estimates. It is shown that both average and variance of price must be known in order to determine the direction and amount of bias in consumer surplus.


Economic measures of the value of recreational catch typically have been based on the aggregate number of fish caught per unit effort. Fishery management councils, however, regulate recreational catch through bag limits and size restrictions that influence the composition of kept and released fish in the catch, not just the number of fish caught. Statistical tests for pooled site...
travel cost demand models for anglers of king mackerel (Scomberomorus cavalia) in the Gulf of Mexico region showed that indicators of kept and released catches outperformed an aggregate indicator. Accounting for the composition of catch had a significant effect on economic measures of the gains and losses from catch regulations and suggested that aggregate indicators may give misleading estimates of the change in economic value due to regulations. Economic studies of the value of recreational catch in other fisheries should give more consideration to the effects of regulations on the composition of kept and released catches and to the social factors that influence the keep or release decision.

To test the results of this methodological approach, a data set should be created based on a theoretical model of recreational fisherman behavior when exploiting a common property resource. Impose management regulations such as size and bag limits for a fishing trip. Estimate the model and compare the estimated parameters to the known or true parameters for management implications (consumer surplus). Modify the model with a catch and keep constraint, if known and estimated parameters differ and compare to the Milon elasticity results that seem counter intuitive on page 187.


Participation and site choice for Atlantic salmon fishing are modeled in the context of a repeated three-level nested-logit model. For comparison, six other travel-cost models are estimated. These include restrictive cases of the nested-logit model, a partial demand model, and two single-site demand models.


The travel-cost method is used to evaluate the demand for hunting trips in Kansas. In contrast to earlier studies, time spent on-site for other recreational activities is explicitly included in the empirical analysis. The demand for hunting trips falls as cost rises. The hunter's age, investment in hunting equipment, and site quality characteristics significantly influence demand. Conversely, time-on-site for non-hunting activities and length of stay do not significantly influence the demand for hunting trips. These results lend support to other analyses which have implicitly assumed that lengths of stay and time spent in secondary recreational activities are not relevant to recreational demand estimation. The estimates suggest that Kansas hunters realize benefits of about $170 per hunting trip.


Often, due to data or computational constraints, the analyst must use aggregated alternatives to estimate a random utility model. These aggregates are defined by averaging
characteristics of alternatives over prespecified groups. The paper demonstrates that unless some very restrictive conditions hold, the use of aggregated alternatives will lead to biased results. A data set of recreational fishing in Wisconsin is used to examine the biases in aggregation.


Instead of observable prices of recreational visits, travel cost method (TCM) researchers are obliged to substitute researcher assigned visitation cost estimates. I argue that visitation costs are inherently subjective, but are ordinally measurable so long as the cost increases with distance traveled. It follows that traditional TCM yields only ordinally measurable welfare estimates. The household production function formulation of TCM “resolves” this problem only by imposing severe and untestable analytical restrictions. TCM cannot serve as a stand-alone technique for estimating recreation benefits; rather it must be calibrated using information generated with fundamentally different methods.


Omitting substitute prices from a travel cost model is shown to cause a significant bias in consumer surplus estimates. Three sets of travel cost models are developed from a common database representing 60,000 day users of U.S. Army Corps of Engineer reservoirs in Kansas and Missouri. The first set of models omitted substitute prices; the latter two sets included them. An analysis of variance test showed that consumer surplus estimates from the first set of models were significantly higher than the other two (F E 26.2 with 2, 20 degrees of freedom). The theoretical and practical implications of these findings are discussed.


An estimation method is presented to measure sport fishermen's valuation of exogenous changes in fishing quality (catch rates). A theoretical model is initially presented to show how variations in prevailing catch rates influence an angler's valuation of recreational fishing. A two-stage estimation approach is suggested that capitalizes on the notion that angler consumer surplus is sensitive to changes in success rates. The procedure entails first estimating sportfishing values at qualitatively different fishing sites using a multiple-site travel cost approach. Afterward, the sensitivity of estimated values to different success rate levels is measured using a separate
regression procedure. An empirical application of this two-stage method to Lake Michigan sportfishing is given. It is estimated that for Lake Michigan anglers who fish for trout and salmon, a 10% increase in success rates will increase average trip values by $0.30.


This paper extends the Brown-Mendelsohn hedonic travel cost model by estimating the travel cost function for each recreationist as a technically efficient frontier. It also constrains the marginal prices for desirable characteristics to be nonnegative. The model is used to value improvements in the quality of sport fishing in the Albemarle-Pamlico Estuary in North Carolina. The application compares the performance of the frontier hedonic travel cost with ordinary least squares estimates, and finds the former to be free of problems identified in the literature and to provide more plausible and robust benefit estimates for quality improvements.


Concern over the theoretical framework underlying the hedonic travel cost (HTC) model's implicit prices (as well as the process of estimating these prices) and the definitions of the quantities of site characteristics "consumed" by recreationists motivated this analysis. This evaluation of the HTC model considers the implication of the definitions of price and quantity measures for both the estimated demands for the characteristics of recreation sites and for the benefit measures based on them. The authors' results contrast with all the published applications of the HTC model. They indicate that application of the model should not be regarded as a routine implementation of a hedonic price function.


This article summarizes the conceptual development and empirical implementation of the travel cost recreation demand model by (1) describing its theoretical underpinnings, (2) outlining how theory must be adapted for the needs imposed by available data, (3) explaining issues to be considered in the future. Applications of the travel cost model have evolved from studies conducted at an aggregate level with origin zone data to an almost exclusive focus on micro data concentrating on individuals' recreational choices. These applications have broad implications. They are among the most detailed and extensive illustrations of models for corner solution and discrete choice problems in microeconomics. Equally important, they explore the theoretical and practical implications of the household production framework. Finally, they also provide
examples of how a commodity's quality can be considered as an argument in describing individuals' consumption choices.


This article compares five methods for estimating travel cost recreation demand models with micro data. The models are distinguished by their treatment of selection effects that arise with on-site surveys. The comparison considers adjusting for selection effects in a variety of ways, including single and double selection rule models. Both parameter and consumer surplus estimates were evaluated. The findings indicate that the treatment of selection effects alone was not important for this case. However, the choice of an estimator did lead to large variations in per trip consumer surplus estimates.


A discrete choice travel cost model, based on data collected from a survey of recreational anglers, was used to estimate changes in recreational fishing benefits at sites in the Upper Oldman River of Alberta resulting from the construction of a dam.

Open-access recreation benefits of forests are shown to be much larger than previously thought by the National Audit Office. Forecasts were classified by tree and recreational characteristics into different classes, and a random sample of visitors interviewed at sites within each cluster. A zonal travel cost model was used to estimate demand for forest recreation. Consumer surplus per visit varied significantly by type of forest, as did total visitor numbers. The effect of the inclusion of consumer surplus from recreation on the internal rate of return of timber production is variable. It is negligible for many areas of forestry.

The traditional travel-cost model uses trips (or visits) as its measure of quantity and travel cost per trip (or visit) as its price. However, because many estimated demand curves do not hold visit length constant, they cannot be used to value increments of use. The simple repackaging model of J. Muellbauer (1974), and F. M. Fisher and K. Shell (1971) is used to derive demand curves exhibiting constant visit length from demand curves exhibiting variable visit length. The former allow the marginal quantity valuations that are necessary for management decisions involving capacity or use.