CHAPTER FIVE

RECREATIONAL VALUE OF KNP: A TRAVEL COST APPROACH
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5.1 Introductory Statement

The travel cost method (TCM) was developed and is widely used for estimating the benefits of access to natural areas for tourism and recreation. Since most natural areas have nominal fees, a market does not usually exist where benefits can be observed as prices paid for the services engaged. TCM is a surrogate market approach whereby expenditure in an associated market i.e., the market for travel is used to estimate the benefits, measured as consumer surplus of the recreation service provided by natural areas. There are two basic approaches of the travel cost method namely, i) Individual Travel Cost Method (ITCM) and ii) Zonal Travel Cost Method (ZTCM). In the present study, the zonal travel cost method was applied.

The zonal travel cost method is one of the oldest approaches to environmental valuation, proposed in a letter from Harold Hotelling to the US Forest service in the 1930s, first used...
by Wood and Trice (1958) and popularized by Clawson and Knetsch (1966). The method has been widely used in both the USA and UK since 1960s for valuing the non-market benefits of outdoor recreation, especially recreation associated with national parks and forests.

5.2 Steps Involved in TCM

The various steps involved in ZTCM are as follows:

a) Conducting of the survey on a sample of p visitors.

b) Collection of the number of visits to the site (v) in a year.

c) Subdivision of visitors' origins into zones can be basis of political boundary.

d) Determination of the number of visitors by zone (P_i) and the relative shares over the sample size (P_i/p).

e) Calculation of annual visits by zone.
f) Collection of data on population by zone ($P_j$)

g) Calculation of average visit rate in each zone.

h) Estimation of demand function.

i) Calculation of average visitor consumer surplus by zone.

j) Aggregation of zonal consumer surplus to get the total annual consumer surplus.

The details are shown in the chart i.e., Figure 5.1 given in the next page.
FIGURE 5.1
THE ZONAL TRAVEL COST METHOD

Data Collection by On-site Survey

Zoning of Visitors
By
Political boundaries
Distance from site

Zonal population

Independent variables

Visitation rate

Descriptive analysis of data

Statistical analysis

Functional Forms:
Linear, log-linear, semi-log, Quadratic
etc.

Specification of the functional form

Estimation of the demand function

Policy Implications:
Value of preservation benefit of natural areas
Impact of price changes on visitation
Implications for management
5.3 The Travel Cost Method as Applied to KNP

The technique we coined in our study followed the technique of Chopra et al. (Chopra et al. 1997) in the assessment of use value from Keoladeo National Park, Bharatpur.

A general form of demand function can be written as

\[ V_{ij} = f (\text{TTCPP}, \text{TLCPP}, \text{OPPTIME}, \text{EDU}, \text{AGE}, \text{AHHI}, \text{GEN}) \]

Where

\text{TTCPP} = \text{Travel cost from place of residence, cost of travel within KNP, cost of fooding and lodging, other miscellaneous expenditure.}

\text{TLCPP} = \text{That part of travel cost incurred within KNP}

\text{OPPTIME} = \text{Per-capita household income per day corrected for number of days}

\text{EDU} = \text{Education (Level of education)}

\text{AGE} = \text{Age (in years)}

\text{AHHI} = \text{Annual household income per family}

\text{GEN} = \text{Gender i.e., male = 1, female = 0}
Another specification problem involves the selection of an appropriate functional form. However, linear (Burt and Brewer, 1971; Brown, Singh and Castle, 1964; Clawson and Knetsch, 1966) semi-log, (Batie, Jensen and Hogue, 1976; Navrud and Mungatana, 1994), quadratic (Gum and Martin, 1975) and double-log, (Wetzstein and Green, 1978) have been used widely in empirical application of the models. Several studies have tried to systematically evaluate the effect of the choice of functional form on travel cost models (Smith, 1975; Ziemer et al. 1980). These studies accepted that a non-linear functional form was accepted as a better fit than a linear one by using Box-Cox transformation. Hence, in the present study we tried for a non-linear functional form like quadratic, semi-log and double log. By taking into account, the value of R square and adjusted-R square and by the sensitivity analysis it was found that the semi-log functional form gave better fits. The semi-log regression equations estimated for the two sets are given in Table 5.1.
### Table- 5.1

**Demand Functions for Visitation Rates of KNP (Total Travel Cost)**

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Semi-log Model (With log of dependent variable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. TTCPP</td>
<td>-1.952E-08 (-1.212)</td>
</tr>
<tr>
<td>2. AHHI</td>
<td>1.101E-09 (1.024)</td>
</tr>
<tr>
<td>3. AGE</td>
<td>4.403E-04 (4.253)*</td>
</tr>
<tr>
<td>4. GEN</td>
<td>3.412E-03 (1.332)</td>
</tr>
<tr>
<td>5. EDU</td>
<td>3.901E-03 (-2.069)**</td>
</tr>
</tbody>
</table>

**CONSTANT** | 1.868E-02

**ADJUSTED R²** | 0.332

Notes: (i) The figures in bracket are ‘t’ values of the respective co-efficient.

(ii) * and ** indicate 0.01 and 0.05 level of significance only.

Table 5.1 shows the first stage regression analysis relating visitation rate to total travel cost expenditure and annual household income, age, gender and education. It should be
noted that there is almost perfect correlation between annual household income and opportunity cost of time. Hence, both variables can not be included in the regression as estimation would have almost perfect multicollinearty. Hence, annual household income per family was considered instead of opportunity cost of time. Table 5.1 indicates that the visitation was, no doubt, negatively affected by total travel cost (which is theoretically correct) but travel cost was not significant even at 0.10 level. However, age and education were found to be significant at 0.01 and 0.05 level of significance respectively with positive coefficients.

It is true that Kaziranga National Park (KNP) is within easy access of other tourist sports of North Eastern Region of India. In view of the joint product nature of the park, an attempt was made to run the regression by including local travel cost instead of total travel cost, the other variables remaining the same. This is shown in Table 5.2.
### Table 5.2

**Demand Functions for Visitation Rates of KNP (Local Travel Cost)**

<table>
<thead>
<tr>
<th>Independent variable</th>
<th>Semi-log Model (With log of dependent variable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. TLCPP</td>
<td>3.459E-07 (- 2.690)*</td>
</tr>
<tr>
<td>2. AHHI</td>
<td>1.525E-09 (2.049)**</td>
</tr>
<tr>
<td>3. AGE</td>
<td>4.479E-04 (4.363)*</td>
</tr>
<tr>
<td>4. GEN</td>
<td>2.898E-03 (1.134)</td>
</tr>
<tr>
<td>5. EDU</td>
<td>3.806E-03 (-2.039)**</td>
</tr>
<tr>
<td>CONSTANT</td>
<td>-2.935 (-1.174)</td>
</tr>
<tr>
<td>ADJUSTED-R²</td>
<td>0.692</td>
</tr>
</tbody>
</table>

**Note:**

i) The figures in bracket are ‘t’ values of the respective coefficients.

ii) * and ** indicate 0.01 and 0.05 level of significance respectively.
Table 5.2 shows that the visitation rate was not only negatively affected by local travel cost but also it was significant at 0.01 level of significance. The other significant variables were annual household income, age, and education. The value of adjusted-$R^2$ was also relatively quite high. On the basis of above regression analysis, the following observations were made:

i) The cost incurred locally was considered as a better index of the price paid by the tourists to visit Kaziranga National Park.

ii) The education variable had a positive and a significant coefficient. This was consistent with standard recreation economics literature that an increasing educational level had an impact on increasing visitation rate.

iii) The age was also a very significant socio-economic variable but it had a positive coefficient. This may be
partly due to the fact that the mean age of sampled tourists was found to be high. For such a sample, an increase in age may not result in an impact of visitation rate.

iv) The annual household income was also found to be significant with positive coefficient. This was expected since the more the income of the consumer, the more they are willing and able to spend on recreation.

v) The gender did not significantly influence the visitation rate.

5.4 Consumer Surplus

The recreational value of an outdoor site is reflected in a visitor's willingness to pay for the visit. This can be estimated as the consumer surplus under the demand curve of the site by travel cost methodology.
This is shown in the figure as follows:

The vertical intercept represents that level of travel cost at which the visitation rate to the site becomes zero - this may be called the 'choke-price'. Having obtained this demand curve, the consumer surplus per visit for each zone can easily be found, by integrating the demand curve between the average travel cost for that zone and the choke price (all other independent variables can be taken at their average values). Multiplying by
the total number of visits from the zone will give us the total consumer surplus for the zone. Thus, if we add all the zonal consumer surpluses, we can get the total annual consumer surplus accruing to the visitors to the park.

Table 5.3 shows the consumer surplus as estimated from the semi-log form of function relating the visitation rate to travel cost (both its total and local variables).

**Table 5.3**

**Consumer Surplus of the Surveyed Tourists to KNP**

<table>
<thead>
<tr>
<th>Model Specification</th>
<th>Consumer Surplus Per visit (in Rs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set 1: Using total travel cost variable under semi-log model</td>
<td>31,217.87</td>
</tr>
<tr>
<td>Set 2: Using local cost variable under semi-log model</td>
<td>4,682.68</td>
</tr>
</tbody>
</table>

As it was expected, the consumer surplus, using total travel cost was higher than that of local cost variant. Since it was observed in the preceding section, the visitation rate was more clearly affected by local cost than by the total travel cost.
and also the fact that the location of KNP was within easy access of other tourist spots of North East India, it was considered more appropriate to estimate consumer surplus from the local cost only. This amounted to Rs. 4682.68 per visit of tourist. With tourist number estimated at an average of 65,459 during last three years, this yields a minimum value of Rs. 30.65 million, a substantial part of which can be taxed to yield the additional benefit for the park. This may not result in the reduction of tourist traffic as the demand for the services of KNP found to be inelastic, ranging from 0.43 to 0.14 for different zones of tourists.

5.5 Recreational Value of Biodiversity for KNP

KNP is characterized by its rich biodiversity especially the presence of exotic wild animals and birds. However, the total recreational value noted above can not be attributed to this biodiversity because there may be other famous geological and geomorphologic features in the park. In order to identify the value of biodiversity, some of the questions in the questionnaire
were designed to investigate visitor's main preference for the alternative recreational resources. The questions aimed to find out the motivation for visiting the KNP from a choice of five. 403 respondents indicated their main preferences as follows:

- To watch wild animals  
  (eg. Rhinos, tigers, etc) : 76.91 per cent  
- Recreation : 11.50 per cent  
  Total : 88.41 per cent

If we assume that the main reasons given by the visitors surveyed for visiting KNP indicate the prime source of their tourism or recreational value from KNP, then the total recreational value from biodiversity = Total tourism value x 88.41 per cent

= Rs. 30.65 million x 88.41 per cent
= Rs. 27.08 million per year.

However, this value should only be regarded as indicative. The numbers used are use values and do not include the option
value and bequest value of visiting the park because of other attributes that might be experienced. Thus, the value estimated may not be a proper reflection of the actual value but the concrete number has the magic power of making our mind conscious regarding the need of the conservation of the park.