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Estimating the Economic Values of Mirissa Coast of Sri Lanka Focused on Sea Whale-watching Tourism Using Individual Travel Cost Method

Meregngnage Isuru Umanda De Silva · Heedong PYO†
Pukyong National University(student) · †Pukyong National University(professor)

개별여행비용법을 이용한 바다고래관광을 중심으로 한 스리랑카 미리사 연안해양의 경제적 가치 추정

이수루 · 표희동†
부경대학교(학생) · †부경대학교(교수)

Abstract

This study focuses on using the Individual Travel Cost Method (ITCM) as a non-market valuation technique to estimate the economic value of sea whale-watching based on coastal and marine tourism in Mirissa, the Southern Province of Sri Lanka where, no previous studies of this kind have been conducted before. An onsite survey in Mirissa beach is inevitable for foreign visitors and tourists to watch sea whale in Mirissa which is a popular hotspot known around the world. The count data models including zero truncated Poisson regression (ZTPR) model and zero truncated negative binomial regression (ZTNBR) model are applied to estimate the consumer surplus (CS) with a sample size of 207. The econometric estimations show that CS estimates per trip per visitor per year in ZTNBR, which avoids the over-dispersion problem that occurs with ZTPR, is $3,634, and for the aggregation of the national level the annual total economic value of foreign visitors for whale-watching in this site in the ZTNBR is estimated to be $556,884,376.

Key words: Individual travel cost method(ITCM), Economic value of sea whale-watching, Count data

Ⅰ. Introduction

Sri Lanka is an increasingly famous destination for international travellers, guides, honeymooners and adventure travellers. Lonely planet nominated Sri Lanka as the #1 destination in the world to visit in 2013 and 2019. In 2015, Forbes magazine ranked Sri Lanka among the "top ten coolest countries" to visit. Global influencers including "Condé Nast Traveller", "Rough Guides", "Lonely Planet", The Guardian, and the New York Times identified Sri Lanka as a top location to visit in 2016(Ministry of Tourism Development and Christian Religious Affairs, 2016).

This study focuses on Mirissa coast and its environment as the study area. It is one of the zones in south coast region that has been proposed as suitable areas for tourism development and for national investment in tourism in terms of beach resort and fishing community. The whale watching industry of southern coast has been developed mainly in Mirissa. The cetaceans in southern

† Corresponding author : 051-629-5959, pyoh@pknu.ac.kr/orcid.org/0000-0003-4996-2801

coastal water are not much different from the overall marine mammal population from Sri Lanka. But the unique feature of the sea of the southern part of Sri Lanka is suited to the residential whale population.

The main objective of this study is to estimate the economic value of foreign visitors for Mirissa beach focused on sea whale-watching trips in the Southern Province of Sri Lanka by using the individual travel cost method (ITCM). The main assumption in this theory is that the costs which are being spent by an individual in order to reach to Mirissa indicate an economic value of that area. In this study, the researcher evaluates the visit demand function of the site after collecting the related questionnaires and then calculates the consumer's surplus which is equal with the economic value of this site.

Ⅱ. Materials and Method

1. Theoretical Background and Principles

The travel cost method is generally referred to as a non-market valuation method for valuable recreation sites, beaches, parks, heritage sites and natural sites. Travel cost method(TCM) is widely recognized as a consumer oriented method for assessing ecological amenities associated with recreation areas, nature reserves and other natural areas (Spaèek and Antouskova, 2013). TCM is considered one of the oldest methods of environmental assessment. It was developed by Harold Hoteling in 1947. There are two basic approaches that can be attributed to TCM. The first is the Zonal model and the second is an Individual model. Parsons(2017) obtained two other models from the above sites: a single site model and a random utility model. The basic specification of the TCM demand curve arising from maximizing standard utilities subject to a full revenue budget constraint includes a measure of travel cost, price of replacement substitute sites, and income. The models follow conventional downward sloping demand functions. The "quantity demanded" for a person is the number of trips taken to a recreation site in a season and the "price" is pseudo price on behalf of the trip cost including flight, accommodation, local transport, onsite expenses, whale-watching fee and etc.

One of the methods which were used in order to value most of recreational sites during the recent years is ITCM. The main assumption of this theory is that the cost of a visit to a particular place is equal to some extent the value of the place (Khoshakhlagh et al., 2013). Then, the individual demand function is created as follows:

$$V_i = f(TC_i,\ X_{1i},\ X_{2i}, \ldots\ldots\ X_{\ni}) + \epsilon_i$$

V_i, number of visits by i th individual, TC_{1i} travel cost incurred by individual i, X_{1i} and X_{2i} other relevant variables and ϵ_i error term.

The idea of consumer surplus(CS) is a central tenet of the travel cost method. The importance of CS in the TCM lies in the fact that it actually represents how much a visitor values a trip or visit to a recreational site. The value is the total consumer surplus, which indicates the difference between a person's total willingness to pay for trips and the actual trip cost incurred over a season, under the single site demand function (Parsons, 2017). Researcher must be able to estimate the mean consumer surplus, and more importantly the confidence interval around the mean. In the count data model, CS per trip is calculated as the reciprocal of the coefficient on the travel cost variable, expressed as $\frac{-1}{\beta_{tc}}$ (Loomis et al., 2016).

2. Onsite Survey and Data Descriptions

In the survey, overseas visitors who visited Mirissa beach at least one time before excluding current visit were surveyed. A question on whether whale watching was the primary purpose of their trip or not was that the foreigner's flight cost should allocate the cost for the flight (two ways/round trip) by dividing the number of other substitutes sites (multipurpose trips) that visitors will visit or visited. The survey team also surveyed visitors who have the intention to visit Mirissa beach when they leave from their final destination.

The questionnaire consists of two parts, namely socio-economic and travel cost and parts. A total 207 questionnaires were used for the study. In ITCM, questionnaires were distributed among visitors within this site and the participants were asked to present their number of visits during a previous two years. In this paper, the temporal dimension is a two year period. As independent variables, Gender, Income, Activities, D_mirissa, Sub_sites, Preferences, OC_time, and TTC were surveyed as shown in <Table 1>.

3. Total Travel Cost (TTC) and Opportunity Cost (OC)

Based on the information obtained from the questionnaires, the total travel cost for each individual was computed by summing the travel cost and the opportunity cost of travel time. Total travel cost consists of accommodation cost, local transportation cost, and onsite cost, whale watching boat cost, beach equipment cost, opportunity cost and other costs. Opportunity cost is included in TTC by calculated with assumptions.

First, their travel time was considered to be zero for students, retirees, and the unemployed because this group of visitors would not have been employed elsewhere if they chose not to go to the beach as a trip.

Second, the focus of this article is on estimating the opportunity cost of travel time as part of the total cost of the trip.

<Table 1> Definition of variables in the data set and their descriptive statistics

Variables	Definition of Variables	Mean	SD
No_visits	Dependent Variable: trip frequencies in Mirissa for last 2 years (including present trip)	2.6666	0.1787)
Gender	Gender discrimination (Male: 0, Female:1)	0.5362	0.0347
Income	Annual household income after taxes($)	79831	4205
Activities	Spending way in Mirisa(in addition to whale watching)	3.0966	0.0708
D_Mirisa	Staying period in Mirissa(days)	2.4396	0.1111
Sub_sites	How many sites will visit or visited	2.4396	1.5994
Preference	Personnel attraction towards Mirissa	0.7653	0.0126
OC_time	Total travel hours(hours)	464.9739	35.8490
TTC	Total travel costs($)	1731	68

Third, visitors are assumed to respond to travel time costs exactly as they respond to non-periodic travel costs and assuming that the opportunity cost of time is equal to the rate of wage.

Fourth, estimating the cost of time as part of an hourly wage assumes that visitors have a flexible work schedule.

Fifth, all visitors work the same number of hours (2,080 hrs) a year and are paid in the same manner for that job (even if different amounts)

Sixth, all individuals travel to the site at the same speed (80km/hr).

Seventh, visitor's flight travel time was calculated from the getting information from the popular website(trip.com) and estimate the shortest time from their capital airport to Colombo international airport and multiply that time by two to calculate the round flight travel time.

Eighth, visitor's local travel time was calculated by using their local travel cost dividing by the fixed charging rate. In here assume every hiring company charge same rate for any vehicle mode ($0.278 per km).

Ninth, since it is somewhat difficult to determine the exactly spend time on each site and the cost of on-site time is excluded.

Tenth, based on empirical studies (Amoako-Tuffour and Martinez-Espineira, 2008), 33% fraction of the hourly wage allocates to measure the opportunity cost.

Based on this, this study has attempted to assess the economic value of whale watching around the Mirissa coast of Sri Lanka using ITCMas one of the most important non-market valuation technique of environmental services. TTC_i indicates the total travel cost of i th individual, RTT_c round trip travel cost, Acc_c accommodation cost, $OnEXp$ onsite expenditure, B_c boat cost, Be_c beach equipment cost, $O_c$other cost and OC_{time} indicates the opportunity cost of time.

$$TTC+i = RTT_c + Acc_c + OnEXp + B_c + Be_c + O_c + OC_{time}$$

Considering the relevant variables in this study, the performance of travel demand function for the selected site is evaluated in the following equation:

$$Y_i = f(TTC_i \geq nder + i, \in come_i, Activities_i . \Pr eference_i,$$

Where $Y+i$denoted by the number of visits during the past 24 months(individual or group i), TTC_i is individual i's travel cost to visit the site and other vector of parameters mentioned in <Table 1>.

4. Economic Models

ITCM is that the dependent variable in this model is a discrete variable, not a continuous one; means it's not a decimal number, it's an integer number. Consequently, the study is unable to use common economic methods of ordinary least squares(OLS). To use this method, the dependent variable must follow the normal distribution, but this variable of ITCM does not follow this distribution(Khoshakhlagh et al., 2013). Shaw(1988) evaluates the limitations of ITCM and the most importance is that the number of visits is count data. Therefore, it is important to choose the right model to assess demand function.

The dependent variable in this analysis is the number of visits made to the site including the current visit and during the previous two years. This variable takes only nonnegative integer values so it is best modelled as a count variable. Count data models are now commonly used in the estimation of single-site recreation demand models(Amoako-Tuffour and Martinez-Espineira, 2008).

4.1 Poisson Regression Model

A Poisson regression model treats the trip as a discrete random variable and assumes the probability of observing that a Poisson distribution can be described as a specific frequency(Chae et al. 2012).

$$Prob[Y = y_1 | X_i] = \frac{\exp(-\lambda_i)\lambda_i^{y_t}}{\acute{\Gamma}(1+y_i)}$$

$$\lambda_i = \exp(\alpha = x_i{}'\beta), y_i = 0, 1 ..., i = 1, ..., N$$

Where y is the number of trips undertaken by each visitor in the past two years and λ is the mean and variance of the distribution(i.e. the expected number of trips). Xi is a vector of covariates and, $i = 1, ..., N$, indexes the N observations in a random sample.

To properly apply the Poisson model for the beach visits, the mean number of trips or visits must be exactly the same as the variance of the trip or visits(equi-dispersion). However, the observed dataset adopts a fast decay process(most visitors have fewer visits and few visitors have more visits), so the variance of the distribution is much higher than the mean. Note that the data set generated for this study has a considerable number of visitors who made at least one trip in the past two years. For this reason, there are no zeros. Then the first option is to Zero-truncated distribution before looking at the alternative models.

4.2 Negative Binomial Regression Model

In cases where the problem of over-dispersion is serious, the most commonly used alternative is the negative binomial model. This is generally achieved by adding an additional parameter(usually denoted α) that reflects the unexpected heterogeneity that Poisson fails to capture. Let the distribution of a random count y be Poisson, conditional on the parameter λ, so that $f(y|\lambda) = \exp(-\lambda)\lambda y/y!$, Suppose now that the parameter λ is random, rather than being a completely deterministic function of the regressors x, In particular, let $\lambda = \mu\nu$, where μ is a deterministic function of x, say $\mu = \exp(\chi'\beta)$, letting $\nu = 0$ be independently and identically distributed with density $g(\nu|\alpha)$,where α is denoted the over-dispersion parameter. This is an example of undifferentiated heterogeneity, where different observations may have different (heterogeneity), but part of this difference is a random (unobserved) component ν, which would not be captured by the Poisson regression model.

$$h(y|\mu, a) = \frac{\acute{\Gamma}(a^{-1}+y)}{\acute{\Gamma}(a^{-1})\acute{\Gamma}(y+1)}\left(\frac{a^{-1}}{a^{-1}+\mu}\right)^{a^{-1}}\left(\frac{\mu}{\mu+a^{-1}}\right)^{y} \quad a > 0$$

Where $\Gamma(\acute{}\ )$ is the gamma function. The parameter α determines the degree of dispersionin the predictions. Special cases of the negative binomial include the Poisson $(a = 0)$ and the geometric $(a = 1)$. A likelihood-ratio test based on the parameter α can be employed to test the hypothesis of no over-dispersion.

4.3 Truncation and Endogenous Stratification

An additional feature of the distribution of individual trip or person tripis that it is truncated at zero, since the data collection was done after the visitors entered the site. Therefore, failing to account for truncation leads to estimates that are biased and inconsistent because the conditional mean is mis-specified(Tuffour and Espineria, 2008). The density of the Poisson distribution truncated at zero for the count (y) is given by:

$$\Pr[Y=y|Y>0] = \frac{e^{-\mu}\mu_y}{y!},[\frac{1}{1-e^{-\mu}}], \quad y=1,2,...$$

The standard Poisson model is unbiased even with over-dispersion, but this is not the case with the truncated version of Poisson. If there is over-dispersion, the truncated Poisson model yields inconsistent and biased estimates(Tuffour and Espineria, 2008). In such a case, the truncated negative binomial model is to overcome this problem. The density of the negative binomial distribution truncated at zero for the count (y) is given by:

$$\Pr[Y=y|Y>0] = \frac{\acute{\Gamma}(y+a^{-1})}{\acute{\Gamma}(y+1)\acute{\Gamma}(a^{-1})}(a\mu)^{-(y+a^{-1})},$$

$$[\frac{1}{1-(1+a\mu)^{-a^{-1}}}]$$

In many studies of recreational demand, modelling the behaviour of individuals and extending the sample results to the individual population. Researchers, therefore, want to compare the sample proportion of particular types of individuals to the population ratio. But when the sample is taken from an onsite survey, people with higher usage levels are more likely to sample(Haab, 2002).

According to Tuffour and Espineria(2008) the sample is endogenously stratified as the data is retrieved from the onsite. This is because the likelihood of getting a sample of visitors is positively correlated with the number of times they visit the site. That is, frequent visitors are more likely to be sampled. There is a high possibility of being sampled by visitors who are more often visited site. This problem(sometimes referred to as choice-based sampling) was first addressed by Shaw(1988), and other researchers extended their analysis with an application of the truncated and endogenously stratified negative binomial model.

Ⅲ. Model Selection and Results

Selecting the model in regression analysis occurs to some bias in considering scenarios and it wants a keen comparison between the models. A most common figure is the over-dispersion parameter. For selecting the appropriate model, the statistical robustness of the signs and magnitudes of the coefficients are very important. The high significance of the over-dispersion parameter áin model ZTNBR confirms that over-dispersion can be occurred. In the sample likelihood ratio test of

$$alpha = 0 : chibar \quad 2(01) = 8.04, \ prob \ >= chibar \quad 2 = 0.002$$

implies that null hypothesis of $\alpha = 0$ should be rejected. Therefore, the model based on Poisson distribution is overly restrictive. Then choice of the best model rests among the models based on the negative binomial specification, which correct the over-dispersion and the overestimation of consumer surplus in the Poisson.

The zero-truncated Poisson regression(ZTPR) model and zero-truncated Negative binomial regression(ZTNBR) model were applied to the sample(n=207). The results of the model estimations for the different model sets are presented in <Table 2>.

The signs of these variables such as, $Income$, $D\_mirissa$ and $Preference$ are positive; means that the number of visits increases in terms of increasing the quality of the site and monthly income of individuals. The sign of $Activity$ variable in these models is negative; means that when they have more activities to do in Mirissa beach, it will be negatively caused to watch whales. In questionnaire, there is a question asking about how visitors intend to spend their time at the beach in addition to whale watching and they have options to choose what kind of activities they will do in Mirissa beach. The sign of substitute's variable is negative; means that by increasing the substitute's sites to visit in the coastal area, the number of visits to Mirissa(whale watching) decreases.

<Table 2> Evaluation of travel demand function

Variables	ZTPR	ZTNB
Constant	-.8344101**	-1.082991**
Gender	.2657605**	.2734452**
Income ($/Rs)	9.97e-06*	.00001*
Activities	-.1147053**	-.081667
D_Mirisa	.0939111**	.0992719**
Sub_sites	-.1003738**	-.0759472***
Preference	1.319811*	1.367037*
TTC	-.0001403**	-.0001495**

Note: *, **, *** and denote significance at 1%, 5% and 10% level, respectively.

Although all of the variables considered in this study are statistically significant at 1% or 5% or 10% level and provide useful information, the most important variable is travel costs. More interestingly, the estimated coefficient of TTC is statistically significant across all the samples and negative across all the samples. This conforms to the theory of the TCM which suggests that as travel cost increases, the number of trips taken bya visitor per season or per year decreases and vice-versa. By using this variable, it is possible to calculate the economic value of this site.

<Table 3> gives a summary of the customer surplus estimates calculated across the sample. The calculation of the CS estimates is based on the fact that if the coefficient of TTC is denoted by β, then the gross consumer surplus per trip and per person is obtained taking the negative inverse of β (CS per trip(per group)= -1/βctc).

<Table 3> CS calculation

Items	ZTPR	ZTNBR
Coefficient of TTC	-.0001403	-.0001495
CS per trip &per group($)	7,128	6,689
CS per trip &per person($)	3,872	3,634
Annual CS($)	592,994,708	556,502,726

There are 174 dependents in that sample and totally 207 visitors were sampled by the study. All together these costs incur with 381 visitors and average number of 1.84058 persons in one group.

$$Avg.No\ of\ person = \frac{sample\ Size + Dep}{sample\ Size}$$

After evaluating the travel demand function of Mirissa, estimating the consumer's surplus for each visit for the models of, ZTPR and ZTNBR, it equals $3,872 and $3,634 respectively.

$$CS\ per\ trip\&\ per\ person = \frac{CS\ per\ trip\&per\ group}{Avg.No\ of\ person}$$

Then, this number in order to determine the total economic value of whale watching for foreign tourists to this site must be multiplied in the total number of visits during a particular year. There are 153,131 foreign visitors for whale watching in Mirissa in 2017. Based on <Table 3>, for the aggregation of national level the annual total economic value in the ZTPR model and ZTNBR are $593,433,200 and $556,884,376 respectively.

Ⅳ. Discussions and Conclusions

The main objective of this work was to estimate the CS per visitor and per trip of foreign tourists visiting the Mirissa beach and the method that was used is ITCM. The two main count data models used in this work are the Poisson model and the negative binomial models in both their zero-truncated forms. However, the econometric results showed that negative binomial models produced better results than the corresponding Poisson models. After evaluating the travel demand function of Mirissa, estimating the consumer's surplus for each visit for the models of, ZTPR and ZTNBR, it equals $3872 and $3634 respectively. Then, for the aggregation of national level the annual total economic value in the ZTPR model and ZTNBR are $593,433,200 and $556,884,376 respectively based on 153,131 foreign tourists for whale watching in Mirissa in 2017. Based on the resulted number, it can be concluded that Mirissa is a valuable site for the visitors and this result was taken from their real behaviour. These results can be as a good guide for the planners, and decision makers of municipalities and also Ministry of Tourism Development in Sri Lanka.

The results of the study will be particularly beneficial to the Southern Municipal Council and other councils across the country in terms of improving public resources, infrastructure, transportation and hotel and catering services. Results obtained from this study will likely serve as a guide to implementing access or entrance fees for Mirissa as the same as most recreational sites in Sri Lanka. This study is important to note that every effort is made to reveal the country's tourism potential. Also, since such research has not been conducted in the country before (based on all the literature reviewed), it is expected to provide the basis for future research in this field of study.

As with all applications of the travel cost method, some areas of analysis require considerable research judgment and some simplification. Although the focus of this contribution is on the comparison of different economics specifications, there are some qualifications to our results and further research is needed to fully examine the welfare values derived from the Mirissa beach, which is the basis for management decisions.

The following suggestions and recommendations can be made based on the results of this work and the discussions.

Many of them are very satisfied with the quality of the beach and there is still much to do in terms of providing the infrastructure and services on the coast. Given these issues and proposals, it is clear that municipal authorities still have much work to do in terms of coastal management and improvement. It is better to conduct marine wildlife interpretation programs and highlight the special biology and human impacts on visitor attitudes, beliefs and conservation outcomes. Developing the awareness of interactions that guide marine wildlife tours inspire visitors to respect marine life, nurture environmentally responsible attitudes and behaviors, and benefit of marine conservation.

The lack of adequate funding to research, manage and monitor the impact of nature-based and coastal and marine tourism on the natural environment (including wildlife) is perhaps the most serious obstacle to effective management. To overcome this obstacle and to provide the resources necessary to make the effective management of their vast natural resources requires the commitment of the Sri Lankan Government and the authority of the tourism industry. This increased commitment is crucial to the sustainability of coastal and marine tourism in the southern province of Sri Lanka. The economic contribution and potential of marine tourism, as well as the potential advantage of a large number of wildlife resources, should be used to encourage improved investment in managing the impact of wildlife.

In addition, although the individual travel cost method is one technique that has been considered by economic researchers in recent years, there is a need to evaluate the preservation value for ecosystem of Mirissa through other methods, such as the contingent valuation method. In general, the estimates of the willingness-to pay(WTP) seem to be quite realistic and therefore could be conveniently used as access fee or as a preservation value. When these figures are combined with WTP by whale watchers, considerable collective economic value is placed on the preservation of these species in Mirissa. This can also be expected to translate into political support for state programs for the preservation of these species.

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