Contingent Valuation and Recreational Demand

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Abstract

A contingent valuation model is developed to estimate the value of the recreational experience for visitors to Reelfoot Lake in northwestern Tennessee. Hicksian compensating variation measures of consumer surplus were estimated. Individual willingness-to-pay and aggregate willingness-to-pay were calculated for the lake.

Introduction

It is generally accepted that outdoor recreational amenities have value. However, estimates of that value are not readily available because outdoor recreational resource prices are not directly observable in the market place. If a recreational resource is to be effectively managed estimates of its value are necessary.

The most widely used and accepted methods for valuing recreational benefits are the travel cost method, originally suggested by Hotelling (1949) and formalized by Clawson (1959) and the contingent valuation method first used by Davis (1963). This paper reports on the application of a contingent valuation model to estimate recreational benefits for visitors to Reelfoot Lake in northwestern Tennessee.

The Contingent Valuation Method

The contingent valuation method is a survey technique described by Randall and Stoll (1983), as follows:

Contingent valuation devices involve asking individuals, in survey, or experimental settings, to reveal their personal valuations of increments (or decrements) in unpriced goods in contingent markets. These markets define the good or amenity of interest, the status quo level of provision and the offered increment or decrement therein, the institutional structure under which the good is to be provided, the method of payment, and (implicitly or explicitly) the decision rule which determines whether to implement the offered program. Contingent markets are highly structured to confront respondents with a well-defined situation and to elicit a circumstantial choice contingent upon the occurrence of the posited situation. Contingent markets elicit contingent choices.

The contingent valuation method can, therefore, be defined as a set of techniques and hypothetical institutions that can be used to elicit values for a nonmarket good. A correctly designed contingent valuation survey must have the following three components:

1: A comprehensive description of the good being valued and situation under which this good would be available to the consumer must be provided.

2: Questions that elicit a respondent's willingness-to-pay for the good being valued must be developed. The most common form of these questions are bidding games and the open-ended question approach. In a bidding game, a recreationist is asked if he would be willing to pay a prespecified price for unlimited access to the resource being valued. A positive answer leads the interviewer to increase the price while a negative response leads him to decrease the price. This process continues until a recreationist's maximum willingness-to-pay has been determined. In the open-ended question approach, a respondent is asked the maximum he is willing to pay for access. Therefore, he is allowed to determine a monetary amount based on his own judgement. Willingness-to-pay questions provide a theoretically correct measure of benefits associated with a new or existing site. However, for the evaluation of benefits lost from the elimination of existing resources (e.g., waterfowl hunting opportunities lost when wetlands are drained), it may be more appropriate to measure the lost benefits in terms of users' willingness-to-sell their

existing rights to a resource (Dwyer, Kelly and Bowes, 1979). Therefore, the appropriate type of question to ask in a contingent valuation survey will depend on the site under study and the existing set of property rights at that site.

3: Questions are needed to determine the socioeconomic characteristics of the visitors to the site.

The survey information collected from the above questions is used to develop an equation which can be used to predict any other user's valuation of a particular site or a new site or benefits lost from the elimination of an existing site. Basically, the survey information is used to generate a regression equation of the following form:

WTP = f(V, Y, M, S, D)

Where:
WTP = willingness-to-pay for a recreational resource;
V = number and length of visit to a site;
Y = years of experience with a site;
M = miles traveled to a site;
S = availability of substitute sites; and
D = socioeconomic variables

Total recreational benefits are derived by summing individuals' willingness-to-pay over the appropriate population. Essentially, the contingent valuation method is a technique to measure equivalent surplus or compensating surplus. The derivation of willingness-to-pay is based on two key assumptions. The first is that consumers can assign an accurate value to a recreational experience. The second is that this value can be elicited from them with a properly constructed series of questions (Dwyer, Kelly and Bowes, 1979). There are, however, a number of problems associated with the contingent valuation method. Three prominent problems are framing, accuracy, and bias.

Framing refers to the description of the contingent market. Effectively, contingent markets transfer information to an individual about a commodity to be valued and the respondents transfer information, back to the researcher, about the value of that commodity. Consequently, the information structure can affect the magnitude of estimated values (Boyle, 1989, pp. 57-63).

Four types of potential biases in contingent valuation measures can be identified. They are starting point bias, vehicle bias, information bias, and strategic bias.

Starting point bias can be defined as a bias resulting from the starting point of the bidding procedure. An initial bid may imply (incorrectly) the appropriate range of bids for valuing an environmental good. Therefore, the respondent may give different values for a good based on the initial bid suggested to him.

Vehicle bias is related to the proposed hypothetical payment method in the bidding game. These payments methods could include tax payments, entrance fees, or higher utility bills. An example of this type of bias is that someone who objects to higher taxes might understate his willingness-to-pay due to his feelings about the tax system.

Information bias is due to a lack of information provided to the respondent concerning the hypothetical market in which he is asked to value an environmental good. If an individual does not clearly understand the good on which he is bidding then he cannot accurately state his willingness-to-pay.

Strategic bias in the contingent valuation method results from respondents trying to influence the outcome of a study by incorrectly stating a maximum willingness-to-pay. An example of strategic bias is when a respondent understates his willingness-to-pay in order to avoid a use fee sometime in the future.

Accuracy refers to the reliability of estimates generated by the contingent valuation method. Cummings, Brookshire, and Schulze (1986) provide a detailed discussion of this aspect of the contingent valuation method. They conclude that contingent valuation method values may yield "accurate" estimates of values in cases where individuals have had some opportunity to make actual previous choices over that commodity in a market framework.

Problems associated with the description of the nonmarket commodity, i.e. framing problems, are believed to be minimal for this study. Respondents were contacted on site and asked their maximum willingness-to-pay for a one year pass to Reelfoot Lake. Since they were presently visiting the site it was believed that they had a clear understanding of the commodity on which they were bidding. Additionally, the survey included a list of all recreational facilities and activities available at the lake.

Strategic bias may have been a problem associated with this study. Although there were no implications in the survey that the results would be used to help set fees for the lake it is likely that some of the respondents would infer that fees may be set based on their responses. Consequently, several of the respondents may have understated their actual willingness-to-pay.

Data Sources and the Measurement of Variables

The data used in estimating the contingent valuation model were taken primarily from a Reelfoot Lake visitor survey conducted by other researchers during the spring and summer of 1985 and the winter of 1986. Questionnaires were sent to 900 recreators who had been contacted on site. A total of 38 were undeliverable or ineligible for use in the study. Of the 862 qualifying questionnaires, 719 were returned, representing a response of 82.4 percent. However, due to missing information, only 393 were used in this study.

The model used in this study expresses willingness-to-pay as a function of quantity, education, availability of substitutes and income. This model can be formally stated as:

$$WTP = B_0 + B_1V_i + B_2E_i + B_3S_i + B_4I_i + e_i$$

Where:

WTP = maximum willingness-to-pay for a one-year pass;
V_i = number of trips taken per year to Reelfoot lake;
E_i = education level for each individual;
S_i = availability of substitute sites;
I_i = total household income; and
e_i = normally distributed error term.

Since there are no a priori considerations to guide the researcher in the selection of functional form three models were hypothesized. These are linear, linear with a squared term in V_i and double-log.

Willingness-to-pay (WTP). The open-ended format of the willingness-to-pay question allowed the respondents to specify a dollar value for a pass to the lake. They were asked: "What is the maximum amount of money you would be willing to pay for a one year pass to be able to use Reelfoot Lake?"

Number of trips (V_i). The number of trips per year taken to Reelfoot Lake by individual i was taken directly from the survey and represents the average number of trips an individual has made over the last five years. It was believed that an average visitation rate over five years would be more representative of visitor behavior than the number of visits over a one-year period.

Education level (E_i). Education level for each individual was also taken directly from the survey instrument. Respondents were asked how many years of formal education they had received.

Substitute sites (S_i). The availability of substitute sites at origin i was an index number developed by Knetsch, Brown and Hansen (1983) designed to capture both the quantity effect and price effect of substitutes. The index value is defined as the ratio of surface acres of water of a substitute site to the distance that site is from origin i. If the ratio for a specific origin-substitute site combination is greater than the ratio for the given origin-study combination, then the substitute site is considered competitive.

Income (I_i) Income for recreationists at Reelfoot Lake came directly from the survey. Respondents were asked to classify their income based on seven categories. The midpoint for each category was used.

Results

Model Estimation The equations estimated for this study are given below. The numbers in parentheses are t values. Significance at the .10 level is indicated by an asterisk (*); significance at the .01 level is indicated by a double asterisk (**).

The linear model is as follows:

$$WTP = 14.02 + .55V_{1i} - .000017I_i + .00018S_i - .235E_i$$
(2.19)** (3.12)** (-1.78)* (.292) (-.516)

$n = 393 \qquad R^2 = .1264$

The double-log model is as follows:

$$LnWTP = 3.33 + .09LnV_{1i} - .14LnI_i - .047LnS_i + .092LnE_i$$
(2.65)** (1.07) (-1.23) (-.759) (.331)

$n = 393 \qquad R^2 = .0089$

The quadratic model is as follows:

$$WTP = 22.16 - .16V_{1i} + .0098V_{2i} - .00014I_i + .00026S_i - .37E_i$$
(4.69)** (-.608) (2.73)** (-2.09)* (.029) (-1.1)

$n = 393 \quad R^2 = .0724$

Where:

WTP = willingness-to-pay for a one-year pass to Reelfoot Lake;
V_{1i} = a five year annual average of visits to Reelfoot Lake;
V_{2i} = the square of V_{1i};
I_i = household income for individual i;
S_i = substitute sites available to individual i; and
E_i = education level for individual i.

The linear model was selected as the most appropriate functional form. There are several reasons for this. First, the double-log model was rejected due to the low R^2 value and the lack of significance of the variables. Second, the quadratic model was rejected due to the positive sign on the squared term. A positive sign indicates that willingness-to-pay would increase at an increasing rate, thus implying an upward sloping demand curve. Finally, the linear model had the strongest relationship between the dependent and independent variables. This is indicated by the R^2 values for the equations. The above linear equation, or household total value curve, can be used to estimate recreational benefits for Reelfoot Lake.

Benefit Estimation The estimates generated from the contingent valuation model are Hicksian compensating variation measures of consumer surplus. This is true because the consumer is asked to state a maximum willingness-to-pay for a one-year pass to Reelfoot Lake when initially access to the lake is free. Therefore, the consumer is asked how much he would be willing to pay to keep himself at the initial level of welfare. The compensating variation measure is approximately equal to a Marshallian measure of consumer surplus. As presented earlier, the household total value curve for recreation at Reelfoot Lake is described by the equation:

$$WTP = 14.02 + .55V_i - .000017I_i + .00018S_i - .235E_i$$

When all of the independent variables are held constant at their respective sample means, an average willingness-to-pay for entrance to Reelfoot Lake on a yearly basis can be estimated. This is a net measure of consumer surplus since it is a value over and above the present zero entrance fee. This amount is equal to $7.50 and represents an estimate of the total willingness-to-pay for recreation on a yearly basis for the average visitor to Reelfoot Lake. Converting this to a per trip basis yields a value of $2.35. The next step in the benefit estimation process is to derive an aggregate total value curve. This is done by multiplying the right-hand side of the household total value curve by the total number of visitors to Reelfoot in the year the survey was taken. The expression for aggregate willingness-to-pay is given below.

$$AggrWTP = 937{,}503 + 36778V_i - 11.36I_i + 12.03S_i - 15714E_i + e_i$$

Substituting the respective sample means for each of the independent variables and then solving the equation yields a total willingness-to-pay for recreation at Reelfoot Lake on an annual basis. This amount is $499,715.

Conclusions

This paper reported the results of the application of the contingent valuation method to estimate the value of the recreational experience for visitors to Reelfoot Lake. These values were $7.50 per person per year, $2.35 per person per trip and $499,715 for total willingness-to-pay for recreation at the lake. This information can be useful in the management of this or any other nonmarket resource. Specifically, the estimates of consumer surplus could be used to set entrance fees at the lake.

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