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Estimating Recreation Value of Darband Area in Tehran (Iran)

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Abstract

Recreation and sight-seeing is one of the important needs of modern time and nature can provide many aspects of it called as ecotourism. But, because the recreation sites are often in the form of public goods rather than private, their value is not evaluated and recorded so as a result either they are misused or not conserved. So, economists have tried to get to the bottom of their scarcity and have provided non market criteria to evaluate the recreation sites.

The goal of this article is to estimate the value of one of the very important areas in the northern part of Tehran called Darband. To do so individual travel cost approach is being used. Using this approach welfare rendered by the Darband area by using visitors' welfare surplus is estimated.

The estimated individual welfare surplus for each visit without considering the value of time spend in the site is about 10.85 dollars and total value obtained for whole population is between 27-41 million dollars for the year 2012. Adding the value of time spend in the site the above numbers rise to 12.47 dollars and between 31-47 millions dollars correspondingly.

Keywords: Recreation Value, Individual Travel Cost Method, Darband Area, Negative Binominal Distribution.

Introduction and Background

Often individuals value each commodity based upon its price determined by the market. But since environmental services such as recreation areas are more close to public, goods markets fail to value them appropriately. Then economists have proposed other approaches to value ecosystem in general and recreation sites in particular. The approaches guide planners and decision makes to deal with these sites in appropriate manner.

Generally two approaches of travel cost method (TCM) and contingent valuation method (CVM) are being applied to estimate the value of these sites. In recent years TCM method is known as better approach since it considers revealed preferences and is being more realistic as compared to CVM (Day, 2000; Curtis, 2003; Anderson, 2010). So this technique is being used in many researches in recent years. (see: Blackwell, 2007; Anderson, 2010; Morgan and Huth, 2010).

At first, this approach was being used in the zonal scale but now due to critics, it is being applied on the individual bases. With this approach a reverse relationship between travel costs and the number of visits for the chosen site, as the demand function, within a particular year is established and estimated and then consumer surplus is being estimated as a proxy for the total value of the recreation site.

Shaw (1988) evaluates the limits of individual travelling cost approach in a theoretical article explaining that count data models must be used in this approach. Ammoako-Tuffour and Martinez-Espineira (2008) tried to include vale of opportunity of time in individual travel cost method. Anderson (2010) also using this approach evaluated Ice Climbing in Hyalite Canyon for each visit to be between 76 and 135 dollars. Huth and Morgan (2010) used CVM and focused the value of Cave Diving for each visit being between 52 and 83 dollars. Finally, Edwards et al. (2011) calculated the economic value of viewing migratory shorebirds on the Delaware Bay as much as 131-582 dollars (2008) using count data model.

Methodology

Individual travel cost methodology is based upon providing needed information through questionnaire. In the questionnaire several socio-economic questions are being asked which are in support of estimating the demand function for visits to the chosen site. Having obtained estimated demand, consumer surplus is evaluated, which then is being used as the welfare obtained. Travel cost approach follows the usual procedure for obtaining demand for a good or services. The demand is obtained by:

$$\text{Max } U = U(X, v, q) \quad (1)$$

$$\text{s.t.} \quad w.T_w = X.P_x + P_v.v \quad (2)$$

where, X is the consumption of individual from private goods, v number of visits in the last year and q quality of the site from standpoint of visitors, w hourly wage rate, T_w the time allocated to work within a year, P_x price of private good and P_v visitors expenditure for each visit of the site. Having solved the above restricted optimization, demand for travel to the site which is relationship between number of visits and expenditure per visit is estimated. Shifting factors for the demand curve are vector representing social variables (such as age, gender, etc), monthly income or expenditure of visitors and also the quality of the site as such we obtain:

$$V = f(P_v, y, z, q) \quad (3)$$

Where, P_v is expenditure or as is called costs per visit and is summation of three items:

- ✓ Expenditures for travel to the site called transportation costs (RTTC).
- ✓ Expenditures occurring at the site which includes amount paid for recreation services, entrance fee, parking fee, etc. (OnExp).
- ✓ Opportunity cost of time spent (OcTime).

So:

$$TC = RTTC + OnEXp + OcTime \quad (4)$$

Calculating opportunity costs of time is one of the challenges for this approach (ITC) and there are differences of opinions about how it should be evaluated. The time spent by the individual visitor includes:

1. The time spent for going to the site and returning from it (travel time).
2. The time spent on the site.

The question is how the costs of the above times should be calculated. Some researchers state that of the above time kind 1 should be included as costs creating (Ward and Beal, 2000), But more researchers believe that the cost of kind 1 (travel time) definitely should be included and if we don't include, that consumer surplus (CS) obtained is under valuating the costs (Allen et al., 1981). In some of researches both kinds of times spent are included (Smith et al., 1983; McConnell, 1992). Next question would be how time should be evaluated monetarily. Should we evaluate it such as opportunity costs of wages and salaries lost? The rate applied varies between 1 and zero, depending upon the stand of researchers on how the time should be included. Rate of 1/3 is used more often (Englin and Cameron, 1996; Morgan and Huth, 2010). Then demand function for number of visits to the site (Trip) is obtained:

$$Trip = f(TC, Age, DumGender, DumMarried, DumEmp, Ledu, AvMI, Q) \quad (5)$$

Their definitions are in the table below. Moreover, descriptive statistics of these variables are mentioned using collected data in the site:

Table 1: Variable definition and descriptive statistics (n=385)

Variable	Definition	Mean	Std. dev.	Min	Max
Trip	Number of trips undertaken in the last year	6.53	6.63	1	40
TC1	Travel cost	14258	7385.25	1945.09	56141.73
TC2	Travel cost	1690.9	7572.59	4353.56	58718.69
Age	Age of respondent	32.2	10.91	17	73
DumGender	=1 if male	0.64	0.48	0	1
DumMarried	=1 if married	0.45	0.499	0	1
DumEmp	=1 if employed	0.55	0.498	0	1
Ledu	Level of education	3.98	0.87	1	6
AvMI	Average monthly income	752597.4	376723.1	500.000	2000000
Quality	Level of Quality	3.6	0.83	1	5

Source: Authors' computation

The answers to the above, through a 14 questions on a socio-economic questionnaire, were obtained. But before estimating demand function focus should be on dependent variable i.e. number of visits (Trip). There are some characteristics about this variable that should be taken into consideration and otherwise we obtain biased estimation. First point is that ordinary least squares estimators are not defendable due to the fact that this variable neither is continuous nor errors are normally distributed, since the number of visits is countable and so discrete. So, we should use models which deal with countable data (Shaw, 1988). Two distributions are being used more than others in this regard: Negative Binominal and Poisson distribution. In both of these distributions dependent variable is countable (Y=0,1,2,...) (Cameron and Triviedi, 1998; Grogger and Carson, 1991).

The approach for estimating them is Maximum likelihood method. Since Poisson distribution itself is particular type of Negative binominal distribution, first this latter one is being explained:

$$\text{Prob}(Y = y \mid \lambda, \alpha) = \frac{\Gamma(y+\alpha^{-1})}{y!\Gamma(\alpha^{-1})}\left(\frac{\alpha^{-1}}{\alpha^{-1}+\lambda}\right)^{\alpha^{-1}}\left(\frac{\lambda}{\alpha^{-1}+\lambda}\right)^{y} \quad ; y = 0,1,2,\ldots \tag{6}$$

Where Γ is a Gamma distribution, α is dispersion parameter, and λ is expected value of the variable being considered.

Dispersion explains how much should be added to the mean to obtain the variance ($\alpha \geq 0$). When $\alpha=0$ then negative binominal distribution becomes Poisson distribution, where variance and the mean are equal. Since Poisson is one of the cases for negative binominal distribution and is recommended more often. Mean and variance for negative binominal distribution is obtained in the following manner:

$$E(Y|X) = \lambda \quad (7)$$

$$Var(Y|X) = \lambda(1 + \alpha.\lambda) = \lambda + \alpha.\lambda^2 \quad (8)$$

Now if dispersion parameter becomes zero then as it was stated earlier Poisson distribution is obtained:

$$Prob(Y = y) = \frac{\exp(-\lambda).\lambda^y}{y!} \quad ;y = 0,1,2,\ldots \quad (9)$$

$$E(Y|X) = Var(Y|X) \quad (10)$$

So using negative binominal distribution is more supportive (Edwards et al., 2011). Another problem arises because the questionnaires are filled out by the visitors attending in the site which means dependent variable observed is not zero and would be at least one. So we use zero truncates negative binominal distribution.

$$Prob(y_i|y_i > 0) = y_i.\frac{\Gamma(y_i+\alpha^{-1})}{\Gamma(y_i+1).\Gamma(\alpha^{-1})}.(\alpha^{y_i}.\lambda_i^{y_i-1}).(1+\alpha.\lambda_i)^{-(y_i+\alpha^{-1})} \quad ;y = 1,2,\ldots \quad (11)$$

In quite few researches ITCM is being evaluated based upon this and is being estimated through maximum likelihood method and in this research also this approach is being taken. Log-line is being estimated, since dependent variable is positive and at least one.

$$\lambda = E(y|x_i) = \exp(x_i\beta) \quad (12)$$

Where, x_i stands for vector of variables affecting number of visits and β is the vector for parameters involved. Then the demand function considered is:

$$Trip = \exp(\beta_1 + \beta_2.TC + \beta_3.Age + \beta_4.DumGender + \beta_5.DumMarried + \beta_6.DumEmp + \beta_7.Ledu + \beta_8.AvMI + \beta_9.Q)$$
(13)

And where the function is estimated, log-line then becomes:

$$Ln(Trip) = \beta_1 + \beta_2.TC + \beta_3.Age + \beta_4.DumGender + \beta_5.DumMarried + \beta_6.DumEmp + \beta_7.Ledu + \beta_8.AvMI + \beta_9.Q)$$
(14)

Having obtained the demand function then by integration consumer surplus (CS) is obtained:

$$CS = \int_{TC^*}^{\infty} Trip.\, dTC \quad (15)$$

$$CS = \int_{TC^*}^{\infty} \exp(\beta_1 + \beta_2 TC + \cdots).\, dTC \quad (16)$$

Finally absolute value of consumer surplus per visit is equivalent to invert of the coefficient of travel cost variable:

$$CS_{per\ trip} = -\frac{1}{\beta_2} \quad (17)$$

To obtain total value of visits we should multiply the above value by total number of visits:

$$CS_{annual} = CS_{per\ trip} * Trip = \left(-\frac{1}{\beta_{TTC}}\right) * Trip \quad (18)$$

Since there is reverse relationship between travel costs per visit and the number of visits so the coefficient is negative and the absolute value obtained is CS.

Conclusion

In order to estimate the chosen model a sample of 350 observers were chosen and socio-economic questionnaires including 14 questions were filled out. To calculate opportunity costs of time two scenarios were chosen. In the first scenario called model (1), time spent in the site was not considered. In the second scenario time spent in the site is also evaluated as the cost component and is considered as model (2). However, rate of 1/3 is being applied to show that all of times spent is not really costs and major part is as time is spent willfully and being as leisure. The results obtained are tabulated as follows:

Table 2: Negative Binominal Regression Results Recreation Demand[1]

Variable	Model (1)		Model (2)	
	Coefficient	Z	Coefficient	Z
Constant	1.099603 (0.017)	2.38	0.8128582 (0.081)	1.74
TC	-0.0000468 (0.000)	-5.93	-0.0000407 (0.000)	-4.81
Age	-0.0017395 (0.784)	-0.27	-0.0007222 (0.911)	-0.11
DumGender	-0.2409082 (0.024)	-2.25	-0.2622272 (0.016)	-2.41
DumMarried	-0.1191142 (0.314)	-1.01	-0.1231936 (0.305)	-1.03
DumEmp	-0.0965226 (0.415)	-0.82	-0.1096388 (0.363)	-0.91
Ledu	0.0381942 (0.584)	0.55	0.0630773 (0.376)	0.88
AvMI	0.000000549 (0.002)	3.13	0.00000074 (0.000)	3.85
Q	0.2745288 (0.000)	4.14	0.2918413 (0.000)	4.35
α	0.7073813		0.7460064	
Pseudo R2	0.0351		0.0297	
LR chi2(8)	75.55		63.9	
Log Likelihood	-1038.4869		-1044.3134	
CS per trip	213675		245700	

Note: Numbers in parentheses are p-values.
Source: Model estimation

Consumer surplus obtained per visit for model (1) was estimated to be 213675 rials equivalent to 10.85 dollars and for model (2) 245700 rials equivalent to 12.47 dollars. Then values obtained were multiplied by the number of visits to obtain total value of recreation site for the whole population. But since total population was in determined, Again three scenarios were applied, such that 20%, 25% or 30% of population of Tehran visits the site once in the year and the total values obtained are tabulated as follows;

[1]The results are obtained by Stata11

Table 3: Recreation Value

	0.2	0.25	0.3
Model (1)	53444380888	66805470768	80166582016
Model (2)	61453034370	76816286820	92179563840

Source: Authors' computation

As it is shown based upon model (1) recreation value is the range of 534-802 billions rials or equivalent to 27-41 millions dollars. And based on upon model (2) recreation value is the range of 614-922 billions rials or equivalent to 31-47 millions dollars.

Therefore this recreational area is of great value for its visitors a fact coming from real behaviors' of visitors. Ultimately this figure can be a suitable guide to state policy-makers and to municipal authorities so that they would take right and necessary measures through their investments firstly to conserve the environment of this recreational site, secondly to attract more visitors, considering the importance of this recreational site to visitors.

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