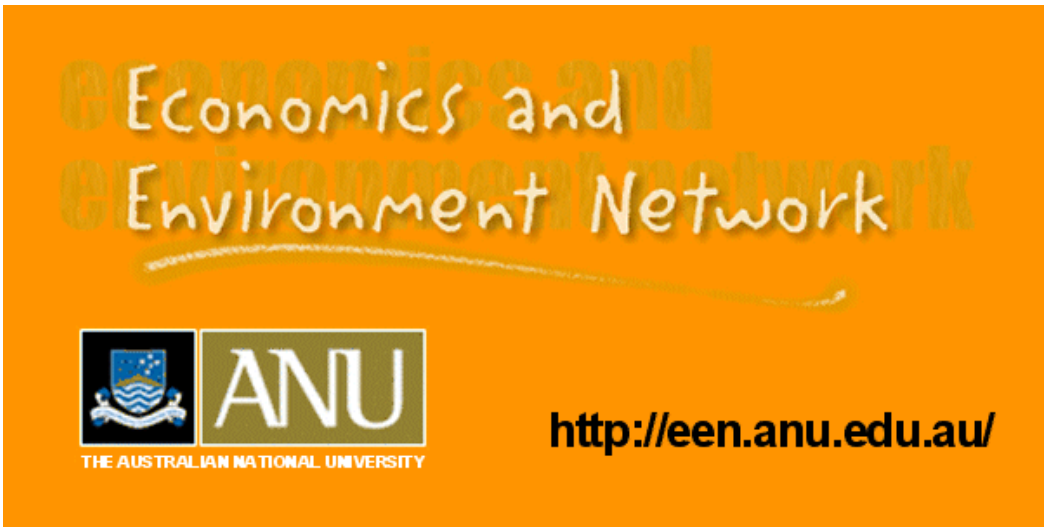

Estimating Wetland Biodiversity Values: A choice modelling application in Vietnam's Mekong River Delta

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‘Estimating Wetland Biodiversity Values: A choice modelling application in Vietnam's Mekong River Delta’

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Abstract

A lack of information on environmental protection values, especially non-market values, has contributed to wetland degradation in the Mekong River Delta. To fill this information gap, this study uses choice modelling to estimate biodiversity protection values of Tram Chim National Park, a typical wetland ecosystem of the Delta. The aggregated values for a wetland conservation program are about USD 3.9 million, justifying its implementation. Also, the use of a short, neutral cheap talk script was found to reduce the estimates of respondents’ willingness to pay in the sub-sample living far away from the Park. Some choice modelling issues, including questionnaire designs and survey methods are discussed in the context of a developing country application.

Key words: Cheap talk, choice modelling, Mekong River Delta, wetland values, willingness to pay.

1 Introduction

The largest area of wetlands in Vietnam is found in the Mekong River Delta (MRD) with an area of 4.9 million hectares (Vietnam Environmental Protection Agency, IUCN and MWBP, 2005). These wetlands can be broadly divided into two categories: inland and coastal wetlands. Inland wetlands are dominated by floodplain paddy fields, seasonally flooded grasses and *Melaleuca* forest, while coastal wetlands are generally dominated by mangrove forest (Torell and Salamanca, 2003).

The wetlands have experienced serious loss in scale and degradation. The area of mangrove forest has decreased about 80 per cent over the last six decades, from 408,500 hectares in 1943 to 110,700 hectares in 2000 (Vietnam Ministry of Natural Resources and Environment, 2002) (see Figure 1). Wetland biodiversity has also experienced losses. For example, in Tram Chim Wetland National Park, the numbers of the endangered species, the Sarus Crane, have reduced from 1057 in 1987 to 93 in 2005 (Vietnam Environmental Protection Agency, IUCN and MWBP, 2005).

<FIGURE 1 GOES HERE>

Information on wetland values is useful to wetland management. Effective wetland management requires data on the rate of harvest of the natural resources, the overall status of natural resources (Torell *el al*., 2001) and the marginal net benefits of alternative uses of the wetland resources (Whitten and Bennett 2005). This information helps inform the management of these resources for sustainable outcomes. Specifically, information on economic values of wetland goods and services is integral to estimating the costs and benefits of alternative management strategies (Barbier *et al.,* 1997; Turner *et al.,* 2000; de Groot *et al.,* 2006). The information on wetland values provides inputs for policymakers so that the policies they develop reflect the relative values of the resources in their alternative uses.

However, at present, there is a lack of information on the values of wetlands in the MRD. Only a few of the numerous wetland benefits in the MRD have been quantified in studies by Hang and An (1999), UNEP/GEF (2003), and Do and Bennett (2005). These studies focus only on market values of the wetlands. While wetland non-market valuation studies have been performed in other parts of the world (for example, Langford *et al.,* 1996; Whitten and Bennett, 2005; Birol *et al.,* 2006; Hein *et al.,* 2006), estimates of the non-market values of wetlands in the MRD remain limited (Do and Bennett 2005). Only one contingent valuation method (CVM) study by Hoang *et al.* (2005) estimating non-use values of coastal wetlands has been documented.

The research reported in this paper helps to fill this information gap by estimating non-market values of the wetlands in the Vietnam's MRD. Specifically, estimates of willingness to pay (WTP) for improvements in the wetland biodiversity of the Tram Chim National Park, a typical inland wetland in the MRD are reported. Environmental choice modelling (CM) was employed with personal interviews being conducted in three sub-samples of household residents in Cao Lanh, Ho Chi Minh City and Ha Noi. These locations represent three geographic areas: in the MRD, on the edge of the MRD and outside the MRD.

In addition, this research contributes to the stock of knowledge on the application of CM by addressing the question: does a short, neutral 'cheap talk'[1] script influence value estimates? This question is of interest for several reasons. First, while there have been some studies on the effect of cheap talk scripts in eliminating hypothetical bias in contingent valuation method (CVM), for example, Cummings and Taylor (1999) and List (2001), few research projects have investigated this issue in CM.

[1] 'Cheap talk' entails reading a script to stated preference technique respondents that explicitly highlights the hypothetical bias before they make any decisions (Murphy et al. 2005).

Second, findings on the effects of cheap talk are mixed in both CVM (Poe *et al.* 2002; Aadland and Caplan, 2003) and CM (Carlsson *et al.,* 2004; List *et al.,* 2006). While some studies conclude that using cheap talk can effectively eliminate hypothetical bias (for example, Cummings and Taylor, 1999; List, 2001), others point out that a cheap talk component might induce internal inconsistency in respondents' stated preferences (List *et al.,* 2006) and appears to exacerbate rather than mitigate the bias (Aadland and Caplan, 2006; Calrsson and Martisson, 2006). Third, to the authors' knowledge, most cheap talk studies have been done in developed countries with very different social contexts from developing countries. Therefore, a cheap talk test in a developing country like Vietnam provides some more insights into the context dependent aspects of cheap talk effectiveness.

This paper comprises five sections. Following this introduction, Section 2 summarises the methodology used, including a description of the studied site of Tram Chim and a brief review of CM. Section 3 details the research design, including the development of a questionnaire and survey implementation. Section 4 reports and discusses the results, including details of the socioeconomic characteristics of respondents, model selection, compensating surplus estimates and effects of cheap talk. The paper ends with discussions on policy implications and a conclusion that CM can be applied in estimating environmental values in Vietnam.

2 Methodology

2.1 Case study: Tram Chim Wetland National Park

The case study reported here involves Tram Chim National Park. Established as a National Park in 1998, Tram Chim is a 9,000 ha wetland located in Tam Nong District, Dong Thap Province (Figure 2). Tram Chim provides habitats for 127 plant species and supports a large number of

herons, egrets, storks and ibises and some rare species such as Black-necked Storks, Lesser Adjutants and Greater Adjutants. Most notably, Tram Chim provides habitat for Sarus Cranes, an endangered bird species listed in the IUCN red book (UNDP/IUCN/MRC/GEF, 2005). Due to its biodiversity values, Tram Chim was Vietnam's first wetland national park and has been nominated by Vietnam's Government to be a Ramsar wetland site (Buckton *et al.,* 1999).

<FIGURE 2 GOES HERE>

Tram Chim National Park is enclosed by 53 km of dykes and canals built in 1985 to retain water during the dry season. This helped restore the wetland ecological systems damaged during the Vietnam war (Pacovsky, 2005). Evidence of ecological restoration came with the return of Sarus Crane. However, since 1996, to prevent fire, the local management authority raised the height of the dyke so that the water level is now constantly higher than the ecological optimal level of 0.5m (UNDP/IUCN/MRC/GEF, 2005).

The current 'high dyke' system has affected Tram Chim's ecological systems (Hung, 2003; Thanh, 2003). While the long inundation supports some deepwater species, overall, it has negative impacts on the ecological system. Native plants have been replaced by invasive *mimosa pigra* (Triet *et al.,* 2004). Eleocharis or 'nang' grasses, the favourite food of the Sarus Crane, have been lost. That has led to reduced numbers of this endangered bird species visiting the Park (Vietnam Environmental Protection Agency, IUCN and MWBP, 2005). The high dyke system has also hindered fish migration and hence reduced the number of fish species living in the wetlands. To address this problem, the Park Management Board has proposed to change the current dyke system and wetland management practices (Tram Chim National Park Management Board, 2005).

2.2 Environmental Choice Modelling

CM involves asking survey respondents to choose their most preferred resource use option from a number of alternatives. While there are numerous stated preference techniques for non-market valuation, including the CVM, contingent rating, contingent ranking and paired comparison, CM has the advantages of providing a richer data set, strategic bias reduction, benefit transfer potential, framing effect control and context flexibility (Bennett and Adamowicz, 2001).

CM is consistent with random utility theory (RUT) (Adamowicz *et al.,* 1998; Louviere, 2001). In RUT, utility is a latent construct that exists in the mind of the consumer but cannot be observed directly. By using CM, some of this unobservable consumer utility can be explained, while some proportion remains unexplained:

$$U_{an} = V_{an} + \varepsilon_{an}$$

where U_{an} is the latent, unobserved utility for choice alternative, V_{an} is the systematic, observable component of the latent utility and ε_{an} is the random component of the latent utility associated with option *a* and consumer *n*. Because of the random component, it is impossible to understand and predict preferences perfectly. This leads to the expression of the probability of choice:

$$P(a/C_n) = P[(V_{an} + \varepsilon_{an)} > (V_{jn} + \varepsilon_{jn)}]$$

for all *j* options in choice set C_n

In words, the probability of consumer n selecting option *a* from choice C_n is equal to the probability that the systematic and random components of option *a* for consumer *n* are greater than the systematic and random components of option *j* for consumer *n* in choice C_n. To estimate

the choice probabilities using Multinomial Logit (MNL), it is assumed that the random components are independently and identically distributed (IID), with the implication that alternatives have independence from irrelevant attributes (IIA).

To introduce respondent heterogeneity, socioeconomic variables are used as independent variables in explaining the probability of choice. When the IID assumption is violated, MNL estimates might be bias. This triggers the use of nested logit, mixed logit or random parameter logit (RPL), and latent class models detailed in Louviere *et al.* 2000, Layton 2000 or Revelt and Train 1998, and Boxall and Adamowicz 2002, respectively. These models have been widely applied in estimating wetland values (Othman *et al.,* 2004; Whitten and Bennett, 2005; Birol *et al.,* 2006; Milon and Scrogin, 2006).

Implicit prices for the wetland attributes used to describe the choice alternatives are estimated on a ceteris paribus basis. That is, they are estimations of the WTP of respondents for an increase in the attribute of concern, given that everything else is held constant. Implicit prices are determined using the following formula:

Implicit price = $- (\beta_{\text{non-market attribute}}/\beta_{\text{monetary attribute}})$

where β are the coefficients estimated in the MNL

In addition to the estimation of values of individual attributes, the compensating surplus relating to a change in overall conditions can also estimated, using the following formula:

Compensating surplus $= -(1/\beta_{\text{monetary}}) (V_1-V_2)$

where V_1 is the value of the indirect utility associated with the status quo

V_2 is the indirect utility associated with the specific levels of the attributes describing the changed resource allocation

β is the coefficients estimated in the MNL

3 Research design

3.1 Questionnaire development

The development of the CM questionnaire was based on focus group studies. Five focus groups were conducted for both potential respondents (4) and wetland managers (1) to ensure that inputs from both demand and supply sides of the environmental goods were received. The purposes of the focus group studies were to determine attributes relevant to respondents and wetland managers, delineate appropriate cost levels and a payment vehicle, and test a draft questionnaire.

The following attributes were found to be of the most interest to both potential respondents and wetland managers:

- Area of healthy vegetation: This is the area having healthy *melaleuca* forest and grassland without any invasive *mimosa pigra*.
- Number of Sarus cranes
- Number of fish species
- The number of local households affected
- The cost options.

The levels of the attributes were determined in consultation with wetland experts. To select a payment vehicle, three criteria were used: a good coverage, acceptability and feasibility. A good coverage means that the payment vehicle should have applicability and relevance across the studied population. Acceptability means that the payment vehicle should be widely acceptable to the respondents. Feasibility means that it is not too costly and complicated to implement in reality. Each criterion was given a score scale of 1-10. Respondents were asked to score the proposed payment vehicles. Consensus was then reached that electricity bills would best suit

these criteria. Among other proposed payment vehicles of water bills, income taxes, solid waste collection fees and a newly set up fund for wetland protection, electricity bills were believed to be superior because of its broad coverage and high degree of compulsion. The focus group studies also showed that that the maximum WTP for the wetland improvement lay within the range of zero to VND 100,000 (USD 6.2). The percentage of focus group respondents agreed to pay for the proposed costs decreased as the cost levels increases (Figure 3), suggesting a suitable range of cost levels.

<FIGURE 3 GOES HERE>

An orthogonal, main effect experimental design involving five attributes each with four levels, including the status quo was constructed after the attributes and levels were determined (Table 1). Twenty-five choice sets were created with five questionnaire versions containing five choice sets.

<TABLE 1 GOES HERE>

The questionnaire briefed respondents about Tram Chim National Park and its biodiversity loss due to poor wetland management. It then described the proposed plan for wetland improvement and the outcomes of different management options. It continued by explaining that to implement the plan, governments would need to raise funds to cover the costs of dyke reconstruction, invasive species removal and control, hydrological and biological monitoring and to pay compensation to local farmers who would suffer from subsequent changes in flood levels. An example of a choice set that followed is provided in Table 2.

<TABLE 2 GOES HERE>

To test the effect of cheap talk, a version following that of Aadland and Caplan (2006) was added. The long version of cheap talk developed by Cummings and Taylor (1999) and List (2001)

was not used for two reasons. First, it is too long and too complex for Vietnamese respondents. Second, it is not easily generalised because it requires either baseline information of the degree of hypothetical bias or a presumption of the degree of hypothetical bias that exists in the population for calibrating the specific wording of a cheap talk script (Aadland and Caplan, 2006). The cheap talk used in this application translates as follows:

'As you prepare to answer the next few questions, please keep in mind the following three things. First, remember your household budget. How much would your household be able to afford a one-off increase in electricity bill? Second, recall that there are other wetland areas in the Mekong Delta such as U Minh Thuong and Lang Sen. And third, keep in mind that in previous surveys we have found that the wetland management options that people say they prefer are sometimes different from the options that they would actually select when the wetland program is implemented and requires a real payment. For this reason, when choosing options, please imagine your household is actually paying for the options you choose.'

3.2 Survey implementation

The study focused on three sub-samples of respondents. The first was drawn from the population of the MRD that is not directly affected by changes in the management of Tram Chim. This allows the estimation of environmental benefits enjoyed by local residents resulting from future management scenarios without the confounding effects of changes in farming income. Cao Lanh in Dong Thap Province was selected as this population. The target sample size was 300.

The second sub-sample was drawn from the population of urban residents in Ho Chi Minh City located adjacent to the MRD. The third sample involved those who live far from the MRD. In this case, Vietnam's capital, Ha Noi was selected. The sub-samples in Ha Noi and Ho Chi Minh City

were further split into two for testing two kinds of questionnaires. For the first sub-sample, questionnaires without cheap talk were used while in the second sub-sample, questionnaires embedded with a cheap talk script were used. The targeted sample size for each sub-sample was 150. The total expected sample size for the CM exercise was 900.

The sampling frames used were maps of Cao Lanh, Ho Chi Minh City and Ha Noi. Stratified sampling was used with communes as strata. In each commune, systematic sampling technique was used to select respondents. Households were the sample units with a member of the household who was over 18 yeas old being the unit of inquiry.

Regarding the method of conducting the survey, some authors suggest that by giving respondents more time to think about their choices, the 'drop off-pick up' method produces results with fewer violations of utility theory (Cook *et al.*, in press). However, it was not used here for several reasons. First, the focus group studies showed that asking respondents to read a complex questionnaire by themselves might be too demanding and hence respondents would be unlikely to answer the questionnaire properly, if at all. Second, provided that interview bias is avoided, personal interviews would enable respondents to have assistance from enumerators in understanding the issues and questions.

Third, the effect of the drop off-pick up method proposed by Cook *et al.* (in press) may not be realised in this study. Despite being conducted in the Vietnamese context, the hypothetical goods studied by Cook *et al.* (in press) were cholera and typhoid vaccines, which can be interpreted as quasi-private goods. Respondents might have different behaviours to those goods, as opposed to the public goods provided by wetlands. Taking into account the relative merits of drop off-pick up and personal interviews (Champ, 2003) in the context of a developing country where

respondents, especially those with less education, do not like reading questionnaires, personal interviews with adequate time for respondents to go over the choice sets were used.

4 Results and discussions

4.1 Respondents' socioeconomic characteristics

The numbers of useable questionnaires in the Ha Noi, Ho Chi Minh and Cao Lanh sub-samples were 370, 289 and 258 respectively. In Ha Noi, the sizes of the spilt samples for cheap talk and 'non-cheap talk' were 186 and 184 while those in Ho Chi Minh City were 145 and 144 respectively. Cao Lanh had the highest response rate (78.6%), followed by Ho Chi Minh City (59.4%) and Ha Noi (52.5%). This also represents the order of distance to Tram Chim National Park: Cao Lanh (40 km), Ho Chi Minh City (250 km) and Ha Noi (2000 km).

To examine the representativeness of the sub-samples, a comparison between the sociodemographic characteristics of the samples and the populations (Vietnam General Statistics Office, 2004) was conducted. It was found that the samples were biased toward younger, better educated males in all three locations (Table 3). This might be due to the fact that the surveys targeted urban residents that have younger and more educated populations. Also, it may be because people with higher educational status are more likely to be willing to participate in the interview, a prospect noted by the survey enumerators.

<TABLE 3 GOES HERE>

4.2 Model selection

4.2.1 Multinomial Logit

LIMDEP was used to run MNL models of the choice data. Two models were estimated for each location. The first model is a basic model showing the importance of the attributes in explaining respondents' choices across three different options in a choice set: a status quo (no change) and two alternatives of changes. This model involves the attributes and an alternative specific constant (ASC) only. The second model includes socioeconomic and attitudinal characteristics interacting with the ASC and selected attributes. In this case, the attribute 'cost' was interacted with 'age', 'gender', 'income' and 'education'. Definitions of the variables used in the models are presented in Table 4.

<TABLE 4 GOES HERE>

Models 1 and 2 were estimated twice: the first time including all respondents and the second time excluding those rejected the choice scenarios. Scenario rejecting or protest respondents are those who meet one of the following criteria:

- did not believe the feasibility of or support the once-off increase in electricity bills
- did not believe the scenarios presented
- did not believe that the funds raised would be used for environmental purposes
- believed that the government should pay for wetland improvement, not citizens
- selected the options randomly without considering the attributes and levels[2].

[2] This was detected by asking a follow up question 'how did you select the options presented'. About three per cent of respondents reported that they had selected the options randomly.

The protest respondents account for 32 per cent of the total respondents. The models without protest respondents were found to have higher Pseudo-R2 than the inclusive models, insignificant ASCs and *a priori* expected signs of the significant variables (Table 5). Therefore, the models excluding protest respondents were used for further analyses. Insignificant socioeconomic variables were not included in subsequent model estimation.

<TABLE 5 GOES HERE>

4.2.2 Random Parameter Logit

To relax the IID assumption and further investigate heterogeneity in respondents' preferences, RPL models were estimated[3]. In RPL models, taste parameters are assumed to have statistical distributions arising from potentially different parameters for each individual (Revelt and Train, 1998). Steps suggested by Hensher *et al.* (2003) were followed to estimate the RPL. First, all attributes except for the cost attribute were estimated as random parameters. Second, the random parameters having distributions with insignificant standard deviations were re-estimated as non-random parameters. The RPL model with 100 random draw and normal distribution for random parameters shows that respondents have heterogeneous preferences over vegetation and birds, significant at one per cent level (Table 6).

<TABLE 6 GOES HERE>

Both the MNL and RPL models show that respondents preferred more healthy vegetation, more birds, fewer farmers affected and less cost. The number of fish species is insignificant to respondents. Older respondents with higher incomes and more education chose wetland improvement options more frequently than young respondents with low income and less education. Respondents who have some knowledge about Tram Chim, and think that they may

[3] The Hausman test for violation of the IID assumption provided inconclusive results. However, the RPL models were still estimated as if the IID assumption had been violated.

visit Tram Chim in the future and that future generations will benefit from Tram Chim wetland improvement chose improvement options more frequently. On the other hand, respondents chose the status quo option more often if they had visited Tram Chim before. The MNL reveals that the respondents with better education are more concerned about the increase in the electricity bill. However, this was not observed in the RPL.

While the RPL is more complex, both models produce similar results in terms of coefficients' magnitudes, signs and significance levels, except for education interacting with the cost variable (Table 6). In addition, the Pseudo-R^2 of the RPL model is not much higher than that of the MNL model. Moreover, the Poe *et al.* (2005) test shows that there is an insignificant difference between implicit price estimates produced by the MNL and RPL models (Table 7). For simplicity, the MNL was used for further analysis.

<TABLE 7 GOES HERE>

The MNL model (Table 7) shows that across the whole sample, respondents were on average willing to pay 920 VND (0.06 USD) for a one per cent increase in healthy vegetation and 900 VND (0.06USD) for an additional ten Sarus cranes. However, they needed to be compensated 870 VND (0.06 USD) for every ten local households made worse-off.

4.3 Compensating surplus estimates

The compensating surplus for a specific management change scenario was calculated for each sub-sample. The status quo and the change scenarios in three years time are:

- Status quo scenario: 50% healthy vegetation, 150 Sarus cranes, 40 fish species, and no farmers affected.

- Change scenario: 70% healthy vegetation, 600 Sarus cranes, 40 fish species, and 300 households to be affected.

Indirect utilities of respondents were calculated using coefficients of significant variables and the sample means of socioeconomic variables. Table 8 reveals a reverse distance decay function. Only respondents in Ha Noi have a positive average WTP of VND 39,327 or USD 2.5. The average WTP of respondents in Ho Chi Minh City is not significantly different from zero, as indicated by zero lying within the range of the confidence intervals at 95%. Cao Lanh respondents have negative average WTP. These results suggest that people in Ho Chi Minh City and the Mekong River Delta are not willing to support the change in wetland management. This is because the marginal benefits for wetland attributes are not large enough to compensate for the marginal costs caused because local farmers are negatively affected.

<TABLE 8 GOES HERE>

4.4 Effects of cheap talk

A cheap talk test was conducted using a dummy variable cheaptalk for the Ha Noi and Ho Chi Minh City sub-samples. It was found that in Ha Noi, respondents answering questionnaires with the cheap talk script chose status quo options more frequently while in Ho Chi Minh City, this effect was not observed (Table 9). This suggests that cheap talk reduces the WTP of Ha Noi respondents who live far a way for the Tram Chim. List (2001) and Lusk (2003) found similar results in a market good: cheap talk ddid not have an effect on those who are more familiar with the good. Also, similar to the findings presented by Aaland and Capland (2003), the effect of cheap talk on respondents' choices increases when the cost levels rise. This is shown by the positive sign of the interaction between the cheap talk and cost variables, significant at five per cent level in the Ha Noi sub-sample model.

<TABLE 9 GOES HERE>

To investigate the effects of cheap talk in the Ha Noi sub-sample, the Swait and Louviere (1993) test was conducted for two sub-samples: cheap talk and non-cheap talk. This test has two stages. The first stage involves testing the null hypothesis that the parameters of the two sub-samples are equal while permitting the scale factors to vary, using a likelihood ratio (LR) test. The LR statistics for this hypothesis is calculated by $-2[L_{joint}-(L_{cheaptalk}+L_{no\text{-}cheaptalk})]$, where Ljoint is the log likelihood value corresponding to the estimation of the relative scale factor in the combined data set, $L_{cheaptalk}$ and $L_{no\text{-}cheaptalk}$ are the log likelihood values corresponding to the cheap talk and no-cheap talk models, respectively. The second stage involves testing the null hypothesis of equal scale parameters. The LR statistic for this hypothesis is $-2*(LL-L_{joint})$, where LL is the log likelihood value for the combined data set in which scale factors of the two samples are assumed to be equal, and L_{joint} is defined as above.

The LR test results in Table 10 show that the hypothesis of equal preference parameters is rejected at 1% level. The $\mu_{no\text{-}cheaptalk}$ was 1.27, implying that the no-cheaptalk model had a lower error variance than the cheap talk model. However, this relative scale factor was insignificantly different from unity at 5% (with the p-value of the LR test for equal scale factors to be 0.08). These results suggest that cheap talk has effects on preference parameters but does not have effects on scale parameters. Calrsson et al. (2004) found similar results when testing effects of cheap talk on Swedish respondents' WTP for food.

<TABLE 10 GOES HERE>

The Poe et al. (2005) test was conducted to test the difference between the implicit price estimates derived from models of choice made with and without cheap talk in the Hanoi sub-sample. It was found that there is no significant difference between the implicit prices for vegetation and birds between the two models while the implicit price for farmers in the cheap talk sub-sample is larger than the no cheap talk model (Table 11). This indicates that cheap talk made respondents more concerned about the impacts on local farmers. It also suggests that the effects of cheap talk on compensating surplus estimates will be more evident in change scenarios involving higher numbers of farmers affected.

<TABLE 11 GOES HERE>

5 Policy implications and concluding remarks

5.1 Policy implications

Two main types of policy implications have been identified. The first relates to wetland management and the second deals with the application of CM in the Vietnamese context.

5.1.1 Wetland management

Respondents living inside or outside the MRD are willing to pay for improved wetland biodiversity conservation resulting from changed dyke management in Tram Chim National Park. However, they are concerned about the impacts of dyke management on the local farmers. Their estimated values for wetland conservation initiatives, therefore, depend not only on wetland biodiversity improvement but also on the number of farmer households affected. This is consistent with the findings of Whitten and Bennett (2005) and van Bueren and Bennett (2004) in the Australian context. Other factors influencing WTP include age, income, education,

knowledge about Tram Chim and distance to the wetland. WTP increases when these factors increase.

For the proposed wetland management plan, the overall WTP differs across respondent locations. On average, respondents in Cao Lanh and Ho Chi Minh City are not willing to pay for the proposed change plan while respondents in Ha Noi are willing on average to pay 2.5 USD per household. Three assumptions are used to extrapolate survey values to overall WTP. First, the three sub-samples represent three zones (zone 1: inside the MRD, zone 2: on the edge of MRD, and zone 3: far from MRD). Second, seven million urban households live in these zones (one million in zone 1, three million in zone 2 and three million in zone 3). Third, respondents who refused to participate in the survey and protest respondents had zero WTP. The overall WTP for the proposed plan is calculated using the following equation:

WTP total = (WTP per house hold zone 1* number of household zone1* response rate zone 1) + (WTP per house hold zone 2* number of household zone 2* response rate zone 2) + (WTP per house hold zone 3* number of household zone 3* response rate zone 3)

The aggregated WTP for the three populations is in the order of about USD 3.9 million. This indicative benefit of the wetland improvement outweighs the cost of the proposed management plan of about USD 3.4 million (Tram Chim National Park Management Board, 2005). Therefore, the proposed project is justified.

5.1.2 Application of choice modelling in Vietnamese context

As environmental non-market valuation is relatively new in Vietnam, lessons from this study are helpful for future CM applications. Some points about the questionnaire design in the Vietnamese

context were observed. First, instead of using the term ‘referendum’, the questionnaire should explain how the voting scheme would work. This is because the term ‘referendum’ is not familiar to the respondents as Vietnam has not had a referendum in the past 60 years (Tuoi Tre, 2006). Second, an example of making choices when building a house was found to help respondents better comprehend the relevance of attributes in the choice tasks they faced.

Third, pictures were found to help explain the issues and choices much better than text. Fourth, the issue of whether an increase in the electricity bill is an appropriate payment vehicle remains unclear. Similar to Thuy (2006)’s findings, while focus groups concluded that the electricity bill could be used, about 15 per cent of respondents in the survey did not support this payment vehicle. Last, unlike Aadland and Caplan (2006)'s findings, the test of cheap talk shows that a short, neutral cheap talk can reduce respondents’ WTP. However, this effect was observed only for respondents who live far from the studied site. Therefore, caution needs to be taken when using cheap talk in different populations.

Another issue for this CM application was the mode of survey. As discussed in Section 3.2, personal interviews with adequate time for respondents to go over the choice sets were used. Following this method, when selecting options in each choice set, respondents were given some time to think while enumerators stayed away. This was designed to take advantage of both the personal interview and drop off-pick up methods. However, it is unclear whether this worked better than the drop off-pick up method. In the survey, some respondents asked for more time to think about the choice sets while others wanted to finish the questionnaire as quickly as possible. A study of the influence of drop off-pick up and personal interview techniques on respondents’ choices would provide more insights into this issue.

5.2 Concluding remarks

Wetlands in the MRD have not only use values but also non-use values. These non-use values are represented by the respondents' WTP for the wetland biodiversity protection. In this specific case of a proposed change in dyke and wetland management program of Tram Chim National Park, the benefits enjoyed by the respondents resulting from biodiversity improvements were estimated at 3.9 m USD. These benefits outweigh the costs of implementing the change. This suggests that if more resources were allocated to wetland conservation in Tram Chim, social welfare would improve. Using the benefit transfer method, similarly, improving the 95,238 ha of natural wetlands with high biodiversity in the MRD (Buckton et al. 1999) would generate benefits of 57 m USD. These indicative benefits from wetland conservation measures could be used to assist the policy making processes involving land management in the MRD.

The wetland biodiversity values estimated in this study can be expected to increase as development progresses. With development, people will have higher incomes and better education. Consequently, their WTP for wetland biodiversity will increase. Therefore, precautions are needed in the decision making processes involving the trade-off between wetland conservation and economic development. Irreversible impacts of the development on wetlands should be avoided. This would help achieve inter-generation equity.

Despite its complexity in design and data analysis, CM has demonstrated its advantage of providing rich data set in the Vietnamese context. By using CM, one can derive not only WTP for one overall change program but also WTP for each wetland attribute and multiple other overall change strategies. This helps wetland managers to priotise the use of available resources for wetland management. Also, CM enables the inclusion of not only wetland biophysical attributes but also conservation program's socioeconomic impacts on local households. Therefore, the value

estimates derived from CM are more helpful to decision makers because the values are derived in the context of the trade-off between environmental protection and development.

In conclusion, this study has shed light on biodiversity values of inland wetlands in the MRD. For the first time, these values have been quantified and used to justify wetland conservation in Vietnam. The study also provides some insights into the application of CM in a Vietnamese context. Although further research on issues such as questionnaire design and survey method is needed, it can be concluded that CM can be applied in a Vietnamese context to estimate non-market values of wetlands. This contributes not only to wetland management in Vietnam but also to other decision making processes involving sustainable development in the whole region.

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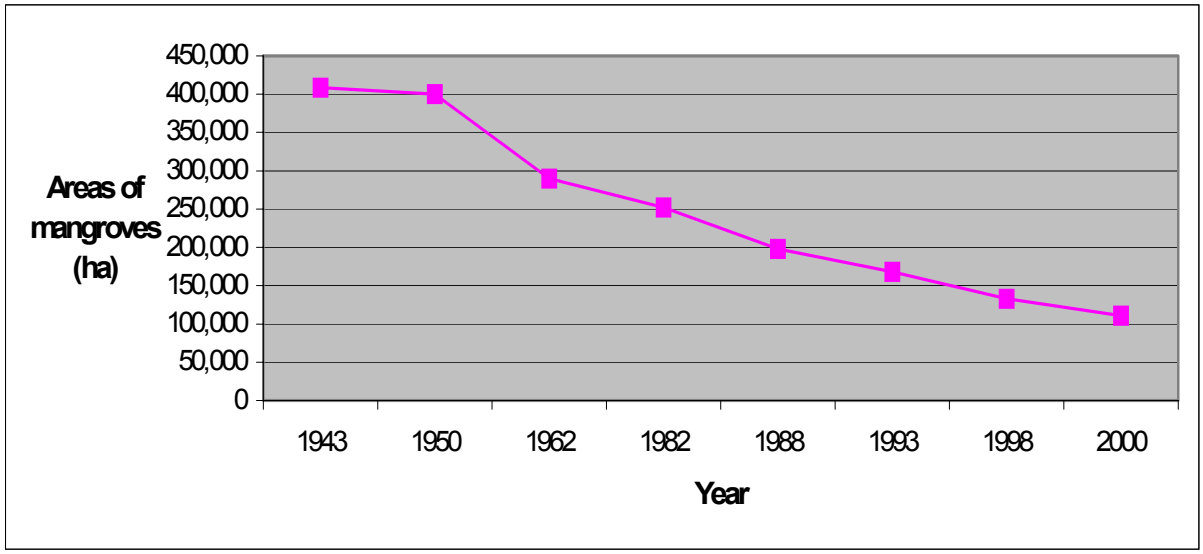
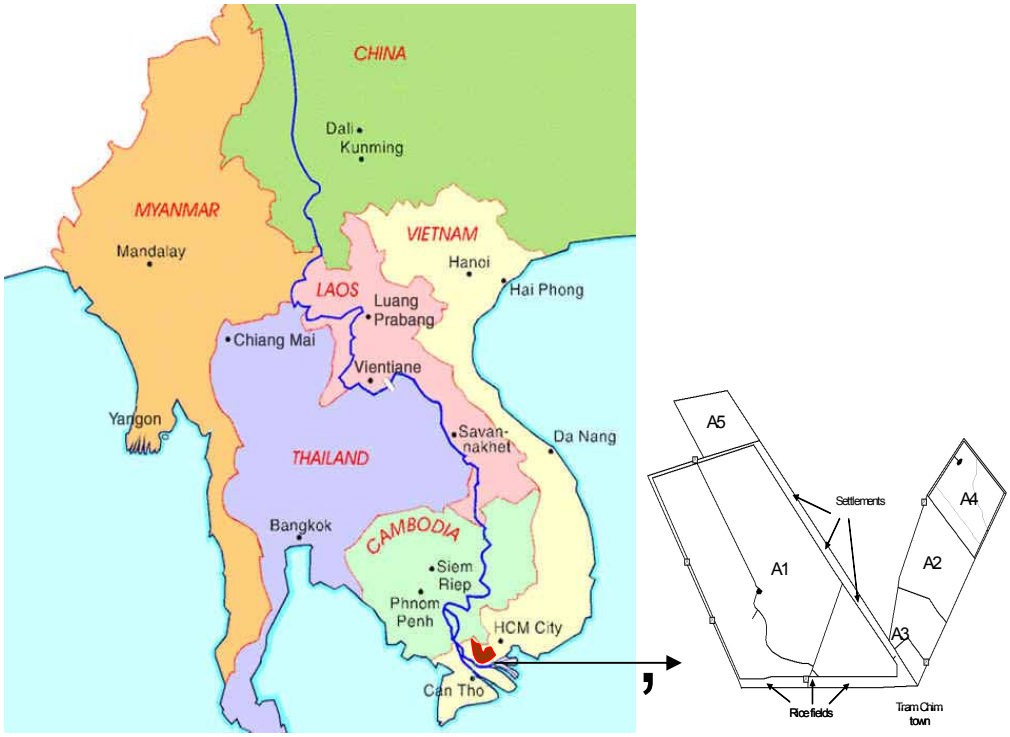
Figure 1 Decrease in mangrove areas in Vietnam 1943-2000



Source: Vietnam Ministry of Natural Resources and Environment, 2002. '*Cac khia canh ve dieu kien tu nhien dat ngap nuoc o Vietnam (in Vietnamese) (Issues of Natural Conditions of Wetlands in Vietnam'),* Vietnam Ministry of Natural Resources and Environment, Ha Noi, Vietnam.

Figure 2 Location and map of Tram Chim



Source: Adapted from Mekong Sources 2004. 'Map of Mekong', http://www.mekongsources.com/MkRegion.asp (15/9/04) and UNDP/IUCN/MRC/GEF 2005. *Integrated Water and Fire Management Strategy Tram Chim National Park*, Cao Lanh 2005.

Figure 3 Willingness to pay of focus group participants decreases as the cost levels increase

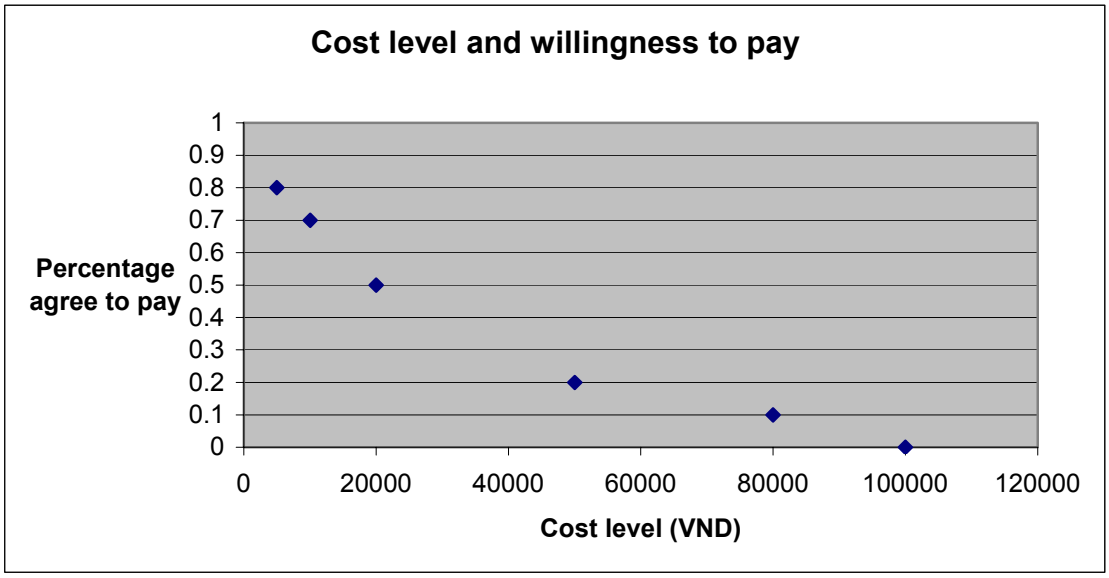


Table 1 Five attributes and four levels used in the experimental design

Levels / Attributes	Status quo	Level 1	Level 2	Level 3
Percentage of area having healthy vegetation	50	60	70	80
Number of globally threatened birds living in the wetlands	150	300	450	600
Number of fish species	40	50	60	70
Number of local households worse-off	0	600	900	1200
Once-off change in current monthly electricity bill (thousand VND)	0	10	50	100

Table 2 An example of a choice set

Scenario 1: Suppose options A, B and C are the ONLY ones available

Note: The first column describes different characteristics that will change under different wetland management options. The next columns describe different outcomes of the wetland management options.

The following factors will vary under different management options	OPTION A (status quo- no change)	OPTION B	OPTION C
Percentage of area having healthy vegetation 	50%	60%	80%
Number of Sarus cranes visiting the wetlands 	150 birds	300 birds	450 birds
Number of fish species 	40 species	50 species	70 species
Number of local households worse-off 	0	900	900
Once-off change in your current monthly electricity bill 	No change	Increase VND 10,000	Increase VND 50,000

If there were a vote (in which if the majority votes for the option you choose then the option will be selected), you would vote for:

TICK ONE BOX ONLY

Option A ☐
Option B ☐
Option C ☐

Table 3 Sociodemographics of the respondents

Socioeconomic characteristics	Ha Noi		Ho Chi Minh City		Cao Lanh	
	Sample mean	**Population mean**	**Sample mean**	**Population mean**	**Sample mean**	**Population mean**
Age (>=18 years)	32.7	42	37.1	40.4	35.9	40.1
Education (%>year 12)	55	21.3	43	11.5	16	4.3
Sex (% male)	51	50	56	53	54	48

Table 4 Definitions of variables

Variables	Description
Attribute variables	
ASC	Alternative specific constant, taking value of 0 for the status quo (no change) and 1 for the changed alternatives
Vegetation	% of Tram Chim National Park covered by healthy *melaleuca* and grass without invasive *mimosa pigra*
Birds	The number of Sarus cranes, an endangered bird species, visiting Tram Chim
Fish	The number of fish species in Tram Chim
Farmers	The number of households affected by the change in dyke and wetland management of Tram Chim
Cost	Cost to respondents in the form of a once-off increase in current electricity bill
Non-attribute variables	
Age	Age of respondents (in years)
Gender	Male: 1, Female: 0
Education	Education level of respondents, taking value of 1 for tertiary and above and 0 otherwise
Income	Income of the household (thousand VND) in discrete cardinal form: 500, 2000, 4000, 6000, 8000, 10000, 12000, 13000
Knowledge	Respondents have heard or read about Tram Chim, taking value of 1 for YES and 0 for NO
Visit	Previous visit to Tram Chim, taking value of 1 if there is and 0 otherwise
Option	The possible future visit to Tram Chim, taking value of 1 if there is and 0 otherwise
Bequest	The benefit from wetland improvement for future generation, taking value of 1 if there is and 0 otherwise
Prowetland	Support wetland conservation, taking value of 1 if YES and 0 otherwise
Concern	Concerned about wetland biodiversity degradation, taking value of 1 if YES and 0 otherwise
Cheap talk	Receiving cheap talk scrip in the questionnaire, taking value of 1 if YES and 0 otherwise

Table 5 Results of multinomial logit models for pooled data of three locations

Variables	All respondents included		Protest zero and scenario rejecting respondents excluded	
	Model 1	**Model 2**	**Model 1**	**Model 2**
ASC	0.925***	-0.446*	1.337***	0.182
	(0.148)	(0.248)	(0.177)	(0.347)
Vegetation	0.91E-02***	0.0112***	0.117E-01***	0.014***
	(0.9E-02)	(0.214E-02)	(0.023E-01)	(0.26E-02)
Birds	0.118E-02***	0.001***	0.014E-01***	0.14E-02***
	(0.19E-03)	(0.2E-04)	(0. 2E-03)	(0.2E-03)
Fish	0.35E-02	0.32E-02	0.42E-02	0.003
	(0.28E-02)	(0.31E-02)	(0.34E-02)	(0.004)
Farmers	-0.12E-02***	-0.124E-02***	-0.13***	-0.133E-02***
	(0.9E-04)	(0.1E-03)	(0.1E-03)	(0.12E-03)
Cost	-0.015***	-0.015E-03***	-0.0165***	-0.166E-04***
	(0.7E-03)	(0. 7E-06)	(0. 8E-03)	(0.9E-06)
ASC*age		0.0114***		0.019***
		(0.32E-02)		(0.004)
ASC*gender		0.025		0.024
		(0.077)		(0.103)
ASC*education		0.089***		1.226***
		(0.081)		(0.111)
ASC*income		0.54E-03***		0.05E-02***
		(0. 1E-04)		(0.02E-03)
ASC*knowledge		0.629***		0.44***
		(0.084)		(0.11)
ASC*visit		-0.478***		-0.63***
		(0.129)		(0.15)
ASC*option		0.455***		0.43***
		(0.087)		(0.11)
ASC*bequest		0.925***		0.533***
		(0.08)		(0.111)
ASC*prowetland		-0.369***		-0.0879
		(0.077)		(0.104)
ASC*concern		0.17		-0.061
		(0.13)		(0.209)
ASC*cheap talk		-0.4268***		-0.558***
		(0.817E-01)		(0.117)
Education*cost		-0.228E-02		0.373E-02**
		(0.15E-02)		(0.176E-02)
Income*cost		0.55E-07		0.15E-06
		(0.228E-06)		(0.27E-06)
Age*cost		0.138E-03**		0.447E-04
		(0.58E-04)		(0.714E-04)
Gender*cost		0.656E-03		0.108E-03
		(0.148E-02)		(0.178E-02)
Summary statistics				
Log-likelihood	-4818.714	-3712.726	-3191.307	-2449.007
Pseudo-R2	0.07	0.149	0.09	0.158
Observations	4755	4755	3225	3225

Note: Standard deviations are in parentheses. *** denotes statistical significance at 1% level, ** denotes statistical significance at 5% level and * denotes significance at 10% level.

Table 6 Results of MNL and RPL models from all sub-samples

Variables	MNL	RPL	
		Mean	**SD**
ASC	-0.323E-01	0.189	
	(0.289)	(0.346)	
Vegetation	0.139E-01***	0.149E-01***	0.358E-01***
	(0.257E-02)	(0.299E-02)	(0.719E-02)
Birds	0.137E-02***	0.149E-02***	0.201E-02**
	(0.242E-03)	(0.273E-03)	(0.976E-03)
Fish	0.305E-02	0.449E-02	
	(0.366E-02)	(0.409E-02)	
Farmers	-0.133E-02***	0.159E-02***	
	(0.124E-03)	(0.159E-03)	
Cost	-0.146E-04 ***	0.172E-04***	
	(0.126E-02)	(0.165E-05)	
ASC*age	0.187E-01***	0.218E-01***	
	(0.43E-02)	(0.541E-02)	
ASC*education	1.339***	1.532***	
	(0.138)	(0.172)	
ASC*income	0.544E-04***	0.699E-04***	
	(0.165E-04)	(0.208E-04)	
ASC*knowledge	0.446***	0.549***	
	(0.11)	(0.139)	
ASC*visit	-0.837***	-1.052***	
	(0.148)	(0.2)	
ASC*option	0.386***	0.467***	
	(0.111)	(0.138)	
ASC*bequest	0.491***	0.627***	
	(0.109)	(0.143)	
ASC*cheap talk	-0.605***	-0.747***	
	(0.115)	(0.148)	
Education*cost	0.373E-02**	-0.282E-02	
	(0.176E-02)	(-0.197E-02)	
Model statistics			
Log-likelihood	-2459.043	-2448.107	
Pseudo-R2	0.15	0.17	
Observations	3225	3225	

Note: Standard deviations are in parentheses. *** denotes statistical significance at 1% level, ** denotes statistical significance at 5% level and * denotes significance at 10% level.

Table 7 Testing for difference in implicit price in MNL and RPL

Implicit Price	Total MNL (VND)	Total RPL (VND)	Proportion of $IP_{MNL} - IP_{RPL} > 0$
Vegetation	920 (607~1239)	868 (550~1190)	0.4
Birds	90 (58~119)	84 (56~111)	0.39
Farmers	-87 (-102~ -73)	-83 (-98~ -68)	0.61

Note: Confidence intervals at 95%, calculated using Krinsky and Robb (1986) bootstrapping procedure, are given in brackets.

Table 8 Compensating surplus in three locations

	Ha Noi	Ho Chi Minh	Cao Lanh
Compensating surplus (VND)	39,327 (8,613~70,195)	14,498 (50,640~ -23,275)	-10,303 (- 21,635~ 2,336)
Distance from Tram Chim	40km	250km	2000km

Note: Confidence intervals at 95%, calculated using Krinsky and Robb (1986) bootstrapping procedure, are given in brankets.

Table 9 Cheap talk effect

	Ha Noi	Ho Chi Minh city
ASC	0.334E-01	0.501
	(0.426)	(0.537)
Vegetation	0.119E-01***	0.013E***
	(0.35E-02)	(0.485E-02)
Birds	0.173E-02***	0.11E-02**
	(0.329E-03)	(0.464E-03)
Fish	0.258E-02	0.151E-03
	(0.499)	(0.689E-02)
Farmers	-0.119E-02***	-0.103E-02***
	(0.166E-03)	(0.233E-03)
Cost	-0.152E-04***	-0.161E-04***
	(0.225E-05)	(0.286E-05)
Knowledge	0.6***	0.901***
	(0.16)	(0.198)
Age	0.269E-01***	0.186E-01**
	(0.677E-02)	(0.866E-02)
Gender	-0.372**	0.693***
	(0.161)	(0.197)
Income	0.557E-04**	-0.221E-04
	(0.276E-04)	(0.254)
Education	2.375***	0.123
	(0.223)	(0.259)
Education*cost	-0.406E-02*	-0.504E-02
	(0.241E-02)	(0.342E-02)
Cheaptalk	-0.977***	0.955E-01
	(0.2)	(0.259)
Cheaptalk*cost	0.617E-02**	-0.237E-02
	(0.24E-02)	(0.342E-02)
Model statistics		
Log likelihood	-1220.68	-674.412
Pseudo-R2	0.16	0.14
Observations	1430	765

Note: Standard deviations are in parentheses. *** denotes statistical significance at 1% level, ** denotes statistical significance at 5% level and * denotes significance at 10% level.

Table 10 Effects of cheap talk on preference and scale parameters in Ha Noi sub-sample.

Variable	No cheap talk	Cheap talk	Joint model
ASC	0.508	-1.09**	-0.291
	(0.682)	(0.535)	(0.393)
Vegetation	0.01***	0.143E-01***	0.841E-02***
	(0.5E-02)	(0.494E-02)	(0.282E-02)
Birds	0.16E-02***	0.189E-02***	0.126E-02***
	(0.474E-03)	(0.458E-03)	(0.263E-03)
Fish	-0.693E-03	0.004E-02	0.247E-02
	(0.714E-02)	(0.701E-02)	(0.406E-02)
Farmers	-0.101E-02***	-0.137***	-0.108E-02***
	(0.239E-03)	(0.234E-03)	(0.132E-03)
Cost	-0.162E-04***	-0.792E-04***	-0.902E-05***
	(0.274E-05)	(0.252E-02)	(0.145E-05)
ASC*Knowledge	0.611***	0.436**	0.51***
	(0.268)	(0.217)	(0.16)
ASC*Visit	28. 9	0.418	0.62
	(159E+4)	(0.685)	(0.646)
ASC*Age	0.24E-02**	0.266E-01***	0.27E-01***
	(0.12E-02)	(0.827E-02)	(0.681E-02)
ASC*Gender	-0.47*	-0.333E-01	-0.354E-01**
	(0.255)	(0.213)	(0.159)
ASC*Income	0.239E-04	-0.691E-04*	0.552E-04**
	(0.455E-04)	(0.365)	(0.278E-04)
ASC*Education	1.756***	2.883***	2.471***
	(0.238)	(0.309)	(0.22)
Education*cost	-0.204E-02	-0.613E-02*	-0.535E-02***
	(0.356E-02)	(0.332)	(0.232E-02)
Summary statistics			
Relative scale factor ($\mu_{no\text{-}cheaptalk}$)	-	-	1.27
Log likelihood	-568.863	-645.815	-1230.26
Pseudo R^2	0.14	0.17	0.16
Observations	685	745	1430

Note: The LR test statistic of equal preference parameters is 31.16; the respective critical value at 5% significant level and 14 df is 23.68. The LR test statistic of equal scale parameters is 3.02; the critical value at 5% significant level and 1 df is 3.84.

Standard deviations are in parentheses. *** denotes statistical significance at 1% level, ** denotes statistical significance at 5% level and * denotes significance at 10% level.

Table 11 Test for the difference of implicit prices between cheaptalk and no cheaptalk

Implicit prices (IP)	Cheap talk	No cheap talk	Proportion of $IP_{cheap\ talk} - IP_{no\ cheap\ talk} > 0$
Vegetation	930 (218 ~1646)	608 (65 ~ 1143)	0.23
Birds	121 (57 ~185)	99 (48 ~ 149)	0.29
Farmers	-114 (-146 ~ -81)	-51 (-75 ~ -27)	0.99*

Note: Confidence intervals at 95%, calculated using Krinsky and Robb (1986) bootstrapping procedure, are given in brackets.* denotes statistical significance at 5% level.