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Valuing the Recreational Uses of Pakistan's Wetlands: An Application of the Travel Cost Method

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Abstract:

The Keenjhar Lake, Pakistan's largest freshwater lake and a Ramsar site, is located in the Lower Indus Basin of the Indus Ecoregion. Global 200, which scientifically ranks outstanding terrestrial and aquatic ecosystems in 238 ecoregions worldwide, the Indus Ecoregion is one of the 40 priority Ecoregions. This study uses a single-site truncated count data travel cost method to estimate the access values of visitors to Keenjhar Lake. Policy makers may use these estimates on the recreational value of the lake to assess the returns on conservation investments. A basic version of the model applied to a subset of visitors using charter transportation allows analysis of impacts on welfare measurement from altering assumptions about embarkation points. This study finds the assumption that this category of visitor does not incur travel and time costs before boarding charter transport to be both unrealistic and simplifying, leading in turn to an underestimate of consumer surplus values. The strongest argument in favour of revising data collection and processing strategies in this regard is perhaps the finding that shared and rented transportation is common in developing countries, while cost coefficients tend to figure prominently in welfare measurement irrespective of the functional form.

Keywords: Travel Cost Method, Truncated Count Data Model, Ecotourism, Keenjhar Lake

1. INTRODUCTION

Keenjhar is Pakistan's largest freshwater lake (14,000 ha) and is situated approximately 120km north of Karachi. A wildlife sanctuary and a Ramsar site, it is set in a stony desert composed of alternating layers of sandstone and limestone. Approximately 50,000 people, from 12 large and 20 small surrounding villages, are dependent on the lake. Another predominant use of the lake, which might be labeled indirect

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because consumption occurs off-site, is the supply of water for residential and commercial use in Karachi. The major, direct consumptive use of the lake among the local population takes the form of fishing. However, tourists, mainly from Karachi, also enjoy swimming, boating, and other entertainment activities offered by the Sindh Tourism Development Corporation (STDC) at a resort on the lake's western banks.

This study estimates the access value of Keenjhar using a travel cost method (TCM). It is expected that this would replace existing decision-making with regard to pricing which does not rely on quantitative tools but on intuition and experience. Adding the use value of recreation to the already measured use value of fisheries and other indirect use values such as the water supply by determining the need to preserve Keenjhar would provide the planners with more accurate estimates of its value. After reviewing the existing literature, we have confined the modeling approach to a count data model for a single site. The study also addresses the issues associated with multiple purpose trips and the impacts of labour decisions on time valuation, in addition to truncation and endogenous stratification via data analysis.

The total economic value of Keenjhar Lake, based on a recent estimate of the direct consumptive use value (i.e., the producer surplus from commercial fisheries), the indirect use value (i.e., the residential water supply to 1 million of the 15 million population of Karachi), and the non-use value (based on an application of the "choice experiment" technique administered in Karachi to examine the willingness to pay for species protection) is in the order of PKR 9 billion annually or USD 145million [Dehlavi, *et al.* (2008)].

At present, STDC does not employ valuation or similar advanced quantitative techniques in their planning or pricing of accommodation and recreational activities. This is unfortunate as models of recreational demand can be put to a number of uses, including addressing economic (for e.g., measuring the welfare derived from the reserve) as well as financial (for e.g., responsiveness to cost components with bearing on overall revenue or revenue per unit of on-site paying activities) questions. This paper addresses the economic question of whether investments in recreational sites provide a return on equity by estimating the monetary access value figure associated with the recreational uses of the Lake.

This study addresses labour market constraints while estimating time costs by distinguishing between recreationists who are committed to a fixed work week and fixed vacation allotments and those who are not constrained in this fashion. The approach followed in this study is developed by Bockstael, Strand and Hanemann (1987) which argued that discontinuous labour market constraints lead to corner or interior solutions.

In the case of Keenjhar, it is necessary to take into account the concerns of the public regarding polluted water which is not only to its recreational use but also to domestic and commercial uses of the Lake by Karachi and a local population, mainly inhabitants of the surrounding twelve large and twenty small villages [WWF-Pakistan (2006)]. Amongst others, pollution of the lake is caused by upstream tanneries, sewerage, and grease from vehicle-washing and motorized fishing boats. In a noteworthy economic and epidemiological contingent valuation survey undertaken at two beaches, Georgiou, *et al.* (1996) established that the British public was prepared to pay an amount in excess of the total clean-up cost that would be incurred to bring British beaches up to the standard required by the European Community (which in 1995 was approximately GBP 9 billion).

TCM is used to a subset of visitors using charter transportation. This was possible owing to a design feature in the questionnaire that permitted us to analyze the impacts on welfare measurement of visitors with different embarkation points for their trip to the Lake. The unrealistic and simplifying assumption that this category of visitor does not incur travel and time costs before boarding charter transport results in an underestimate of consumer surplus values. We understand that our analysis makes the case for revising data collection and processing strategies since shared and rented transportation is common in developing countries while cost coefficients tend to figure prominently in welfare measurement irrespective of the functional form. This study is useful in Pakistan to estimate non-market values for public policy purposes. An earlier study by Khan (2004) adopted the TCM with an objective to shape national policy on the regulation of a national park in

Islamabad while this study is an attempt to shape national policy for wetlands.

2. THE STUDY SITE AND SAMPLING

Choice of the study site in part was motivated by the STDC's own interest in providing economic values for the recreational services it provides. However, in addition to aiding management decisions, we were also interested in complementing Keenjhar's total economic value estimates USD 145 m [Dehlavi, *et al.* (2008)].This includes a direct use component for commercial fisheries, which would be complemented by recreational use, another direct use value. Even if an augmented value were not to be applied in a benefit cost analysis in the context of Keenjhar since it already benefits from protected status as a Ramsar site, the exercise would be useful for its replicability within the Indus Ecoregion and elsewhere in Pakistan. Furthermore, the valuable dataset accompanying our analysis allows for further analysis, which would help with the allocation of scarce resources, allowing planners in turn to assess whether and by how much to raise fees depending on the magnitude of the consumer surplus.

Seven-day reconnaissance survey (in February and March of 2009) was held for the purpose of designing a reliable survey instrument. We conducted a count at the two entrance gates of the site which showed that 5,892 individuals had visited it during this period. Based on the findings from the reconnaissance survey, an innovative survey instrument design element was generated that was incorporated into the final questionnaire: that is, questions which partitioned travel costs for those using chartered transport into within-city travel to a common point of departure and travel onwards to Keenjhar. The form of chartered transport mentioned here refers to the renting of a bus/van typically by a single but large family. As there was no reason to assume that all members of an extended family were picked up from their front door, we asked respondents using chartered transport if they incurred time and petrol costs to reach a "common point of departure". During the main survey (undertaken between 12-18 August, 2009), the chartered mode remained the most popular (59 percent), with only a fraction not picked up from home and thus incurring travel costs before boarding the chartered transport. Privately owned cars (35 percent) and motorcycles (6 percent) came second and third among preferred modes of travel.

Our Sampling plan for 1,000 observations which was designed based on weights of the total observed participation in: (a) activities on zone basis; (b) activities by each day of a 7-day week; (c) activities by time periods within a single day and (d) activities by category. This formulation yielded a convenient way to determine the specific number of questionnaires to be filled within a given zone, day, time, and activity category.

The main survey was conducted from 12th to 18th August, 2009, and coincided with a national holiday, the Pakistan Independence Day, which fell on a Friday in 2009. The survey yielded a sample of 741 visitors.

3. METHODOLOGY

The paper estimates access value to Keenjhar using the TCM. After describing the theoretical construction of TCM, welfare measurement using Poisson and negative binomial regression models is described. This section described the analytical techniques used to address the separate issues of multiple purpose trips, the impact of labour decisions on time valuation, truncation and endogenous stratification.

3.1. The Model

The basic recreational demand model used in this paper may be written as follows:

$$\Pr(x_j = n) = f\left(n, z_j, \beta\right), \quad n = 0, 1, 2, \ldots, k \qquad \ldots (1)$$

where, the demand variable *x* can take an integer value from 0 to *k;* z_i is the row vector of *M* demand arguments (including the vector of prices and qualities for recreational sites and the amount of income that could be earned if the person worked all of the available time); and, β is an $M \times 1$ column vector of parameters to be estimated.

TCMs are based on an idea first introduced by Hotelling (1949). Researchers can derive resource values through the use of TCM by estimating a demand curve for complementary market goods (for example a day visitor's costs of travelling to Keenjhar) and calculating the welfare value for the household by integrating between the present price faced by the household for the complementary good and the choke price, i.e., the price at which the quantity demanded goes down to zero.

3.2. Welfare Measurement in the Poisson Regression Model

Welfare measurement or the value of access to Keenjhar in its general form is calculated and approximated as the willingness to pay for use of the site. The computation then is that of the area under the utility-constant demand curve for the site, or the income-constant demand curve, given expected low income effects and budget shares of recreational demand models [Haab, and McConnell (2002)]

$$WTP(access) = \int_{p_i^0}^{p^*} f(s, C_{2i} + w_i t_{2i}, y_i^f) ds \qquad \ldots (2)$$

where, $P_i^0 = c_{1i} + w_i t_{1i}$ (P, the price of a trip to the primary site) and P^* is the relevant choke price; ($c_{2i} + w_i t_{2i}$ denotes travel cost to the substitute site, c denotes the round-trip travel cost, w is the after-tax wage rate, and *t* is a unit of time for the trip, while y_i^f is a measure of full income, i.e., the amount that would be earned if all available time were used up for work, and *s* is the dummy variable of integration). Each household is denoted by i, while subscripts 1 and 2 index the primary and substitute sites. As this is an on-site sample with the number of visits expressed as counts, Poisson regression model is suitable whose probability density function is given by Haab and McConnell (2002) as follows

$$\Pr(x_i = n) = \frac{e^{-\lambda_i} \lambda_i^n}{n!} \quad where, n = 0, 1, 2, \ldots \qquad \ldots (3)$$

where, $\lambda_i > 0$ is mean of number of visits and according to characteristics of poisson distribution equal to the variance.

$$\lambda_i = \exp(z_i,\ \beta) \qquad \ldots (4)$$

Willingness to pay for access using the Poisson regression model is calculated and assuming an exponential function, the choke price is infinite. Defining P^0 as the current travel cost, consumer surplus for access is given by Haab and McConnell (2002):

$$WTP(access) = \int_{P_i^0}^{\infty} e^{\beta_0+\beta_{1s}} ds = \left[\frac{e^{\beta_0+\beta_1 s}}{\beta_1}\right]_{P_i^0}^{P\rightarrow\infty} = -\frac{x}{\beta_1} \qquad \ldots (5)$$

where, $\beta_1 < 0$

The Poisson regression model is commonly used in recreational demand models. Since the Poisson regression model is subject to misspecification owing to its implicit restriction on the number of counts: $E\ (x_i|z_i, \beta) = V\ (x_i|z_i, \beta) = \lambda_i$ (the conditional mean and variance are equal). One consequence of variance exceeding the mean (over dispersion), as is characteristic in recreational data, is that the Poisson regression model's standard errors are underestimated, leading often to the rejection of the null hypothesis of no association. The Negative Binomial is used to test for over dispersion, a common version of which is a Poisson regression model with a gamma distributed error term [Green (2005)]. In such a case, the Negative Binomial's probability function can be written as Haab and McConnell (2002):

$$\Pr(x_i) = \frac{\Gamma\left(x_i+\frac{1}{\alpha}\right)}{\Gamma\left(x_i+1\right)\Gamma\left(\frac{1}{\alpha}\right)}\left(\frac{\frac{1}{\alpha}}{\frac{1}{\alpha}+\lambda_i}\right)^{\frac{1}{\alpha}}\left(\frac{\lambda_i}{\frac{1}{\alpha}+\lambda_i}\right)^{x_i} \qquad \ldots (6)$$

where, $\lambda_i = \exp(z_i,\ \beta)$

The mean and variance of the negative binomial distribution are $E\ (x_i) = \lambda_i = \exp(z_i,\ \beta)$ and $V\ (x_i) = \lambda_i\ (1 + \alpha\lambda_i)$, respectively. The parameter is the over dispersion parameter. If $\alpha > 0$, over dispersion is said to exist. If $\alpha = 0$, no over dispersion or under dispersion exists and the Negative Binomial collapses to the Poisson distribution in the limit. If, on the other hand, $\alpha < 0$, the data are under dispersed so that the Poisson regression model should be rejected in favour of the Negative

Binomial model, revealing that the test is also one of the Negative Binomial models against the null hypothesis of a Poisson.

3.3. Endogenous Stratification and Truncation

Count models with truncated samples, i.e., models where only those visiting the site are sampled, should make use of the appropriate functional form and also be observant of the effects of functional form choice and truncation on consumer surplus estimates [Ozuna, *et al.* (1993)].

It is expected the sample average number of trips to be higher than the population mean (endogenous stratification) since on-site interviewing process is inherently likely to have intercepted avid visitors to Keenjhar. To obtain the correct likelihood function, it is needed to account for this oversampling of visitors who have a high use level. Endogenously stratified and truncated Poisson Regression Model may be estimated by running a standard Poisson regression of $x_i - 1$ on the independent variables and can be written as its probability [Haab and McConnell (2002)]:

$$h\ (x_i\ and\ interview | x_i > 0) = \frac{e^{\lambda_i} \lambda_i^{w_i}}{w_i!} \qquad \ldots (7)$$

where, $w_i = x_i - 1$ and right hand term is the probability function for a Poisson distribution for the random variable w_i. To address over dispersion relative to the Poisson, truncation at zero, and endogenous stratification due to oversampling of frequent visitors at Keenjhar, Negative Binomial regression model should be estimated [Haab and McConnell (2002)].

$$\boldsymbol{h(x_i and\ interview | x_i > 0)} = \frac{x_i \Gamma\ (x_i + \frac{1}{\alpha})}{\Gamma\ (x_i + 1)\ \Gamma\ (\frac{1}{\alpha})} \left(\frac{\frac{1}{\alpha}}{\frac{1}{\alpha} + \lambda_i} \right)^{\frac{1}{\alpha}} \left(\frac{\lambda_i}{\frac{1}{\alpha} + \lambda_i} \right) \lambda_i^{x_i - 1} \quad \ldots (8)$$

3.4. Multiple Purpose Visits

The model, as is standard, distinguishes single purpose visits from multiple purpose visits, that is, visits made to destinations on the way to Keenjhar or on the way back home. This turned out to be very important since as much as 42 percent of our sample undertook incidental visits. Using a somewhat recent approach Parsons and Wilson (1997), one can interact a dummy variable with price to capture both the shift and rotation of the demand function due to the existence of complementary sites, thereby adjusting the reported total trip cost of multiple purpose visitors in our sample.

3.5. Implications of Labour Decisions on Time Valuation

Model in the study also attempted to reflect the implications of labour decisions on time valuation (opportunity cost of time) and allowed these decisions to vary over individuals in our sample. In particular, adopting an approach based on Bockstael (1987), this study distinguished visitors to Keenjhar who give up on the opportunity to earn income for a day trip to the Lake from those who do not face any such trade off. The former "unconstrained" category is different from the "constrained" one in that it describes individuals whose labour/leisure choice is at an "interior" and whose opportunity cost of time is reflected in the wage rate. The modeling structure adopted here is:

$$x_i = h^I(P_i + w_D t_i, P^o + w_D t^o, \bar{Y} + w_D \bar{T})$$
$$x_i = h^C(P_i, t_i, P^o, t^o, \bar{Y}, \bar{T})$$
$$lnx_m^1 = g\ (P_m +\ W\ t_m, I + W\ T)\ for\ m = j, k, l \qquad \dots (9)$$
$$lnx_m^2 = g\ (p_m,\ t_m, I\ , T)\ for\ m = j, k, l \qquad \dots (10)$$

where, Equation [9] describes the natural log of the quantity of trips demanded in the m^{th} mode by unconstrained individuals and Equation 10 describes this with reference to constrained individuals; p_m is the travel cost and t_m is the travel time, both associated with the m^{th} mode; *w* is the wage rate, *I* is household income, and *T* is discretionary time. Time and budget constraints are collapsed into a single constraint in the case of

Equation (9), which describes "unconstrained" individuals, while time and budget constraints are separately binding in the case of Equation (10) "constrained" individuals.

4. RESULTS AND DISCUSSION

The study began by selecting the best estimator for our TCM through estimating two simple versions of our model. One version uses travel cost and income variables while the other adds travel time as a separate variable for so-called "constrained" individuals. Table 1 present the descriptive statistics of the explanatory variables and theoretically expected signs. While in Table 2, the two estimators tested were the Poisson and Negative Binomial, both corrected for zero-truncation and endogenous stratification. As over dispersion is characteristic in recreational data, the Negative Binomial tested for over dispersion but found Poisson more suitable as compare to Negative Binomial.

Table 1. Explanatory Variables and Associated Hypotheses

Variable	+/-	Mean	Std. Dev.	Min	Max
Travel Cost *(TC) (PKR)*	-	1,283	1,162.30	0	16,078
Travel Time *(Ti) (minutes)*	-	174.05	90.83	3	900
Household Income *(mon_income PKR)*	+	43,000	74,343.36	2,000	1,000,000
Education *(Years of schooling)*	+	11.85	3.58	0	21
Age *(Years)*	-	31.66	9.97	12	73
Distance *(KM)*	-	49.57	79.84	28	487
Interacted_TC	?	568.29	969.97	0	8212
Interacted_Travel_Time	?	1.65	2.95	0	30
Gender (male=1, Female=0)	+	0.99	0.11	0	1
Unmarried (yes=1, No=0)	+/-	0.43	0.50	0	1
Region(Urban=0, Rural=1)	-	0.85	0.36	0	1

Source: Survey (12-18 August 2009); the sample size is 741.

Having determined an appropriate model, the endogenously stratified and truncated Poisson alone to estimate demand models were selected, the first time using seven variables and the next time eleven. In each of the seven- and eleven-variable versions of the TCM, we carried out one regression in which incidental consumption effects are ignored (Model 1); one in which an indicator variable for multiple destination visits is included (Model 2); and a third one, a fully interacted model, in which the indicator variable is interacted with the price variable and travel time (Model 3).

4.1. Estimator Selection for the TCM

The study began by noting some interesting results from the estimator selection process before proceeding to discuss the travel cost model. Firstly, in the case of the endogenously stratified and truncated Poisson, the signs on our coefficients were as expected (see, Table 1). Secondly, for the purpose of computing the marginal change with variables held at their means, it is possible to interpret the coefficient of the total trip cost as semi-elasticity showing the percentage by which visits would drop for a single unit (i.e., PKR 1) increase in TC. The coefficients show an extremely low degree of elasticity in both models. As discussed in Section 3 above, a Keenjhar trip is a unique and high quality recreational experience and, based on the empirical evidence reviewed in Woodall, *et al.* (2002), unique and high quality recreational experiences have been shown to have low price elasticities. In an analysis of day trips to Canyon County for wine tourism, the same authors include a "stay home" dummy variable which confirms the site in question to be unique, with few substitutes.

As it is an on-site sample with self-selection on the part of those who go to Keenjhar, the data are truncated because only those visitors are considered who have visited Keenjhar Lake at least once. Hence, zero-truncated Poisson regression model is taken. Again, owing to the fact that ours is an on-site sample, it is inherently likely to have intercepted avid visitors to Keenjhar. The endogenous stratified truncated Poisson addresses this problem because it is expected that the sample average number of trips to be higher than the population mean.

4.2. Estimation of the TCM Model

The results for the selected estimator; the zero-truncated and endogenously stratified Poisson regression model are presented in Tables 3 and 4. Seven-variable model is discussed first. Its overall significance, as measured by χ^2, was 0.0000 in all three models showing that the sign of the coefficients across all variables in Table 3 is as expected. In general, when displaying marginal effects for travel cost models we are presented with the predicted number of events in the dependent variable against each of the independent variables.

Table 2. Estimator Selection for the Travel Cost Model

	Endogenous Stratified and Truncated Poisson		Endogenous Stratified Negative Binomial	
	1	2	3	4
Variable	Estimate (S.E.)	Estimate (S.E.)	Estimate (S.E.)	Estimate (S.E.)
Constant	-0.195***	0.373***	-14.347	-12.988
	(0.053)	(0.065)	(196.956)	(93.716)
Travel Cost	-0.00005*	-0.00006**	-0.00005	-0.00005
	(0.00003)	(0.00004)	(0.00005)	(0.00005)
Monthly Income	1.09e-08	7.58e-08	-3.62e-08	-8.29e-09
	(5.13e-07)	(5.09e-07)	(7.45e-07)	(7.46e-07)
Travel Time		-0.048***		-0.051***
		(0.0106)		(0.016)
LR / Wald χ^2	2.41	24.12	1.16	11.84
Level of sig.	0.2998	0.0000	0.5601	0.0080
Pseudo R^2	0.0010	0.0096		

Note: ***, ** and * indicate significance at the 1 percent, 5 percent and 10 percent levels, respectively. Results are for a sample size of 741.

Based on a high Pseudo R^2 value as compared to Models 1 and 2, the marginal effects in Model 3 are examined in Table 3. It can be observed that trips are predicted by the Model to increase by 0.03 percent for a PKR. 1000 increase in monthly income. By looking at elasticities after Poisson, a 10 percent increase in travel costs would result in a 1.3 percent decrease in the frequency of trips. It is noteworthy that travel cost variable is significant at the 5 percent level for all three models.

The coefficient of monthly income is insignificant in all the models, considering that nearly half the sample has undertaken an approximately 3-hour long journey. Supporting hypotheses that males, more importantly single males, face nominal constraints when it comes to traveling unaccompanied and exercising travel decision prerogatives, gender and married coefficients show significance at the 5 percent and 10 percent levels, respectively.

Table 3. Endogenous Stratified and Truncated Poisson Regression- Basic Models

Variable	1 Estimate (S.E.)	2 Estimate (S.E.)	3 Estimate (S.E.)
Constant	-1.192 (0.728)	-1.288* (0.729)	-1.218* (0.729)
Travel Cost	-0.00006** (0.00003)	-0.00007** (0.00004)	-0.0001** (0.00004)
Travel Time	-0.052*** (0.011)	-0.053*** (0.011)	-0.080*** (0.015)
Monthly Income	2.17e-07 (5.06e-07)	2.91e-07 (5.11e-07)	3.19e-07 (5.13e-07)
Gender	1.696** (0.709)	1.719** (0.709)	1.783** (0.710)
Married	0.231*** (0.072)	-0.216*** (0.072)	-0.218*** (0.072)
Urban	0.299*** (0.088)	-0.301*** (0.088)	-0.304*** (0.088)
Waterac_pref	0.255* (0.139)	0.234* (0.139)	0.220 (0.139)
D_mp		0.225*** (0.070)	-0.048 (0.132)
Interacted_TC			0.00007 (0.00007)
Interacted_T_Time			0.058*** (0.022)
LR (χ^2)	58.19	68.5	76.43
Level of sig	0.0000	0.0000	0.0000
Pseudo R^2	0.0233	0.0274	0.0306

Note: Note: ***, ** and * indicate significance at the 1 percent, 5 percent and 10 percent levels, respectively.

The correlation between the decision to travel to Keenjhar and the preference for water-based activities appears to be supported by the significance of the coefficient of our “water based activities” variable at the 10 percent level except in Model 3. Moreover, the coefficient of the dummy variable for multiple purpose visits is highly significant in Model 2 but not so when interacted with travel time in Model 3.

Table 4. Endogenous Stratified and Truncated Poisson Regression - Extended Models

Variable	Model 1 Estimate (S.E.)	Model 2 Estimate (S.E.)	Model 3 Estimate (S.E.)
Constant	-1.299*	-1.424*	-1.352*
	(0.751)	(0.752)	(0.753)
Travel Cost	-0.00007**	-0.00007**	-0.0001***
	(0.00003)	(0.00004)	(0.00005)
Travel Time	-0.051***	-0.052***	-0.079***
	(0.011)	(0.011)	(0.016)
Monthly Income	1.72e-07	2.31e-07	2.65e-07
	(5.22e-07)	(5.29e-07)	(5.32e-07)
Gender	1.699**	1.725**	1.777**
	(0.710)	(0.711)	(0.711)
Married	-0.254***	-0.241***	-0.239***
	(0.085)	(0.084)	(0.085)
Urban	-0.296***	-0.310***	-0.304***
	(0.089)	(0.089)	(0.089)
Waterac_pref	0.254*	0.234*	0.221
	(0.139)	(0.139)	(0.139)
Education	0.004	0.006	0.007
	(0.010)	(0.010)	(0.010)
Unemp_09	0.061	0.073	0.050
	(0.089)	(0.089)	(0.090)
Wtp_50	0.080	0.083	0.094
	(0.080)	(0.079)	(0.080)
Age	-0.0005	-0.0004	-0.0005
	(0.004)	(0.004)	(0.004)
D_mp		0.231***	-0.047
		(0.071)	(0.133)
Interacted_TC			0.00007
			(0.00007)
Interacted_Travel_Time			0.058***
			(0.022)
LR χ^2	60.10	71.00	78.95
Level of Sig.	0.0000	0.0000	0.0000
Pseudo R^2	0.0240	0.0284	0.0316

Note: ***, ** and * indicate significance at the 1 percent, 5 percent and 10 percent levels, respectively.

The mean consumer surplus result relates to Model 1 and needs to be interpreted in light of Models 2 and 3 (Table 3) which exhibit incidental visits to complementary sites such as Badshahi Masjid, Bhamboor, Makli and Chowkandi. In Model 2, following the introduction of an indicator variable, the statistical significance of the differential intercept implies that the intercept for the multi-purpose trips (the 58 percent of our sample undertaking single purpose visits and the 42 percent undertaking multiple purpose visits) is different. As the coefficient is positive, the incidental visits may be interpreted to serve as complements [Loomis, *et al.* (2000)].

All the models estimated are presented in Tables 3 and 4 while segregating visitors to Keenjhar who forego the opportunity to earn income for the purpose of enjoying a day trip to the Lake from those who do not. The former "constrained" category describes individuals whose labour/leisure choice is at an "interior" and whose opportunity cost of time is reflected in the wage rate. In demand function, the opportunity cost of time of the latter "unconstrained" category is reflected in the absolute value of the coefficient of the travel time variable in Tables 3 and 4.

Constrained individuals' opportunity cost of time was based on empirical evidence presented by Cesario (1976) where the most common assumption is that the price of time spent travelling can be valued at between a ¼ and ½ of the wage rate. The unconstrained individuals' time was set at zero. When this structure of modeling is not followed, and all individuals are treated equally for time valuation, the estimated mean consumer surplus per visit is PKR27,322 (or USD329). As shown in Table 4, for Model 3, the estimated mean consumer surplus per visit in the endogenous stratified truncated Poisson is PKR9,024 (or USD109). This estimate is only marginally smaller (a 5 percent difference) when compared to the result obtained from our 7-variables endogenous stratified truncated Poisson regression.

4.3. Impact of Outset Origins on Welfare Measurement

A design feature in our questionnaire permitted the analysis of impacts on welfare measurement arising from differences among visitors in terms of their point of departure. In particular, respondents travelling as a large group in rented buses/vans (437 visitors or 59 percent of our sample of 741) were asked if they incurred petrol and time costs before boarding their charter transport. In other words, we did not assume that all members of an extended family or all members of a group of friends were picked up from their front door. As referred in Table 5 to a "common point of departure" (CPD) to describe the point of boarding chartered transport for those who were not picked up from their home (6 percent of sample). The term "home" indicates that welfare was calculated on the assumption that all chartered transport visitors were picked up from their doorstep. Common point of departure "CPD" and "home" is the embarkation points for each of the two sub-samples that are used to estimate consumer surplus in Table 5. The impact on consumer surplus, an increase of 41 percent, is pronounced when the sub-sample is restricted to only those who reported costs before boarding their chartered transport.

However, the analysis does show that the unrealistic and simplifying assumption that this category of visitor does not incur travel and time costs before boarding charter transport results in a significant underestimate of consumer surplus values. The design feature is cumbersome and cause respondent fatigue. Moreover, in a review of revealed preference valuation techniques, Bockstael (2007) found that cost coefficients tend to figure prominently in welfare measurement irrespective of the functional form. With regard to the zonal travel cost method, Bateman, *et al.* (1997) undertook research on embarkation points for the trip emphasizing the accuracy of road distances and routing to recreational sites and the impact that this has on welfare measurement.

This study was based on a sample of 351 visitors to a woodland recreation site. The authors use actual road network distance in order to compare the consumer surplus estimates derived using it with those obtained by assuming straight line travel, where they found the latter to underestimate welfare values up to 20 percent. The revision of data collection and processing strategies in our case is all the more important given the fact that chartered transport of the kind used by Karachiites is common in the urban centers of developing countries. For example, in an application of the travel cost method in Bangladesh, Shammin (1999) found as many as 58 percent of visitors to the Dhaka zoo to use a bus as compared with 20 percent in the tempo/scooter category. The easy avail-

Table 5. Results of Access Values for Different Specification of Time Cost and Out of Pocket Expenses in the Travel Cost Variable

Sample Used	Outset Origin	TC Coefficient	Standard Error	t - Value	Log Likelihood	Prob > chi2	Consumer Surplus (mean per visit, USD)
47 charter transport users who were not picked up from home (6 percent of the sample)	CPD	-0.000189	0.000374	-0.51	-47.23	0.12	64
	Home	-0.000266	0.000373	-0.71	-47.10	0.11	45
Entire sub-sample of 437 charter transport visitors (59 percent of the sample)	CPD	-0.000281	0.0001	-2.81	-699.2	0.02	43
	Home	-0.000296	0.000010	-2.97	-698.7	0.02	41
Full sample (741 visitors)*	Home	-0.000111	0.000051	-2.19	-1211	0.00	109
Full sample (741 visitors)**	Home	-0.000105	0.000050	-2.11	-1213	0.00	115

Note: The term "home" indicates that welfare was calculated assuming that all chartered transport visitors were picked up from their doorstep; conversely, the welfare measurement incorporating time and out-of-pocket expenses incurred before boarding chartered transport is denoted by "common point of departure" (CPD).

ability of buses, microbuses and other shared/chartered transport for low income groups visiting popular public attractions is also underlined in Mahat and Koirala (2006), which applies the travel cost method to study visitors to the Jawalakhel Central Zoo of Nepal where this category represented 80 percent of all transport modes.

5. CONCLUSION AND POLICY IMPLICATIONS

This study used a single-site truncated count data travel cost method to estimate the access values of visitors to Keenjhar Lake. A basic version of the model applied to a subset of visitors using charter transportation allowed to analyze the impacts on welfare measurement from altering assumptions about embarkation points. Policy makers may use these estimates on the recreational value of the lake to assess the returns on conservation investments.

Using the TCM, in this study we estimate the recreational value of Keenjhar Lake. The estimated value is PKR3.46 billion (or USD42.2 million) calculated on the basis of an annualized PKR9,500 (or USD116) illustrating consumer surplus per visit value, that is, assuming average daily visits at 1,000.

From the above results it can be inferred easily that amenity value of the site can be improved by providing facilities to the visitors. It is well known fact that amenity sites are scare in Pakistan. People chose to go for recreational trips if facilities are available at the site. Facilities may be provided to the visitors when the funds are available. Funds can be generated through increase in entry ticket, introducing parking fee, taxing vendors and minor percentage raise in the STDC huts charges. Sindh Tourism and Development Corporation and WWF Pakistan may collaborate so that to generate revenue and save the environment at the same time.

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