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An Economic Analysis of Phu Kradueng National Park

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***Abstract*—**The purposes of this study were as follows to evaluate the economic value of Phu Kradueng National Park by the travel cost method (TCM) and the contingent valuation method (CVM) and to estimate the demand for traveling and the willingness to pay. The data for this study were collected by conducting two large scale surveys on users and non-users. A total of 1,016 users and 1,034 non-users were interviewed. The data were analyzed using multiple linear regression analysis, logistic regression model and the consumer surplus (CS) was the integral of demand function for trips. The survey found, were as follows:
1)Using the travel cost method which provides an estimate of direct benefits to park users, we found that visitors' total willingness to pay per visit was 2,284.57 bath, of which 958.29 bath was travel cost, 1,129.82 bath was expenditure for accommodation, food, and services, and 166.66 bath was consumer surplus or the visitors 'net gain or satisfaction from the visit (the integral of demand function for trips).
2) Thai visitors to Phu Kradueng National Park were further willing to pay an average of 646.84 bath_per head per year to ensure the continued existence of Phu Kradueng National Park and to preserve their option to use it in the future.
3) Thai non-visitors, on the other hand, are willing to pay an average of 212.61 bath per head per year for the option and existence value provided by the Park.
4) The total economic value of Phu Kradueng National Park to Thai visitors and non-visitors taken together stands today at 9,249.55 million bath per year.
5) The users' average willingness to pay for access to Phu Kradueng National Park rises
from 40 bath to 84.66 bath per head per trip for improved services such as road improvement, increased cleanliness, and upgraded information.

This paper was needed to investigate of the potential market demand for bio prospecting in Phu Kradueng national Park and to investigate how a larger share of the economic benefits of tourism could be distributed income to the local residents.

***Keywords*—**Contingent Valuation Method, Travel Cost Method, Consumer surplus.

JEL Classifications: H41, Q23, Q51.

I. Introduction

DRIVEN by global concerns to achieve better environmental resource management, a voluminous literature has developed addressing the methodologies that seek to yield the benefit and cost information essential for policy prescription. The quest for superior methodologies has generated, in an often quite technical form, developments in economic theory and in econometric methodology. As Michael Burns(1999):Optimal policy management requires both total and marginal measures of a resource's value and to estimate these measures one of three approaches has usually been adopted: the Hedonic Price approach, the Travel Cost Method (TCM) and Contingent Valuation Method (CVM).

The purposes of the present paper, that the approaches that have been adopted may conveniently be split into two categories:

1. demand focussed approaches, which include TCM, which seek to infer properties of demand relations and then to derive resource valuations from consumer surplus type measures associated with these demand relations
2. willingness-to-pay (WTP) focussed approaches, which include most CVM studies, which seek to identify directly the WTP functions

The aim of this brief is to consider an approach which can be used to place a value on an un-priced environmental asset: the Travel Cost Method (TCM). As its name suggests, the technique is underpinned by the idea that by incurring time and money costs, consumers are revealing a willingness to pay for a particular location and willingness-to-pay (WTP) focused approaches, which include most CVM studies.

A. The Travel Cost Method (TCM)

TCM is useful to first look in slightly more detail at the underlying TCM methodology. There are a number of variations of this approach but the basic idea, as outlined for example in Johansson (1991), is that we can use information regarding the travel costs incurred by different individuals visiting an environmental resource to derive a distance decay curve. Such a curve is assumed to have properties that are usefully similar to those of a Marshallian demand curve.

The data required to derive this curve can be obtained by identifying population zones located at different distances to the resource and for each zone obtaining two variables: the number of trips as a proportion of the zones population; the average travel cost per trip from that zone. The set of observations generally lie on a downward sloping locus. Areas to the left of the curve and above a zone's cost line are used in conjunction with zone population data to obtain estimates of the aggregate Marshallian consumer surplus

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accruing to the population of the zone in question as a consequence of the availability of the resource.[3]

B. The Contingent Valuation Method (CVM)

Contingent valuation surveys frequently elicit respondents willingness to pay (WTP) for multiple scenarios within a survey. Multiple scenarios may include varying the level of quantity or quality of a good over a series of questions [1][17], or questioning respondents about their WTP for related goods [9].

This approach has several advantages, the most obvious being the reduced cost associated with one survey instead of multiple surveys. Another advantage of this approach is that joint surveying of multiple and potentially related goods can offer information concerning substitution effects between the goods[18]. It is well documented from empirical evidence and theory that total WTP for related environmental improvements cannot be formulated as the sum of estimated WTP for the individual improvements [9][18][19]. Substitution effects between the goods can lead to reduced WTP for the total improvements when changes in environmental quality are made jointly.

II. Methodology

As for the econometric part of the study, the author will use 1) multiple linear regression analysis, 2) logistic regression model and 3) the consumer surplus (CS) was the integral of demand function as follows:

A. Multiple Linear Regression Analysis

The above exploratory analysis of the available data in the park valuation literature does of course not allow for interactions between the various explanatory variables. In order to attain marginal effects – given the interference of potentially relevant intervening characteristics – Author use multiple linear regression analysis to assess the relative importance of all potentially relevant factors simultaneously.

The dependent variable in regression equation (1)is a vector of values in Baht per person per trip in 2007 prices, labeled Y. The explanatory variable are grouped in three different matrices that include the study characteristics in Xs (i.e., valuation method), geographical characteristics in Xp (i.e., service variables, information, activity variables and nearby Province) and the socio – economic characteristics in Xe (i.e., Income, Education, age, marital status and number of employed family numbers) the model fit was considerably improved, and heteroskedasticity was mitigated, by using the logarithms of the dependent variable. The estimated model is, in matrix notation:

$$\mathrm{In}(y)=a+X_s b_s+X_p b_p+X_e b_e+u \tag{1}$$

where a is the usual constant term, u a vector of residuals (assuming well behaved underlying errors), and the vector b contain the estimated coefficients on the respective explanatory variables[1]. [12]

B. Logistic Regression Model

This paper focus is on how to analyze these data by Logit Regression. The ‘rare event’ literature focuses on methods for improving the statistical accuracy when estimating the probability of a specific rare event happening within a certain time frame. However, emphasize that once such a probability is estimated - the simulation analysts should try to identify the most important factors that affect that probability [16]. In this section we propose logit regression models for such a sensitivity analysis (present a case study that concerns a ‘not so rare’ event).

For logit regression, the original simulation output w (is changed into the binary variable w .In case study, w denotes the time it takes for a specific event to occur. Author transforms w to 1 if for w the censoring event does occur, and to 0 if not:

$$\begin{aligned} w &= 1 \text{ if } w\,(\text{event}) = 1 \\ w &= 0 \text{ if } w\,(\text{no event}) = 0 \end{aligned} \tag{2}$$

Logit regression models uses the regression dependent variable y to predict P(w=1)= E(w):

$$y = \frac{e^{\beta' x}}{1+e^{\beta' x}} = \frac{1}{1+e^{-\beta' x}} \tag{3}$$

so that $0 \le y \le 1$; [4][20].

Rejection or acceptance to pay this sum (coded 1 or 0 respectively), provided a binary dependent variable to be modelled in respect of the bid amount plus other explanatory variables.

The general format for parametric dichotomous choice evaluation of WTP requires the choice of a suitable functional form which maps the coefficients of the explanatory variables onto the probability space.

Denoting Pr^{no}, the probability of a negative response at a given bid level as F(bid; θ), then:

$$Pr^{no} = F(bid;\theta) \text{ and } Pr^{yes} = 1-F(bid;\theta) \tag{4}$$

The expectation of a qualitative variable is a nonlinear function of explanatory variables.

[1] A multi – level modelling (MLM) approach such as used in Brouwer et al. (1999), and Bateman and Jones (2003) was considered but not adopted. This approach incorporates natural hierarchies or levels within the data, e.g., study sites, author, method and study, allowing the (somewhat unrealistic) assumption of independence between estimates to be relaxed. MLM is, however, problematic in that it requires the use of dummy variables for each group within a level, e.g., for each author of study site. This may be feasible in reasonably limited or homogeneous data sets but less so for very diverse data.

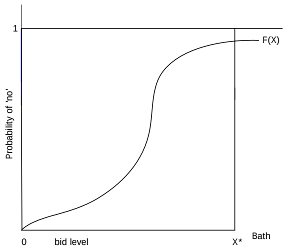

Fig. 1 Deriving E (WTP) from discrete choice data (with modifications adapted from Dominic Moran, [13])

The link F is therefore conventionally a cumulative logistic or normal distribution (see Gujarati, 1988)[2] and θ the parameter vector of an index function f(x). For computational ease a logit (using a logistic link function F(x)) model was tested for the current study, thus:

$$Pr^{no} = [1+e^{-f(x)}]^{-1} \qquad (5)$$

with

$$f(x) = a_0 + b_0 Xi + \sum_j \beta_j X_{ij} \qquad (6)$$

where Xi represents bid level faced by respondent i and a multivariate extension is feasible to j explanatory variables. Maximum likelihood estimation fits a curve to observed responses which traces the probability of refusal. Figure 1 demonstrates how the properties of fitted a cumulative density can be used to bound E(WTP) by the area above (F(X) and below the line for F(X) = 1. This area can be calculated mathematically or approximated geometrically [8][9].

C. Estimating Consumer Surplus from the Travel Cost Models

Estimating the consumer surplus per trip can be done by intergrating under the demand curve for trip (i.e., trip generation function). It is simple to show that the consumer surplus per trip, assuming the linear relation between visitation and travel cost, is equal to:

$$CS_i = \frac{\left(\alpha + \beta p_i^0 + \delta x_i + \varepsilon_i\right)^2}{-2\beta} = \frac{\left(\overline{N}\right)^2}{-2\beta}$$

N represents the average number of visits annually, which was 1.00 times from our sample. Coefficient β represents the slope of the fitted curve and show the negative relation between travel cost and visitation rate [5][4].

D. The Sample Size

The following subsections explain sampling design, questionnaire development and pretesting, and major features of the questionnaire.

The total sample size was determined by available budget. At the planning stage this paper targeted a total of 1,016 samples for domestic users and 1,034 for domestic non – users nearby province[10].

The sample size of users divided into three groups according to three version of the survey questionnaires. A well know source of potential bias arises from the starting point and type of elicitation format employed [11].

E. Questionnaire Design

The questionnaire were randomly assigned for park users and non – park users.A well know source of potential boas arises from the starting point and type of elicitation format employed [11][14]. For park users, it was confirmed that different starting point did affect respondents' WTP bids. The average bids were as follows: open-ended, low closed-ended and high closed-ended. All began by eliciting basic preference information in a manner commonly employed to maximize responses for self – administered surveys. Next, country of origin and component travel cost information was gathered, plus questions on days spent in parks, parks visited, length of parks and days prior to questioning. Respondents were then asked to consider the costs of park management and the constraints binding on conservation decisions. The option of higher entrance fees was then suggested as a possible solution to finance conservation with an implication that quality would decline otherwise. Respondents were made aware that they had the option of alternative vacation choices and of the existence of competing game viewing alternatives which may or may not raise prices [13].

Survey versions differed in the contingent valuation question posed with three versions attempting to elicit dichotomous choice and open – ended responses. The dichotomous choice format was double bounded with higher or lower follow – up offers in response to an initial offer. By concentrating on single bid estimation, the current study avoids the current empirical debate concerning the bias and statistical efficiency of double – bounded estimation. In framing WTP questions, one difficult issue concerned choice of payment vehicle. Numerous studies have identified a vehicle bias where responses are shown to represent protests against the mechanism of payment rather than a refusal to value the good on offer [2].

Finally, all questionnaire versions asked for basic socio – economic information; income, age, sex, member of conservation group, education, as well as information on how respondents thought higher fees should be charged, and (in the case of the open – ended format), reasons to validate zero bids in order to separate true zero value statements from protest bids.

III. RESULT

The total economic value of Phu Kradueng national Park to domestic users and non – users taken together stands today at 9,249.55 million baht per year (see table 1). The users' average willingness to pay for fee access to Phu Kradueng national Park rises from 40 baht to 84.66 baht per head per trip for improved services such as road improvements, in

[2] Choice of functional form is not arbitrary and several forms can be shown consistent with the way economic theory predicts consumers maximize utility (McFadden, 1974; Hanemann 1984; Loomis 1988).

created clanliness and information. Using TCM ,the survey found that the individual benefits of the recreation services offered were about 2,284.57 baht of which 958.29 baht was travel cost, 1,129.82 baht was expenditure for accommodations, food, and service variables(i.e. toilets ,road, trails and viewpoint) and for each single individual, the consumer surplus (CS) was 166.66 baht if the total benefit were about 10.59 million baht a year for users park. (see table II)

Using CVM, the mean maximum WTP was found to be 84.66 bath per trip for users and 38.15 bath for non users. From this, the total users and non users value of Phu Kradueng national Park was estimated to be 1,400.10 million baht per year, or an average of 122.61 bath per hectare per year. (see Table III).

IV. Conclusion

This conclusion, using TCM and CVM had attempted to quantify the benefit associated with the park users and non park users. The central estimate of consumer surplus of 10.59 million bath per annum demonstrates the magnitude of benefit provision by Phu Kradueng national Park and some proportion of revenue foregone at current pricing rate. This surplus represents only one category of total economic value but is itself sufficient to overturn approximate estimates of the opportunity cost.

However, this paper was needed to investigate of the potential market demand for bio prospecting in Phu Kradueng national Park (see e.g., Khao Yai National Park ,1995 and Costa Rica) and to investigate how a larger share of the economic benefits of tourism could be distributed income to the local residents.

Atakelty et al.(2000),the environmental being valued were not substitutes but that some were complement. Thus, an important challenge to the validity of conventional CVM value is whether the method induces respondents to seriously consider budget constraints. Arrow et al.(1993) raised this issue economists have found that reminding respondent of substituted seems to have no effect on stated value. However, Neill (1995) suggests that providing respondents with a simple description of budgetary substitutes is not enough if substitution effects are to be reflected in CVM value. The author also believes this to be significant and this study attempted to go beyond the approach of simply reminding respondents of substitutes.

Finally, as Carson and Mitchell (1995) illustrate using economic theory such finding were to be expected. The question is what is the appropriate package of goods to present to respondents in valuation efforts. This paper provides a method for presenting several alternative programs in a flexible and easily administered fashion.

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TABLE I
TOTAL ECONOMIC VALUE

Total Economic Value	Use Value	Non-Use Value	Option	
			Use Value	Non-Use Value
9,249.55 million	5.40 million	1,400.10 million	41.27 million	7,802.78 million

TABLE II
PHU KRADUENG NATIONAL PARK BENEFITS BASED ON THE TRAVEL COST METHOD (TCM)

Sample size	Consumer surplus per visit (Bath)	Number of visitors (2007)	Total benefit (Bath)
Users(Domestic) N= 1,016)	166.66	63,811	10.59 million

TABLE III
UNITS PHU KRADUENG NATIONAL PARK BENEFITS BASED ON THE CONTINGENT VALUATION METHOD (CVM): WTP FOR ENTRANCE FEE

	Users			Non-Users
	Domestic (N= 1,016)	International		Domestic (N=1,034)
WTP per visit (Bath)	84.66	400[2]	WTP per person (Bath)	38.15
Number of visitors(2007)[1]	63,811	418	Number in labor Force(2007)[3]	36.7 million
Total Benefit(Bath)	5.40 million	0.16 million	Total Benefit	1,400.10 million

[1] National Park, Wildlife and Plant Conservation Department "Tourist statistics 2007" online www.mol.go.th/Septemper 2007.
[2] The fee was fixed by National Park, Wildlife and Plant Conservation Department.
[3] Ministry of Labour .2007. "Labor statistics 2007" online www.mol.go.th/Septemper 2007. (see Seenprachawong, U. (2003) 'Economic valuation of coral reefs at Phi Phi Islands, Thailand', Int. J. Global Environmental Issues, Vol. 3, No. 1, pp.104-114).