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Estimating the Benefits of Beach Recreation: An Application of the Contingent Valuation Method

NIK MUSTAPHA R. ABDULLAH
Department of Natural Resource Economics
Faculty of Economics and Management
Universiti Pertanian Malaysia
43400 UPM Serdang, Selangor Darul Ehsan, Malaysia

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ABSTRAK

Kajian ini melaporkan penggunaan kaedah penilaian kontingen pilihan dua aliran untuk menganggar faedah daripada rekreasi pantai di Port Dickson. Model logit dan probit digunakan untuk menganalisis data dan nilai kesanggupan membayar telah dikira daripada anggaran kebarangkalian maksimum. Nilai median kesanggupan membayar untuk rekreasi pantai di Port Dickson berkisar di antara RM55.01 dan RM534.80 masing-masing untuk purata pendapatan di antara RM404.56 hingga RM3933.50. Nilai ini boleh digunakan oleh penggubal dasar untuk mengira jumlah faedah tahunan yang diperolehi oleh sumber pelbagaiguna ini.

ABSTRACT

This study presents an application of the dichotomous choice contingent valuation method to estimate the benefits of beach recreation in Port Dickson. The logit and probit models were used to analyse the data and the willingness-to-pay values were computed from the maximum likelihood estimates. The median willingness-to-pay value for beach recreation in Port Dickson ranged from RM55.01 to RM534.80 for mean income of RM404.56 to RM3933.30, respectively. These values can be used by policy-makers to compute the annual total benefits obtainable from this multiple-use resource.

INTRODUCTION

Research in outdoor recreation has generated a lot of interest to economists as it provides tools for the economic evaluation of natural resources in recreational use. These tools were developed in response to problems which arise in the management of natural resources. Despite considerable work on the economics of outdoor recreation to measure benefits of national parks (Clawson 1959), sport fisheries (Brown *et al.* 1965), lakes (Burt and Brewer 1971), endangered species (Bowker and Stoll 1988) and other types of natural resources, there is a paucity of literature on measuring benefits of recreational beach resources. Beach renourishment, public acquisition of beachfront and beach carrying capacity have become important policy issues in practically all coastal states. Critical to these policy issues is the evaluation of these beach recreational resources.

The most popular method of measuring the benefits of outdoor recreational resources is the travel cost method (TCM). It occupies a major place in the applied research programmes of resource and environmental economists (Smith 1993). Some of the works utilizing this technique on Malaysian data are by Wan Sabri (1987) and Ahmad Shuib (1993). However, no research carried out in this region has ever applied the alternative technique of non-market valuation - the contingent valuation method (CVM) to value outdoor recreational resources. Research to measure the benefits of beach recreation using either technique is almost nonexistence in this country.

Although some authors have utilized TCM to evaluate beach recreational demand in Florida, the results obtained mixed responses from economic studies (Bell and Leeworthy 1990; Shaw 1991; Hof and King 1992). The purpose of this study is to make the first attempt of the estimation of benefits from beach recreation in Port Dickson using the contingent valuation method. A dichotomous choice form of contingent valuation is applied to quantify individual economic surplus associated with the preservation of beach recreation in Telok Kemang, Port Dickson.

The Contingent Valuation Method

The contingent valuation method has been in use for over 30 years and is now the most frequently used approach to estimate nonmarket economic values. It is a highly developed survey approach to nonmarket valuation. The survey tries to elicit how people would respond to certain hypothetical changes in environmental resources. It is a powerful tool for valuing nonmarket goods, so much so that a panel established by the National Oceanic Atmospheric Administration (NOAA) in the United States co-chaired by Professors Kenneth Arrow and Robert Solow issued a report which concluded that "CV studies can produce estimates reliable enough to be the starting point for a judicial or administrative determination of natural resource damages - including loss of passive-use value" (Carson *et al.* 1993a).

Considerable research has been carried out using CVM for estimating values for public decisions. Some of the more popular studies are by Randall *et al.* (1974); Bishop and Heberlein (1979); Hanemann (1984); Seller *et al.* (1986); Bowker and Stoll (1988); and McConnell (1990). The different kinds of work done using CVM can be found in Mitchell and Carson (1989). A recent bibliography (Carson *et al.* 1993b) lists over 1400 contingent valuation studies and papers from over 40 countries covering a highly varied empirical applications of contingent valuation.

There are several forms of the contingent valuation method. In this study the dichotomous choice technique for CVM is used. The respondents were asked to pay a certain level of membership fee in order to use the recreational resources. They were then asked to accept or reject the offer to pay for the use of these facilities. The dichotomous choice CVM has several advantages over other forms. It is simple to administer and respondents are not faced with intricate bidding schemes and do not have to contemplate exact values for the resource. The respondents have to respond "yes" or "no" to the dollar offer. In addition, this approach provides analysis which is consistent with utility theory (Hanemann 1984).

However, the dichotomous choice model provides researchers with limited information from the respondents and therefore requires more sophisticated statistical and estimation techniques to analyse the qualitative responses. In addition, this technique requires the appropriate range of offer levels of the goods being valued and this has to be determined in advance in order to capture it in the data for analysis. In most cases these offers are arbitrarily set and usually done in an *ad hoc* manner. Although CVM is argued to suffer from theoretical biases such as strategic and selection bias (Cummings *et al.* 1986), but interviewer bias and starting point bias common to iterative bidding are minimized in this dichotomous choice approach (Bowker and Stoll 1988).

METHODOLOGY

Hanemann (1984) has proposed the theoretical model from which Hicksian compensating and equivalent surplus measures are obtained from dichotomous choice, discrete response data. In this paper Hanemann's approach is followed in a willingness-to-pay framework to obtain a measure of individual's equivalent surplus. It is assumed that the individual derives utility from participation in beach recreation and money income. Variable r represents recreation, where r=1 if the individual is able to recreate and r=0 if he is not. Income is represented by Y and other attributes of the individual which may affect his preferences are denoted by vector d. If he can use recreational facilities the individual's utility is $U_1 = U(1,Y,d)$; if he cannot, his utility is $U_o = U(0,Y,d)$. Since there are unobservable random components to an individual's utility function, utility is treated as a random variable with a parametric probability distribution with means ν (O,Y,d) and ν (1,Y,d), and the

stochastic components e_r, which are independent and identically distributed (i.i.d) random variables with zero means.

When confronted with a price, \$A, to enter and use the recreation area, an individual will pay the amount only if

$$\nu\ (1, Y\text{-}A; d) + \epsilon_1 > (0, Y; d) + \epsilon_0 \qquad (1)$$

The willingness-to-pay probability may be written as:

$$P_1 = F\eta\ \ (\Delta\nu) \qquad (2)$$

where $\Delta\nu = \nu\ (1, Y\text{-}A; d) - \nu\ (0, Y; d)$ and $F\eta$ is the probability function for the error. If the argument $\Delta\nu$ is a utility difference, then the binary response model can be interpreted as the outcome of a utility-maximizing choice (Hanemann 1984).

Hanemann (1984) also suggested explicit specification of the non-random component of the indirect utility function to be:

$$\nu\ (j, Y; d) = \alpha_j + \beta Y\ ,\ \alpha > 0;\ \ j = 0, 1 \qquad (3)$$

where the vector d has been suppressed, then

$$\Delta\nu = (\alpha_0 - \alpha_1) + \beta A \qquad (4)$$

and the statistical discrete choice model becomes $P_1 = F\eta\ \ (\alpha + \beta A)$ where $\alpha = (\alpha_0 - \alpha_1)$. The other suggested functional form is

$$\nu\ (j, Y; d) = \alpha_j + \beta\ \ \ln Y,\ \ \beta > 0; j = 0,1 \qquad (5)$$

which gives

$$\Delta\nu = (\alpha_0 - \alpha_1) + \beta\ \ \ln\ (1\text{-}A/Y) \qquad (6)$$

From these specifications and assuming that the equivalent surplus is random with a probability distribution (G_E (A)), estimate of equivalent surplus is obtained by using the expected value of E, E_{MN} where

$$E_{MN} = \int_0^\infty F\eta\left(\Delta\nu(A)\right) dA \qquad (7)$$

Alternatively, an approximation of equivalent surplus may be obtained by using the median value, E_{MD}, of the distribution G_E (A), where

$$F\eta\ \ (E_{MD}\ ) = 0.5 \qquad (8)$$

Estimating the parametric probability function $F\eta$ ($\Delta\nu$ (A)) allow us to obtain estimates of the desired welfare measure.

Estimation Procedure

Central to the whole exercise is the estimation of parameters which define the willingness-to-pay probability function ($F\eta$). Several quantitative response models have been used by researchers and this includes the linear probability model (LPM), the logit model (LM) and the probit model (PM) (Judge *et al.* 1980; Amemiya 1981; Maddala 1983). In this paper, a transformation approach using an index variable Z_i β, representing the utility difference [equations (4) and (6)] is employed. The bigger Z_i are associated with higher probabilities that the event (Y_i) will occur, i.e. Y=1. Therefore, there exists a monotonic relationship between the probability of the event occurring and the index variable. Under such circumstances, the true probability function would resemble a distribution function. The two most commonly used distribution functions are the normal and the logistic, resulting in the probit and logit models.

In many economic applications, however, the standard logistic distribution function,

$$\left(1 + \frac{1}{e^{(-Xi\beta)}}\right) \qquad (9)$$

is assumed for $F\eta$. The logistic distribution closely approximates the normal and is relatively easier to estimate (Judge 1980). Both the logit and probit models are used in this study. The parameters for the binary response models can either be estimated using generalized least squares (Pindyck and Rubinfeld 1976) or maximum likelihood method (Capps and Kramer 1985; Hanemann 1984). In this study the latter estimation technique is employed. Two different specifications for the index variable $Zi = Xi\beta$ for equations (4) and (6) are used here. Each specification is estimated using both logit and probit models.

Study Area

This study was carried out in Port Dickson, Negeri Sembilan. The whole district of Port Dickson has an area of 572.63 sq. km and a population of 101707 people. This is the only district in Negeri Sembilan that faces the Straits

of Malacca and has about 54 km of beach stretching from Sungai Sepang in Selangor to Sungai Linggi in Melaka. Telok Kemang beach, 12 km from Port Dickson town, is one of the more popular beach recreation sites in West Malaysia. Its sandy beach has attracted and continues to attract millions of holiday-makers to this area, especially on weekends and public holidays, much more than any other beach resorts elsewhere. As many as 30,000 picnickers flock to this area on a given weekend. It is strategically located between Kuala Lumpur in the north and Singapore in the south, easily accessible from the north-south highway and is well-served with good roads and public transport.

Source of Data

The data were collected through on-site surveys in November 1991 using a structured questionnaire. A total of 188 domestic recreationists, all of whom were day-trippers, were interviewed at the beach recreational site and 169 questionnaires were used for further analysis. The statistics of the respondents are shown in Table 1.

About 52.7% of the respondents were government servants. The average monthly income of the respondents was about MR940. The majority of the respondents were 21-39 years, age category and travelled about 75 km to the beach. Each interviewee was informed of the purpose of the study with respect to the club membership, the facilities available in the study area and the format used in the contingent valuation technique. Following the briefing, the respondents (the head of the group or family) were asked to give a "Yes" or "No" response to the question. Example:

> "If the annual membership fee costs RMx in 1991, would you have joined the club so that you could have continued to use the beach recreational area throughout the year"?

where x ranged from RM1 to RM500. These values were arbitrarily selected as they represent a "reasonable" amount of entrance fee to many privately managed recreational areas in this country. Furthermore, there was no comparative value to refer to as this was the first attempt at using CVM in valuing benefits of beach recreation in this region.

RESULTS

Equation (4), represented by Model 1 and equation (6) in Model 2, were estimated using both the logit and probit models. The likelihood estimates of these two specifications are shown in Table 2.

The estimates of both logit and probit models for the two specifications (Models 1 and 2) did not differ very much in terms of the summary statistics and parameters significance. All variables had the expected results and were significant at 1% level. This finding is consistent with earlier work in the binary dependent variable case (Bowker and Stoll 1988). Model 2, however, had a slight edge over Model 1 in terms of McFadden-R2 and it was argued to be more preferable than the latter model as "income effect" was present, as expected in the

TABLE 1
Some descriptive statistics of the respondents

Variable	N	Mean	Std. Deviation	Max	Min
Income (RM)	176	939.7	620.42	4800.0	200.0
Group/Family size	188	5.4	3.14	32	2
Distance travelled (km)	171	75	49.7	350	1.0
Expenditure (RM)	183	57.8	108.9	999.0	1.0

utility model. Based on these criteria, model 2 was chosen for the subsequent measure of welfare from the consumers' willingness-to-pay for beach recreation in Port Dickson.

Welfare Measurement

From the estimates of Model 2 given in Table 2, the equivalent surplus welfare measures can be computed. The mean values were calculated by numerically integrating the area under each estimated willingness-to-pay function over the range of offer amount. Income was set as its sample mean. The computed mean and median values for income groups are presented in Table 3. The mean for willingness-to-pay ranged from RM63.83 to RM620.58 for a mean income of RM404.56 to RM3933.30 and RM71.74 to RM597.48 for the same mean income in logit and probit models, respectively. The median willingness-to-pay, meanwhile, varied from RM55.01 to RM534.80 for the logit specification and from RM60.54 to RM588.36 for the probit model. For all income groups, the mean willingness-to-pay was found to be about 15% higher than the median equivalent surplus measures and this is consistent with the finding of Hanemann (1984).

However, the logit specification in Model 2 performed slightly better than the probit model in terms of McFadden-R2 (Table 2). Based purely on this criterion, the mean and the median willingness-to-pay derived from the logit model can be considered as a more reliable measure of welfare. Nevertheless, one has to make a choice between which measure of WTP to use. From an economic point of view, the selection is purely a value judgement. Hanemann and Bowker and Stoll preferred the median WTP as a welfare measure as it is statistically more robust than the mean WTP measure. For this reason the median WTP values will be used in this study to represent the equivalent surplus measure for beach recreation in Port Dickson.

The median WTP computed from the logit model varied from RM55.01 for a mean income of RM404.56 to as high as RM534.80

TABLE 2
Parameter Estimates for Dichotomous Choice CVM Models for Port Dickson Beach

Variable	Model 1		Model 2	
	Logit	Probit	Logit	Probit
Constant	1.1818	0.7016	1.1879	0.6391
	(4.372)*	(4.363)*	(4.388)*	(4.130*)
Price	-0.0120	-0.0067		
	(-6.244)*	(-6.9864)*		
$\log\left(1-\frac{\text{price}}{\text{income}}\right)$			0.3181	4.5834
			(5.708)*	(6.535)*
McFadden R2	0.336	0.331	0.366	0.344
Log-likelihood ratio	76.18	75.09	83.07	78.08
% of correct prediction	0.83	0.78	0.81	0.81
N	169	169	169	169

Note: t - statistics are given in the parenthesis

* - significant at 1% level

TABLE 3
Estimate of mean and median WTP for beach recreation in Port Dickson (RM)

Mean Income (RM)	Mean WTP		Median WTP	
	Logit	Probit	Logit	Probit
404.56	63.83	71.74	55.01	60.54
787.84	124.30	139.70	107.12	117.89
1232.70	194.49	218.59	167.60	184.46
1845.0	291.10	327.17	250.86	276.08
2285.0	360.52	405.19	310.68	241.92
3933.30	620.58	597.48	534.80	588.36

for a mean income of RM3933.30. This estimate is, however, for one individual and expressed in an annual basis. Taking a very conservative estimate of RM55 which by no means reflects the average value of WTP, as an individual annual benefit of using beach recreational resources in Port Dickson, the total annual benefit from beach recreation can be very substantial if the total annual visits to this area is taken into account.

Suppose there were 300,000 visitors to the Port Dickson beach in 1993, and using MR55 as an example of a willingness -to-pay measure for this recreational resource, then the annual total economic benefits that can be obtained from this resource comes to about RM1.65 million. This value represents both consumers' consumptive and non-consumptive use of the resource. If for some reason, the beach recreation area is turned into some commercial project or put to other uses, then the annual opportunity cost of this new development will be the total economic benefits that this intangible resource is capable of generating for that particular year. These economic benefits carefully discounted must then be compared with benefits arising from new projects to justify the rational use of the same resource.

CONCLUSION

Attempts at valuing outdoor recreational resources in Malaysia have been sketchy and on an *ad hoc* basis. Previous works used the indirect valuation technique - the travel cost method to value the economic benefits of the these resources. This study presents an alternative valuation technique, the contingent valuation method (CVM) and is the first attempt at CVM to value beach recreational resources in Malaysia. The dichotomous choice form used in CVM is purported to reduce some inherent biases that occurred in the CVM techniques and it is consistent with consumers' utility maximizing behaviour.

The binary response models estimated by logit and probit specifications and the maximum likelihood estimates were satisfactory and consistent with expectations. The median willingness-to-pay (WTP) measure was chosen to represent the reliable equivalent surplus values for beach recreation in Port Dickson. The median WTP computed from the logit model ranged from RM55 for a mean income of RM404.56 to RM535 for a mean income of RM3933.30. These values represent reasonable estimates of economic benefit per individual per year obtainable from the resource. However, since this is the first attempt to use

CVM in valuing beach recreation in Malaysia, the results and conclusions must be interpreted with caution until further such studies are carried out. Taking a very conservative estimate of median WTP value at RM55, the annual total economic benefits derivable from this resource can be very substantial if one takes into account the total number of visitors to Port Dickson beach for a particular year. This value should reflect the "true" value of the resource as it includes both consumptive and non-consumptive aspects of this multi-purpose resource. From a policy-making point of view, the total economic benefits could be used as a bench mark for alternative development of the area to make it economically attractive and justifiable.

However the shortcomings in using CVM are biases with regards to the responses by those interviewed. Although a lot of effort has been undertaken in past years to minimize these biases, much more refinement is needed to improve this method. More work is needed especially in this part of the world with different cultural settings, before using CVM to get "reasonable" and reliable estimates of value of non market goods for policy uses in this country.

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