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Use and Non-use Values of Wild Asian Elephants: A Total Economic Valuation Approach

Abstract

The contingent valuation method is often used for valuing environmental goods possessing use as well as non-use values. This paper investigates the relative importance of these values in relation to the existence of the wild Asian elephant. It does so by analysing results from a contingent valuation survey of a sample of urban residents living in three selected housing schemes in Colombo. We find that the major proportion of the respondents' willingness to pay (WTP) for conservation of wild elephants is attributable to the non-use values of the elephant. However, differences in the relative importance of these values exist between those who visit national parks and those who do not. Differences in respondents' WTP for conservation of elephants are found to be largely influenced by attitudinal and behavioural factors rather than socio-economic ones. We conclude that policymakers must recognise and take account of the importance of non-use values of the Asian elephant, if this endangered species is to survive in the long run. Nevertheless, the non-consumptive use value of elephants in Sri Lanka is also found to be substantial

Keywords: Asian elephant, endangered species, total economic value, non-consumptive use value, contingent valuation, Sri Lanka.

Use and Non-use Values of Wild Asian Elephants:
A Total Economic Valuation Approach

1. Introduction

The Asian elephant (*Elephas maximus*) is one of the world's seriously endangered species of large mammals (IUCN, 1996). However, the economic value of conserving it in the wild from a total economic valuation perspective has been little studied (Bandara and Tisdell, 2002a). Loomis and Larson (1994), Oglethorpe and Miliadou (2000) and Tisdell, (2002) stress the importance of taking into account total economic value (TEV) when determining whether a species should be conserved. Furthermore, a number of recent other research studies, for example, Langford *et al*. (2001), Jenkins-Smith *et al*. (2002) and Nielsen *et al.* (2003) have discussed the significance of observing both user and non-user perspectives in relation to environmental policy development. The estimation of TEV provides a framework for policymakers to assess the relative importance of both use and non-use values of any environmental amenity of importance to human (Albani and Romano, 1998; Loomis et al. 2000). This framework also enables the attitudes, motivations and perceptions of different stakeholder groups towards nature conservation to be easily evaluated (Kotchen and Reiling, 2000). Among others, the works by Fredman (1995) and Goodman, et al. (1998) provide a useful account of the application of the contingent valuation method (CVM) in estimating the TEV in relation to several non-marketable commodities.

Although several economic analyses have been completed on African elephant (*Loxodonta africana),* these mostly focus either on issues involving the international trade in ivory (see Khanna and Harford, 1996; Burton, 1999) or the impact of human-elephant conflict (see Abel and Blaikie, 1986; Hoare, 2000). Furthermore, the non-consumptive use values of elephants are rarely studied, and economic values associated with the pure existence of this species of wildlife have been almost completely ignored. However, these value components encompass a significant portion of the TEV of the Asian elephant (Santiapillai and Wijesundara 2002), perhaps because the elephant an integral part of many Asian cultures (De Silva, 1998). Additionally, as Rudd (2001) points out, a large body of literature in economics on non-market valuation widely acknowledges that the non-consumptive use value of scenic amenity, including wildlife, contributes to human wellbeing and hence provides economic benefit to the community at large.

The purpose of this study is to assess the relative importance of the use and non-use value of the wild Asian elephant from user and non-user perspectives by analysing results from a contingent valuation survey of a sample of urban residents in three selected housing schemes in Colombo. This survey was undertaken to elicit their WTP for a hypothetical scheme to conserve the elephant in the wild in Sri Lanka.

The paper first outlines and discuses the total economic valuation framework and relates this to the different value components of the Asian elephant. Next follows an empirical analysis of results from the contingent valuation survey. First the relative importance of the various value components of the TEV of elephant are assessed by analysing the individual WTP contributions; second, a binary probit analysis is undertaken to examine to what extent these value components influence the respondents' decision to say 'yes' for the WTP elicitation questions presented in the survey; finally, three separate probit models are specified to identify the factors that influence differences in respondents' appreciations of various TEV components of the elephant. The final section of the paper presents conclusions reached in these analyses.

2. The Concept of Total Economic Value: An Application to the Wild Asian Elephant

The total economic valuation paradigm emerged in the early 1980s (Albani and Romano, 1998). It appraises the TEV that a person, or a household, places upon non-marketable or only partially marketable commodities such as wildlife (Fredman, 1995). There have been a number of attempts to divide the TEV into several value components, consistent with welfare economic theory (see Randall and Stoll, 1983; Boyle and Bishop, 1987). Moreover, the application of the TEV framework has extended to several fields of environmental and natural resource management such as coastal and marine resources (Goodman, *et al.* 1998), wetlands (Oglethorpe and Miliadou, 2000), forests (Torras, 2000), agriculture and organic farming (Huang, 1996), river and water quality (Loomis *et al.* 2000), and threatened and endangered species (Kotchen and Reiling, 2000).

More recently, Bandara and Tisdell (2002b) conceptualised the positive attributes of the Asian elephant in Sri Lanka from a TEV perspective. In their analysis, the TEV of the Asian elephant is defined as the sum of use and non-use values. Boyle and Bishop (1987) suggest that the 'use value' of a wildlife species, such as the elephant can be divided into three

typologies of values: 1) the 'direct consumptive use values', arises from the consumptive use of elephants , for example, elephants are slaughtered for ivory and hides; 2) the ' direct non-consumptive use values' associated mainly with the conservation-friendly elephant-based recreation and eco-tourism in which the elephant is not taken away from its natural habitat but used for activities such as viewing and photographing. This could also indirectly include the use of domesticated elephants for religious and cultural pageantry. This is because the domestication of the elephant in Sri Lanka does not involve any regular forced removal of the animal from its natural habitat but today is purely based on the elephant calves who are orphaned from their family or herd[1]; and 3) the indirect use value. This is not associated with direct contact of elephants but occurs because people derive satisfaction from reading publications on elephants, viewing their pictures, watching television specials about elephants and so on. This latter category could also include the ecological role of elephants as a flagship species, and habitat impacts favourable to conservation of other wildlife (see Sukumar, 1989).

The 'non-use values' of elephant include non-marketable intangible benefits that people derive without any direct or indirect use. In the literature, this category of values has been variously defined and classified (see Boyle and Bishop, 1987; Fredman, 1995). Our classification of the non-use values of the wild elephant involves a variation on the work by Oglethorpe and Miliadou (2000)[2]. They identified six separate non-use value components. First is the 'existence value'; the economic value that people attach to the knowledge that the 'bequest value'; the value (satisfaction) that people derive from ensuring the continued existence of the elephant in the wild for future generations. Third is the 'option value'. This arises because individuals may be uncertain about their future demands for elephant products and services/or their availability in the future. Fourth is the quasi-option value. It is simply the expected value of the information as yet unknown or imperfectly known about the future

[1] On average around 30 elephants, mostly calves are separated from their herd and are reported to the wildlife authorities in Sri Lanka every year (The Department of Wildlife Conservation, 2003).These elephants are located in the Pinnawala Elephant Orphanage (PEO) and Udawalawe Elephant Transit Home (UETH). The elephant is kept in the UETH to be released back to their usual habitat. The PEO is now well established as a recreational center for the public as well as the center for releasing domesticated elephants. However, it seems that the number of elephants that are released by the PEO, and earlier by the Department of Wildlife, is far from adequate to meet the current demand for domesticated elephants in Sri Lanka. This situation was clearly demonstrated by a public protest which was held in Colombo early this year demanding that wildlife authorities in the country release more elephants for domestic use (see Wijewardana, 2003).

[2] Note that our decomposition, as reported later in Table 2, does not include all non-use values identified by Oglethorpe and Miliadou (2000). It does not, for example, include option values. These may however be small in the case of the elephant

worth of the elephants derived from delaying of extinction of the elephant today. Fifth is the 'intrinsic value'; the value that environmental resources (i.e. elephant) possess inherently. This is a form of non-use value that is extremely difficult to measure and may reflect the view that humankind has a stewardship role in relation to nature and it can also reflect 'deep ecology' concerns (O´Doherty, 1998). Finally is the altruistic value; the value that people place on ensuring that the environmental resource (i.e. the elephant) is available to others.

Although a theoretically disjoint classification of the different components in the TEV of the elephant may be possible, in practice many of these components are interconnected or overlapping. For example, the satisfaction that one obtains from the knowledge that the elephant exists in the wild may also be linked with its other perceived non-use values as well as its non-consumptive use value to a some extent. Loomis and Larson (1994) believe that this is because conservation of any wildlife species is a joint product. For an example, ensuring the existence of a species in its natural habitat would initially assure the continued existence of the species for future generations (bequest value) but would also leave open various other use and non-use valves. Here we try to decompose the TEV of wild Asian elephants into six components (see Table 2). These include two types of consumptive use values (direct and indirect non-consumptive use values, and indirect use value); three types of non-use values (existence and bequest and intrinsic values). However, in our decomposition of TEV of elephant, the direct consumptive use value is not included because such use of elephants is illegal in Sri Lanka and culturally not condoned. Moreover, game hunting of the Asian elephant is also forbidden in Sri Lanka. Whitehead (1993) provides a useful justification why it is not necessary to include the consumptive use value in estimating the TEV of nongame wildlife species such as the Asian elephant. According to his observation, the largest portion of the TEV of these species is contained non-use values, particularly the existence value.

3. Sample, survey instrument and data collection procedure

3.1. Sample

The data presented in this analysis were collected as part of a contingent valuation survey of a sample of 300 urban residents in three selected housing schemes, *Jayanthipur*a, *Jayawadanagam*, and *Anderson Flats* in Colombo. The Urban Development Authority of Sri Lanka (2001) classifies these schemes into three broader categories of income earners i.e. high, mid and low. A hundred residents were chosen from each of these housing schemes so

as to provide a stratified sample. Moreover, in relation to the respondents' interaction with the elephant based recreation and other facilities allow us to classify the survey respondents into two main groups, user and non-user. This was done based on the responses received for the following close-ended survey question: *Have you* ever visited *a national park or a protected area to see the elephant or wildlife in general?* Those who answered 'yes' to this question were regarded as users of these elephant based facilities (EFU) and the others in the sample as non-users of such facilities (EFNU). Bateman and Langford (1997) have used a similar classification in estimating the non-users' WTP for preserving Norfolk Broads wetland area in UK.

3.2. Survey instrument

An interview schedule (IS) in five separate sections was used as the main survey instrument. In section one, the respondents were presented a number of questions to gather the information about their social, economic and demographic characteristics and also to establish conversational rapport. In section two they were presented two questions: one was to assess their awareness about human-elephant conflict (HEC) related issues and the other was to evaluate the attitudes towards conserving elephants in their natural state. A hypothetical programme for conserving the elephant and mitigating HEC was presented in section three. Sections four and five presented contingent valuation questions.

3.3. Data collection procedure

In administrating the IS, face–to–face surveys were conducted in *Sinhala*, the major language in Sri Lanka. Nine graduate students from the Faculty of Graduate Studies of the University of Colombo acted as interviewers. Hadker (1997) describes the value of this method in the context of India and the situation in Sri Lanka is comparable: mail surveys have a low response rate and suffer from self-selection biases; and telephone surveys are ruled out because the facility is not available to every signal household chosen for the samples. Further, in face-to-face surveys trained interviewers interact with respondents, clarifying their doubts to minimise non-response rates, and judging their sincerity. Consequently, the quality of the data generated improves.

4. The WTP elicitation format and nature of the questions asked

Prior to the contingent valuation questions being presented, a hypothetical market to assess the respondents' WTP for conservation of wild elephants in Sri Lanka was established. White

et al. (2001) discuss the empirical procedure that needs to be adopted in establishing a contingent valuation market in the valuation of non-market commodities. FAO (2000) provides a useful guideline to establish such a market situation in the context of developing countries. In the present study, in establishing the contingent valuation market to assess the economic value of conserving the elephant, the respondents were presented with a hypothetical programme for conserving the elephant and mitigating HEC.

In this discussion, respondents were asked to assume that an autonomous body, reputed for its efficient and honest work, would introduce an appropriate programme so that the current downward trend in the elephant population could be halted while addressing other elephant related issues. Respondents were then briefed on the details of the policies and strategies that this organisation intended to implement to encourage farmers in the unprotected areas to tolerate the presence of elephants on their private land. An appropriate programme would be undertaken to compensate farmers for the damage caused by elephants in order to encourage them to allow elephants some access to their crops for food and reduce the likelihood of farmers' killing these animals. The respondents were also informed about the possible benefits that they would be able to obtain after the successful implementation of this programme. Then they were told that finance was required for the proposed programme and that the support of the general public would be needed to establish a 'trust fund' to undertake it. In this process, we adopted non-obligatory, specific voluntary contribution mechanisms (VCM) to determine the survey respondents' likely contributions to the proposed trust fund. A number of recent CV studies, for example, Champ *et al.* (1997), Chiton and Hutchinson (1999) have used this mechanism to motivate respondents to tell the truth.

After contingent valuation market was established, the survey respondents were asked: *For the next five years, would you be willing to pay Rs X from the monthly income of your household, that is Rs X per year, starting from January 1st 2002, towards the establishment of the proposed trust fund to implement the above mentioned programme to conserve the elephants in Sri Lanka".* The dichotomous choice format with a set of optional follow-up questions was used as a WTP elicitation technique. This format was initially proposed by Hanemann *et al.* (1991). FAO (2000) reports that, in the recent past, this method has become a widely used elicitation format, particularly in developing countries. In the present study, a bid vector with five different bid values (i.e. Rs. 500, 250, 100, 50, and 25) was offered to elicit the respondents' likely WTP contribution for the proposed scheme. The initial WTP

question was presented with the highest bid value in the bid vector. The follow-up question is conditional on the respondent's response to the bid value offered in the initial question: the amount offered is lower if the response is 'no'. This process is continued by reducing the bid value offered on each occasion, if the respondent's response is 'no', until the lowest bid value in the bid vector is reached.

The respondents who responded positively to contingent valuation questions were presented a follow-up question. This was designed to investigate the relative importance of use and non-use values of the elephant based on respondents' WTP contributions. They were asked: *Can you kindly allocate the amount that you agree to pay for the proposed scheme to conserve the elephant among the following value components of the elephant.* A set of six selected value components in the TEV of the Asian elephant was presented[3]. Illustrative examples were used to present these value components to avoid the difficulties that respondents could face due to unfamiliarity with the technical terms (Table 2 presents the TEV components offered in this study). Respondents' responses for this question were recorded as a percentage of their WTP contribution.

5. WTP for conserving the elephant: an analysis of user and non-user responses

Of the 300 respondents in the entire sample, 266 (88.7%) answered positively to the WTP elicitation questions and 34 (11%) protested all the bid values offered by these questions. Of the sub-sample of 92 respondents who were recognised as the EFUs, 5 (5.43%) protested all the bid values offered by the survey. On the other hand, of the sub-sample of 208 respondents who were categorised as the EFNUs, 29 (13.94%) were identified as protest bids. However, some of these respondents who protested the bid values indicated that they were WTP various insignificant amounts of less than Rs. 25, the lowest bid value offered by the survey. The others were unwilling to pay at all (gave zero bids) and gave a variety of reasons to justify their decisions. Hence, both these zero and insignificant bids were excluded from the calculation of WTP based estimates undertaken in this study. This approach is similar to that of Hanemann (1984). A summary of the descriptive statistics of the respondents' response for the WTP elicitation questions is presented in Table 1.

[3] See earlier comment that consumptive use values are not included and possibly some non-use values for the elephant are also omitted as mentioned in note 2.

Table 1

Descriptive statistics of the respondents' response for the contingent valuation questions

Variable description	Statistics		
	Users' sub-sample (n =92)	Non-users' sub-sample (n =208)	Aggregate sample (n = 300)
Protest and insignificant bids[a]	5 (5.43) [b]	29 (13.94)	34 (11.3)
Non-protest bids	87 (94.56)	179 (86.05)	266 (88.67)
Mean monthly WTP (in Rs)	137.38	82.96	110.17
Standard Deviation	49.72	34.83	41.91
Con.int. estimate for MWTP[c]	120.53:154.23	71.65:94.27	94.24:126.10

Note: a. Insignificant bids refer to the WTP amounts less than Rs. 25; **b.** Bracketed values refer to the percentage of total respondents in each sample; c. 95**%** level of confidence estimated for the mean monthly WTP.

Our estimates of mean WTP value reveal that a considerable difference exists between these two sub-groups, the EFUs and EFNUs. The EFUs were WTP Rs. 137.38 per month, amounting to an annual value of or Rs. 1648.56 for the conservation of elephant whereas the EFNUs were WTP Rs. 82.96 per month or Rs. 995.52 per annum. However, at the aggregate level, the survey respondents in general were WTP Rs. 110.17 per month, amounting to an annual value of Rs 1322.04. As the payment is to be made over a period of five years, the total present discounted value of these annual amounts at a 5% real rate of discount equals Rs. 6,009.75.

A number of recent contingent valuation studies have observed a similar pattern of results. For instance, Painter *et al.* (2002) discovered a significant difference exists between the user and the non-user valuation of a community service, rural transit systems in the Washington State, USA. These authors found that this difference is closely associated with the degree of awareness of these two groups about the benefits they could derive from the existing transit systems. Shrestha (2002) found a similar difference in the amount respondents were WTP for conserving recreation facilities. He suggests that this is linked with the respondents' degree of intersection with resource-base; if the respondent is a frequent visitor to such a facility,

she/he would WTP more for conserving it than the less-frequent or non-visitor. In addition, Fredman and Emmelin (2001) found that the tourist, users of Swedish mountains always placed a relatively higher value on the restoration of these nature-based outdoor recreation facilities than the non-users[4].

6. The Distribution of WTP Attributabted to the Specific TEV-Components of the Asian Elephant: Empirical Evidence

Most economists recognize that the existence of an endangered wildlife species, such as the Asian elephant, is to a larger extent a public good (Boyle and Bishop, 1986; Jakobsson and Dragun, 1996). The TEV of such wildlife species or any other environmental amenity could be measured by the amount of money that the individuals or the households in any given society would be WTP for conserving them. Albani and Romano (1998) show how such public contributions could be in principle split between the various value components of the TEV. Earlier, Fredman (1995) undertook an empirical analysis to rank different reasons for preserving the white-backed woodpecker in Sweden by segregating the WTP contribution attributable to different TEV components of this species. More recently, from a case study of Lake Kerkini, Oglethorpe and Miliadou (2000) found that 96% of the survey respondents' WTP contribution was attributable to the 'passive use value' or 'non-use value' of preservation of this lake and its environment in northern Greece.

In the present study, we assess the relative importance of the use and non-use value of the elephant based on the survey respondents' allocation of their WTP contributions among six selected value components of the TEV of the elephant. The distribution of the respondents' WTP contribution attributable to these specific TEV components of elephants both at sub-sample and aggregate levels is presented in Table 2.

[4] There could be several reasons why this is so. First of all those who value the resources most might be more likely to make use of it. Secondly experience with the natural resource may reinforce or develop a preference for it. Some circular causation may therefore, be present.

Table 2

The distribution of the individual WTP attributable to the specific TEV components of the Asian elephant in Sri Lanka .

The survey question; *What proportion of your WTP would be contribution attributable to the following benefits that could derive from conserving the elephant in Sri Lanka?*	Mean monthly WTP contribution (in Rupees) EFUs' sub-sample (n=87)	EFNUs' sub-sample (n=179)	Aggregate Sample (n=266)
1. The knowledge that the elephant exists in the wild (existence value)	29.57 (21. 25)[a]	45.88 (55.30) [a]	37.73 (34.24)[a]
2. Wild elephant based recreational and eco-tourism (direct non-consumptive use value)[b]	43.89 (31.95)	8.44 (10.17)	26.17 (23.75)
3. The continued existence for successive generations (bequest value)	24.58 (17.89)	10.67 (12.86)	17.63 (16.00)
4. The use of elephant in religious and cultural pageantry (indirect non-consumptive use value)[c]	17.86 (13.00)	5.17 (6.23)	11.52 (10.45)
5. Maintaining biodiversity and ecological balance in the natural areas (intrinsic value?)	18.87 (13.73)	8.87 (10.69)	13.86 (12.58)
6. Educational, scientific and journalistic value (indirect use value)	2.59 (1.88)	3.93 (4.74)	3.26 (2.99)
Total	**137.38 (100)**	**82.96 (100)**	**110.17 (100)**

Note: a. As % of the mean monthly WTP contribution in each sample, **b.** This includes the benefits that could derive conserving the elephant in it natural habitat, **c.** This includes benefits that could be obtained from the elephant in the outside of its natural habitat.

As shown in Table 2, the respondents in the sub-sample of EFUs have allocated the highest proportion of their WTP contribution to the non-consumptive use value of the elephant whereas the EFNUs allocated it to the existence value of the elephant. Thus, the EFUs give more weight to the economic use of elephant than do the EFNUs in the sample. However, the respondents in the EFU sub-sample do not neglect the existence value of the elephant either as they have allocated about 21% of their WTP contribution to it. Moreover, they also placed a relatively larger weight on the bequest value of the elephant. In the aggregate sample, about one third of the respondents' WTP contribution is attributable to the existence value of the elephant. The second and third largest portions are attributable to the non-consumptive use and bequest values, respectively. A further observation is also pertinent: the allocation of the third largest portion to the continued existence of the elephant for the benefit of future generations indicates that the majority of respondents at the aggregate sample level acknowledge the fact that it is their responsibility to conserve this species for future generations.

Several valuation studies of wildlife, in particular of endangered species, have found the existence values to be very important components of the TEV (see Whitehead, 1993; Fredman, 1995; Tisdell and Willson, 2003). Moreover, a number of researchers, for example, Goodman *et al.* (1998) and Jenkins-Smith *et al.* (2002) have used this value component as the main justification in appraising policy alternatives in relation to several important environmental amenities. Alexander (2000) point outs that unless the policy makers are recognised the role of non-consumptive use value of the endangered African elephant, its extinction is unavoidable. And he also highlights several key economic factors that are influential in determining the fate of endangered species in general. Unfortunately, no TEV

estimates of the elephant in Sri Lanka (or elsewhere in Asia) are available for comparison with our findings.

7. The influence of TEV components on the respondents' responses for the WTP elicitation questions: A probit analysis

Three separate binary probit models were specified in order to identify what specific TEV component(s) of elephants influenced the respondents' responses for WTP elicitation questions. One of these models was estimated for the aggregate sample and the others for the sub-samples where we adopted a similar procedure which was suggested by Huang (1996). The binary probit models are quite similar to the other log-linear models such as logit (Ronald, 2000) because they use a mixture of categorical and continuous independent variables with respect to a dichotomous and polytomous dependent variable (Zvi and Shelby, 1994). Thus these models can easily be confused with one another as both produce predicted probabilities that are very similar. However, the relative use of the logic model has increased more than the use of probit models. Aldrich and Nelson, (1984) believe that this may be because the exponentiated logit coefficients can be interpreted as odds ratios whereas probit uses the cumulative normal probability distribution, or because there are more diagnostic tools available for logit models. This last reason involve chicken and egg issue: that is, there might be more diagnostic tools for logit because it is being used more often. Moreover, in practical terms, probit models come to the same conclusions as logit models. Hence the relative rarity of the use of the probit model may be a consequence of the researchers' personal preferences (Even, 1998).

Equation 1 presents the conceptualised binary probit model that predicts the respondents' response for the WTP elicitation questions in relation to specific TEV components of the elephant:

$$P_1 = f\,(\beta_1 + \beta 2 X_{i2} + \ldots. + \beta_k X_{ik} + \varepsilon_i) \qquad (1)$$

where P_1 is the dependent variable which is formulated from the respondents' responses for the payment principle questions. β_i *is* a vector of unknown parameters and ε_i is an error term. X_i *is* a matrix of explanatory variables which were formulated based on distribution of the respondents' WTP contribution to specific TEV components of elephants offered by the survey (see Table 3).

In adjusting our data to make it suitable for probit analysis, we adopted the procedure proposed by Gillingham and Lee (1999): if less than 5% of an individual WTP contributions was allocated for a specific TEV component offered by the survey, it was categorised as 'not valued' and coded as 0; if the allocation ranged between 5 and 30%, it was categorised as 'some what valued' and coded as 1; between 30-55% it was categorised as 'moderately valued' and coded as 2; and it greater than 55% it was categorised as 'highly valued' and coded as 3[5].

Table 3
Statistics of important variables included in the preliminary probit
Analysis both at sub and aggregate sample levels

Variable[a]	Description	Mean and standard deviation		
		EFU	EFNU	Aggregate
EVOE	The existence value	1.97 (0.2 10)[b]	2.81(0.227)[b]	2.39 (0.385)[b]
BVOE	The bequest value	1.57 (0.261)	2.25 (0.204)	1.91 (0.135)
NCVE	Non-consumptive use values	2.37 (0.265)	1.62 (0.215)	2.16 (0.298)
IVOE	Intrinsic value	0.89 (0.201)	1.07 (0.160)	0.98 (0.171)
IUVE	Indirect use value	0.88 (0.214)	0.84 (0.210)	0.86 (0.121)

Note: a. These variables are based on the distribution of the respondents' WTP contribution attributable to specific TEV components of the elephant. **b.** Values in parentheses are standard deviations.

Once the probit equation is estimated, expected probabilities can be determined by the following distribution function:

$$P\,(P_j = 1) = \int_{-\infty}^{x'j\beta} 1/\sqrt{2\pi}\ \ exp - t\,2/2\ \partial t \qquad (2)$$

where P is the probability of a 'yes' response to the WTP questions. Here, the expected probabilities are constrained to zero and one, and t is distributed with mean zero and variance equal to one. The interpolation of estimated probit regression coefficients could be carried out on the basis of how much difference a unit in the independent variable in question makes in terms of the cumulative normal probability of the dependent variable (holding all other independent variables constant). Therefore to assess the effect of the probit coefficient it is

[5] Observe that these coding are to some extent arbitrary. This could influence the relative values of the coefficients shown in table 4.

necessary to choose some level of significance as a reference point. This gives the baseline statement that, when all independent variables are at their sample means, the probability that the dependent variable will have a value of 1 is that probability.

Table 4 presents parameter estimates for the probit dichotomous decision models which were estimated both at sub-sample and aggregate levels. In addition, several goodness-of-fit measures are reported. One measure is the log-likelihood ratio. A second measure used is the pseudo-R^2. A third measure examines how well the model classified the respondents correctly based on estimated probabilities. These measures indicate that the estimated models in general has satisfactory explanatory power and fits the data reasonably well. The results suggest that the overall ability of these models to yield the correct prediction about respondents' WTP for conserving elephant was 61.3% on average.

Table 4
Parameter estimates for the probit dichotomous decision models
Estimated both at sub and aggregate sample levels[a]

Variable	EFUs'sub-sample		EFNUs'sub-sample		Aggregate sample	
	Coefficient & Standard error	Asymptotic *t* statistic	Coefficient & Standard error	Asymptotic *t* statistic	Coefficient & Standard error	Asymptotic *t* statistic
Constant	-3.65 (0.32)[b]	-3.181*	-2.92 (0.29)[b]	-2.098*	-2.13 (0.26)	-2.091*
EVOE	1.81 (0.27)	2.401	2.90 (0.17)	3.394**	1.98 (0.27)	4.341***
BVOE	1.20 (0.32)	1.001	1.97 (0.21)	2.914*	1.10 (0.02)	2.671**
NCVE	2.21 (0.26)	3.519**	1.09 (0.35)	0.822	2.11 (0.06)	3.641*
IVOE	0.13 (0.32)	0.791	1.13 (0.32)	2.769***	0.10 (0.12)	0.671
IUVE	0.97 (0.42)	0.996	0.67 (0.33	0.963	0.05 (0.22)	0.106
Log-likelihood ratio		43.580[b]		44.219[b]		41.381[b]
Pseudo-R^2		0.63		0.59		0.62

Note: a. Dependent variable: the probability of saying 'yes' to the principle WTP questions; **b.** The likelihood ratio statistic distributes as Chi-square with 6 degrees of freedom and is significant at the 0.01 levels; *, **, *** significant at the 0.10, 0.05, and 0.01 levels, respectively.

The asymptotic *t*-statistics indicate whether a particular parameter estimate is statistically different from zero: that is, the variable has no impact on respondents motivation to say 'yes' to WTP elicitation questions. In the present study, except, for *EVOE,* the existence value, *BVOE,* bequest value, and *NCVE,* non-consumptive use values, the other explanatory variables were not statistically different from zero at the aggregate sample. Of these variables which were significant at the aggregate level, only the *EVOE* was significant for the models both for the EFU and EFNU sub-samples. The variable *BVOE* was significant at the aggregate and EFNU sub sample levels. Similarly, the variable *NCVE* was significant at the aggregate and the EFU sub-sample but not at the EFNU sub-sample. Variable *IVOE*, the intrinsic value of elephant was significant only at the EFNU sub-sample. Nevertheless, the estimated coefficients for all these variables which were significant either at aggregated or sub-sample levels had positive signs which support the hypothesis that the probability of respondents' willingness to pay for conserving the elephant in Sri Lanka increases as appreciations of these value components of this species of wildlife increase.

Fredman (1995) observes a more or less similar situation. He found in his study that 81% of the variation in the respondents' responses for the WTP elicitation questions was explained by the variables capturing the non-use and non-consumptive use value of species. Furthermore, Berrens *et al.* (1998) found that the existence value of grazing land to be the most important non-use value category that influenced the farmers' support for a specific policy reform which was designed to control over grazing on the federal lands in New Mexico. More recently, Oglethorpe and Miliadou (2000) identified the reasons why the existence value is so significant in determining the respondents' response for WTP elicitation questions. They found that more often people choose to pay for nature conservation to secure the existence of the environmental amenity (or amenities) that they are interested in. The chain of reasoning is: to retain the option for them to enjoy it in the future (option value); b. to ensure that future generations would be able to enjoy the same (bequest value); c. to ensure the use of the environmental amenity in question by themselves through non-destructive means (non-use value); d. to ensure that other people could use it (altruistic value). Therefore, similarly, in the present study it could be argued that the influence generated by the variables developed on non-use and non-consumptive use values of the elephant dominated the responses to the alternative WTP questions which were presented in the survey.

8. Attitudinal, socio-economic and other factors influencing respondents' appreciation of different TEV components

As observed in section 6, by allocating the largest proportion of their WTP contribution to existence value of the elephant, majority of the respondents in the aggregate sample indicated they ranked this is as the highest value. A similar situation was observed at the non-user sub-sample level. However, the majority of the respondents in the user sub-sample allocated the largest portion of their WTP contribution on the non-consumptive use value of the elephant. In this section, three separate binary probit models are specified to identify the factors that influenced the respondents to place the above value components higher than the other TEV components offered in the survey. One of these models was estimated for the aggregate sample and the others for the sub-samples.

These models were specified in relation to four sets of explanatory variables which included measures of respondents' conservation attitudes and behaviour, socio-economic status, use of the wildlife based recreation facility and their familiarity with the current elephant conservation issues in the country. Table 5 presents the description of these variables.

Table 5

Variables included in the estimated probit models both at sub and aggregate sample levels

Cluster	Variable description & hypothesized sign[a]
1. Attitudinal	
ATHEC	(+) Attitude towards alternative conservation approaches; 3 = Very concerned, 2 = Concerned, 1= Not concerned
FUPRE	(+) Concern about future generation needs; 3= Very concerned, 2 = Concerned 1=Not concerned.
GREEN	(+) Pro-conservation attitudes; 3 = Very supportive, 2 = Supportive, 1 = Not supportive.
2. Socio-economic	
AGERE	(-) Age of the respondent in years
PERIN	(+) Personal monthly income in Rupees
YRSCH	(+) Years of schooling
3. Elephant based facility use	
USRER	(+) 1 if the respondent had visited national park(s) to see the elephants or wildlife in general; 0 otherwise
4. Familiarity with the issues	
CONSE	(+) Awareness about the current elephant conservation issues; 3 = Very aware, 2 = Aware,1=Not aware.

Note: a. Hypothesized signs are in the brackets

The dependent variables used in these models were developed based on distribution of the respondents' WTP contribution attributable to specific TEV components of elephants offered by the survey (see Table 3 in section 6). In this process, the probability of allocating the largest portion of the WTP contribution on a specific TEV component by a given survey respondent was coded as 'one' and 'zero' otherwise. Thus the probability of allocating the largest portion of the WTP contribution on any of these specific value components by the

respondents in respective samples can be found: In (π_I / 1- π_I) where π_I = Probability of allocating the largest portion of the WTP contribution on the existence/non-consumptive use value of the elephant.

A summary of the final probit models developed both at aggregate and sub-sample levels is presented in Table 6. The common characteristic of these models is the high degree of dependence on the attitudinal factors such as *ATHEC***,** the attitude towards alternative conservation approaches, and *FUPRE***,** the concern about the needs of future generations in predicting respondents' appreciation of the specified TEV components (i.e. the existence and non-consumptive use values) presented in the survey. The goodness-of-fit measures which are used in evaluating the statistical significance of these models indicate that their overall ability to yield a correct prediction of the respondents appreciation of these value components was significant either at the 0.10 or 0.05 level and fitted the data reasonably well. Moreover, most of the explanatory variables used in each of these models were statistically significant in common with their hypothesized signs.

Table 6
Probit regression results: Factors influencing the respondents appreciation of a particular TEV component of the elephant[a]

Variable	**Users' sub-sample (n = 87)**			**Non-users' sub-sample (n =179)**			**Aggregate sample[b] (n =266)**		
	Coefficient	*t*-statistic	$\partial p/\partial x_i^b$	Coefficient	*t*-statistic	$\partial p/\partial x_i^b$	Coefficient	*t*-statistic	$\partial p/\partial x_i^b$
Constant	-2.831	-2.813	--	-2.714	-2.871	--	-2.051	-3.871	--
ATHEC	1.971	2.573**	**11.90**	1.137	2.981*	**10.65**	1.910	2.574*	**12.43**
FUPRE	0.416	0.941		2.104	3.941**		1.684	2.941**	
GREEN	0.761	0.984	--	1.672	0.573	**12.07**	0.652	0.984	**14.01**
AGERE	-0.982	0.182		-0.061	0.182		-0.591	0.182	
PERIN	2.974	4.193*	--	0.812	0.193	--	0.872	1.103	--
YRSCH	1.791	2.152**		1.421	**3.852****		2.175	**3.152***	
USRER	2.915	3.783*	--	**0.562**		--	**0.910**	**0.783**	--
CONSE	0.690	0.918	**13.91**		0.026				
				1.982	2.912*	--	1.053	2.941***	--
			--			**17.9**			**10.87**
			14.87			--			--
			--			7.18			16.32
Log-likelihood ratio		44.10			41.90			41.778	
Pseudo-R^2		0.67			0.61			0.64.	

Note: a. Dependent variables: the probability of allocating the largest portion of the WTP contribution on a specific TEV component (i.e. the existence value used for the aggregate and non-user sample, the non-consumptive use value used in for user sub-sample); **b.** This quasi-elasticity coefficient measures the percentage change in the probability of a positive response with respect to a one unit change in the explanatory variable; **c. *** significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level.

As indicated in Table 6, most of the estimated coefficients hypothesized did indeed influence the probability of allocating the largest proportion of the WTP contribution to the existence value of the elephant by the respondents both at the aggregate and EFNU sub-sample levels. Similarly, it was assumed that the respondents in the EFU sub-sample would allocate the largest proportion of their WTP contribution to the non-consumptive use value of the elephant. In the aggregate model, except for *GREEN, AGERE, PERIN, RAGE, USRER* the other explanatory variables used were significant either at the 0.01, 0.05 or 0.0 level of significance. However, while some of these variables were significant in the aggregate model, they were not significant for the models developed for the sub-samples.

Both at aggregate and sub-sample levels, the variable *ATAM* was significant with a positive sign. This supports the hypothesis that the probability of allocating the largest portion of the WTP contribution to the existence value of elephant by the respondents increases as their enthusiasm towards this alternative approach for conserving the elephant in the country increases. The variable *YRSCH* (years of schooling) was significant either at 0.1 or 0.05 levels of significance with positive coefficients both at aggregate and sub-sample levels. The positive sign of coefficients implies that the proportion of the WTP amount allocated to the existence value by the EFNUs and non-consumptive by the EFUs increases with the increase in the number of years of schooling. Thus respondents in the user sub-sample feel that the economic use of the elephant in recreation and wildlife based tourism should be a major reason for conserving it in the wild. In contrast, the respondents in the non-user sub-sample regard the existence of the elephant as much more important than any other use or other non-use values in justifying its conservation in the wild.

The variable *FUPRE* (the concern about future generation needs) was significant only in the models developed for non-user sub-sample and the aggregate sample. The positive sign for the *FUPRE* supports the hypothesis that the proportion of the WTP amount allocated to the existence value of the elephant increases with the respondents' concern about future generation needs. Loomis and Ekstrand (1998) observe a similar situation in relation to conservation of the Mexican spotted owl. So too, from an analysis of public attitudes to contingent valuation, Brouwer *et al.* (1999) found that respondents with stronger intergeneration concerns are more likely to place grater weight on the existence value (or right to exist) of the wildlife than those with weaker intergeneration concerns.

As expected, the variable *USRER* **(**the respondents who visit the national park(s) and other recreational facilities to see the wildlife in general or the elephant in particular) was significant only for the model developed for the EFU sub-sample. The positive sign of the coefficient *USRER* implies that the amount allocated to the non-consumptive use value of the elephant increases with the increase in either number of visits to a national park or level of satisfaction that the survey respondents obtained from such visits. Fredman and Emmelin (2001) observe a similar situation in a study of Swedish mountain tourists with an application of a wilderness purism index to outdoor recreation management. In their study, they found that the amount WTP for the proposed management change in the Swedish mountain region is significantly correlated with the absolute number of trips by the survey respondents to this region.

9. Concluding Remarks

This paper used part of the data gathered from a contingent valuation study of a sample of urban residents chosen form three housing schemes in Colombo in order to assess the relative importance of use and non-use values of the Asian elephant.

The analysis undertaken to investigate the distribution of individual WTP contribution among the various TEV components of the elephant revealed that about 62% of the individual WTP contributions is attributable to the non-use value of the elephant at the aggregate sample. Of this, the largest portion of WTP is for the existence value. The remaining portion of the WTP contribution is attributabuted to the non-consumptive use values of the elephant. The analysis undertaken at the sub-sample level reveals that the respondents in the EFU sub-sample allocated the highest proportion of their WTP contribution to the non-consumptive use value of the elephant whereas the EFNUs allocated it to the existence value of the elephant. Thus, it appears that the EFUs give much more weight for the economic use of the elephant on recreational and wildlife based tourism, whereas the EFNUs give more weight to the knowledge that the elephant exists in the wild and the assurance of its continued survival into the future.

This results of binary probit models (estimated to examine what specific TEV component of elephants influenced the respondents' responses for the WTP elicitation question) reveals that the survey respondents do not choose to pay for the conservation of the elephant only to

secure the existence or continued existence of this species in the wild; they are also want economic use of the elephant such as in recreation or wildlife based tourism.

The issue of why the survey respondents' valued the different TEV components of the elephant differently was analysed by specifying three separate binary probit models in relation to measures developed on respondents' conservation attitudes and behaviour, socio-economic status, use of the wildlife based recreation facility and their familiarity with the current elephant conservation issues in Sri Lanka. The finding of this analysis reveals that there is greater dependency on the attitudinal factors such as the attitude towards alternative conservation approaches, and the concern about future generation needs in predicting respondents' appreciation of the specified TEV components presented in the survey.

To conclude: The wild Asian elephant is highly valued in Sri Lanka. Our estimates of the TEV of the Asian elephants indicate that the major portion of their economic value in Sri Lanka arises from its non-use values such as, its existence, bequest and intrinsic values. While non-consumptive use values of the elephant are important in Sri Lanka, they tend to be substantially higher as a proportion of the TEV for the EFUs than for EFNUs. Overall, the EFUs in Sri Lanka placed higher TEV on the conservation of the elephant compared to the EFNUs. At least, this is so judging from our stratified sample taken in Colombo.

The paper demonstrates that even though Sri Lanka is not a high income country that non-use economic values are of importance to its people. They have strong values supportive of the existence of wildlife and feel a strong concern for conserving wildlife for future generations. These attitudes play a dominant role in economic valuation placed by Sri Lankans of the conservation of wild elephants. Thus non-use values are not only of important in higher income countries but also seem important in low income countries where they have the same type of cultural values as Sri Lanka[††].

[††] These could include India and Thailand for example.

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