Fondazione Eni Enrico Mattei

Warm Glow and Embedding in Contingent Valuation

Paulo A.L.D. Nunes* and
Erik Schokkaert**
NOTA DI LAVORO 73.2001

SEPTEMBER 2001

SUST – Sustainability Indicators and Environmental
Evaluation

*Katholieke Universiteit Leuven,
Center for Economic Studies, Leuven, and
Vrije Universiteit,Department of Spatial Economics,Amsterdam
** Katholieke Universiteit Leuven,
Center for Economic Studies, Leuven

This paper can be downloaded without charge at:

The Fondazione Eni Enrico Mattei Note di Lavoro Series Index:
http://www.feem.it/web/activ/_activ.html

Social Science Research Network Electronic Paper Collection:
http://papers.ssrn.com/paper.taf?abstract_id

Warm glow and embedding in contingent valuation

Paulo A. L. D. Nunes [a,b,*]
Erik Schokkaert [a]

[a] Katholieke Universiteit Leuven, Center for Economic Studies
69 Naamsestraat, 3000 Leuven
Belgium

[b] Vrije Universiteit, Department of Spatial Economics
De Boelelaan 1105, 1081 HV Amsterdam
Netherlands

[*] Corresponding author. Tel.: +31-20-4446029; Fax.:+31-20-4446004;
E-mail address: pnunes@econ.vu.nl

Abstract

This paper reports the results from a contingent valuation study designed to investigate the influence of warm glow in willingness-to-pay responses. Interindividual differences in warm glow motivation are measured through a factor analysis, performed on a list of attitudinal items. The reported willingness to pay measures fail to pass the scope test. Both socioeconomic variables and motivational factor scores are significant in the explanation of the individual WTP measures. We compute *dry* WTP measures by taking out the effect of the warm glow motivation. These dry measures satisfy both the scope test and Hausman's adding-up property and could therefore be interpreted as reflecting true economic preferences.

JEL Codes

C12, C13, C14, Q26

Key words

Contingent valuation, recreation, wildlife, willingness to pay, warm glow.

1. Introduction

One of the main points in the ongoing debate about the use of contingent valuation (CV) studies is the so-called embedding phenomenon. The embedding problem is present whenever reported willingness to pay (WTP) responses fail to meet the scope test, i.e., when the WTP for two environmental goods taken together, is about the same as the WTP for one of the individual goods, considered separately. It has been suggested that this valuation pattern may result from a tendency for CV respondents to signal non-economic considerations and, in particular, as a signal indicating that respondents also bid because they derive moral satisfaction or a warm glow from the act of giving *per se* [11]. Prominent critics of CV [9] hold that the evidence on the embedding problem shows that CV answers do not reflect real economic preferences and should therefore not be used in cost benefit analysis.

In this paper we present some further empirical evidence on the significance of the warm glow effect. Our data refer to a CV survey designed to measure the economic benefits from preventing commercial tourism development in the Alentejo Natural Park in Portugal. The survey contained three protection programs: the Recreation Areas protection program (RA); the Wilderness Areas protection program (WA); and the joint Wilderness and Recreation Areas protection program (WA+RA). To investigate the warm glow effect we included in the questionnaire a list of attitudinal items. Factor analytic techniques are used to reduce these different individual items to three underlying factors that can be related to the use value, the existence value and the warm glow of giving. We then test whether interindividual variation in the factor scores for these different motivations can explain differences in the WTP answers. We also investigate the relationship between the warm glow and the embedding phenomenon.

In section 2 we present a simple testing strategy for the scope and the adding-up test. We also

1

propose a methodology to correct the WTP answers for the warm glow component, i.e. to compute what we call a "dry" WTP measure. Section 3 describes the survey and introduces the attitudinal items and the factor analysis. In section 4 we perform a traditional CV analysis. Given that our survey instrument implements a double bounded dichotomous choice elicitation format, we hypothesize that the CV answers follow a lognormal distribution to calculate mean and median WTP for the three protection scenarios. It turns out that these results are subject to the embedding problem and do not pass the scope test. In section 5 we refine the estimation procedure by specifying the sources of interindividual variation in the WTP answers. The psychological motivation factors are highly significant and this holds also for the warm glow effect. After taking out this warm glow effect, the resulting dry WTP measures are much lower and satisfy both the scope and the adding-up test. Section 6 concludes.

2. A simple strategy to operationalise the warm glow effect

In order to focus our discussion, we consider the case of a Natural Park, consisting of a wilderness area with restricted visitor's access and a recreation area where visitors may enjoy recreational activities in a natural environment. Three different protection programs are considered. In the first one, the wilderness area is protected while the recreation area is further developed for commercial tourism. In the second one, the wilderness area is given up but the recreation area is kept intact, i.e. remains reserved for activities that are unagressive for the natural environment. The last one protects both the wilderness area and the recreational area. Call these protection programs WA, RA and WA+RA respectively.

It is immediately obvious that the first two programs are embedded in the last one. It is therefore interesting to test whether the reported values of willingness-to-pay satisfy the scope test. This can be formalized with the following hypotheses:

Hypothesis 1: Scope effect for the reported willingness-to-pay

(H1a)   (H1b)

$$H_0: \quad E\left(WTP^r_{WA}\right) = E\left(WTP^r_{(WA+RA)}\right)$$
$$H_a: \quad E\left(WTP^r_{WA}\right) < E\left(WTP^r_{(WA+RA)}\right)$$

$$H_0: \quad E\left(WTP^r_{RA}\right) = E\left(WTP^r_{(WA+RA)}\right)$$
$$H_a: \quad E\left(WTP^r_{RA}\right) < E\left(WTP^r_{(WA+RA)}\right)$$

where the notation WTP^r_j refers to the *reported* willingness-to-pay for protection program j. The literature contains many examples of CV studies in which the hypotheses (H1) are not rejected.[1] Unless one accepts the (not very realistic assumption) that WA and RA are perfect substitutes, this suggests that there is a problem of incoherence of the reported willingness-to-pay values. As a matter of fact, Diamond et al. [6] go further and argue that "if the answers reflect economic preferences", they should satisfy an adding up-hypothesis:

Hypothesis 2: Adding-up hypothesis for the reported willingness to pay

(H2)

$$H_0: \quad E\left(WTP^r_{WA}\right) + E\left(WTP^r_{RA}\right) = E\left(WTP^r_{(WA+RA)}\right)$$
$$H_a: \quad E\left(WTP^r_{WA}\right) + E\left(WTP^r_{RA}\right) \neq E\left(WTP^r_{(WA+RA)}\right)$$

Critics have used the empirical findings (acceptance of H1 and rejection of H2) as one of the main arguments to claim that CV studies give an unreliable measure of non-use values [9]. In fact, at least since Kahneman and Knetsch [11], these findings have been related to the idea that respondents purchase moral satisfaction through their CV answers. This idea is inspired by the

work of Andreoni [1, 2] and others on impure altruism. In this approach the individual consumer contributes to the provision of a public good for two reasons. First, because she simply wants more of the public good and, secondly, because she derives some private benefit from contributing to its provision. The latter effect may be related to social pressure, to feelings of guilt and sympathy, to the quest for moral satisfaction or simply to the desire for a "warm glow". In any case, it implies that the individual's contribution to the public good enters into her utility function twice: firstly, as a contribution to public good provision; secondly, as a private good. By inference, it is plausible that the act of assisting in the supply of an environmental good through a CV question could also provide a private benefit, or warm glow, on top of the benefits derived from the increased supply of the public good.

Let us therefore write in general

$$WTP_{ij}^r = f(WTP_{ij}^{wg}, WTP_{ij}^{dry})$$ (1)

where the subscripts i and j refer to the respondent and the project respectively. The first component at the RHS refers to the warm glow, the second to the "dry" measure related to economic preferences. Equation (1) immediately shows that (H2) can be rejected even if the adding-up condition is satisfied at the level of the "dry" measure, i.e. at the level of the economic preferences. An easy example would be the case where *f(.)* takes a simple additive form and where the warm glow effect is subject to rapidly declining marginal utility so that it can be hypothesized that for each respondent

$$WTP_j^r = WTP_j^{dry} + WTP_j^{wg} \qquad j = WA, RA, (WA + RA)$$

$$WTP_{RA}^{wg} = WTP_{WA}^{wg} = WTP_{WA+RA}^{wg}$$

$$WTP_{WA}^{dry} + WTP_{RA}^{dry} = WTP_{WA+RA}^{dry}$$

Even if the adding-up condition holds for the dry measures, it will be rejected for the reported willingness-to-pay measures. If this description of reality makes sense, it is obvious that much progress could be made if we were able to distinguish empirically the different components in (1). One possible approach to this problem (already proposed in another context by Schokkaert and Van Ootegem [18]) is to exploit the interindividual variation in the willingness-to-pay and in the importance attached to the warm glow-effect.[2] This interindividual variation will be related to differences in socioeconomic characteristics such as income, education, gender, etc. Different individuals will also differ in their sensitivity to the warm glow effect and in the importance they attach to use and existence values. We can therefore write $WTP_{ij} = f_j(\mathbf{a_i}, \mathbf{m_i})$, where $\mathbf{a_i}$ refers to a vector of socioeconomic characteristics and $m_i = (m_{wg,i}, m_{u,i}, m_{ex,i})$ refers to the psychological characteristics of respondent i: the satisfaction generated by the act of giving (warm glow motivation), the importance attached to the use or recreational value (use motivation), the utility with respect to the protection of nature independently of recreational use (existence motivation) respectively.

In our empirical work we will work with the following semilogarithmic form:

$$\ln WTP_{ij}^r = \boldsymbol{b}_j + \sum_k \boldsymbol{d}_{kj} a_{ki}^r + \boldsymbol{d}_{wg,j} m_{wg,i}^r + \boldsymbol{d}_{u,j} m_{u,i}^r + \boldsymbol{d}_{ex,j} m_{ex,i}^r + e_{ij} \qquad (2)$$

where the superscript r indicates the values of the variables as reported by the respondents, e is the normally distributed error term and the $\boldsymbol{d}_j$'s are the coefficients to be estimated. Note that $(\boldsymbol{d}_{wg,j}, \boldsymbol{d}_{u,j}, \boldsymbol{d}_{ex,j})$ relate to the amount of warm glow obtained from contributions for project j

and to the use and existence value of that same project respectively.

We will return in the next section to the operationalisation of the vector of psychological characteristics m. Estimation of equation (2) will allow us to test directly whether the warm glow effect plays a role in the reported willingness-to-pay measures and, more specifically, whether individual respondents with different values for the warm glow component indeed report different values for their WTP:

Hypothesis 3. Significance of the warm-glow effect

$$(H3)$$

$$H_o : \quad \boldsymbol{d}_{wg} = 0$$
$$H_a : \quad \boldsymbol{d}_{wg} \neq 0$$

We can even go further and simulate what would be the WTP of the respondents if they were immune for the warm glow effect. Define by m_{wg}^{dry} the minimal value of m_{wg}, i.e. the value of the warm glow motivation for a *Mr. Scrooge* who does not get any warm feeling from giving and can resist social pressure without problem. We can then simulate for each respondent a "dry" WTP, i.e. the value of her willingness-to-pay if she had the same (minimal) warm glow motivation as *Mr. Scrooge*:

$$\ln WTP_{ij}^{dry} = \boldsymbol{b}_j + \sum_k \boldsymbol{d}_{kj} a_{ki}^r + \boldsymbol{d}_{wg,j} m_{wg,i}^{dry} + \boldsymbol{d}_{u,j} m_{u,i}^r + \boldsymbol{d}_{ex,j} m_{ex,i}^r + e_{ij} \qquad (3)$$

If rejection of the scope test and the adding up test for the reported values of willingness-to-pay can be fully explained by the presence of the warm glow effect, there should be no problem with the dry measures. This can be tested as

Hypothesis 4. Scope effect for the dry willingness to pay

(H4a)   (H4b)

$$H_0 : \ E\left(WTP_{WA}^{dry}\right) = E\left(WTP_{(WA+RA)}^{dry}\right)$$
$$H_a : \ E\left(WTP_{WA}^{dry}\right) < E\left(WTP_{(WA+RA)}^{dry}\right)$$

$$H_0 : \ E\left(WTP_{RA}^{dry}\right) = E\left(WTP_{(WA+RA)}^{dry}\right)$$
$$H_a : \ E\left(WTP_{RA}^{dry}\right) < E\left(WTP_{(WA+RA)}^{dry}\right)$$

and

Hypothesis 5. Adding-up hypothesis for the dry willingness to pay

(H5)

$$H_0 : \ E\left(WTP_{WA}^{dry}\right) + E\left(WTP_{RA}^{dry}\right) = E\left(WTP_{(WA+RA)}^{dry}\right)$$
$$H_a : \ E\left(WTP_{WA}^{dry}\right) + E\left(WTP_{RA}^{dry}\right) \neq E\left(WTP_{(WA+RA)}^{dry}\right)$$

In our empirical work we will formally test the five hypotheses introduced in this section. Before we turn to the hypothesis testing, however, we first have to construct a measure of the vector of psychological characteristics $m_i = (m_{wg,i}, m_{u,i}, m_{ex,i})$.

3. The data: willingness to pay and consumer motivations

In section 3.1 we will first describe the general features of the survey design. In section 3.2 we go deeper into the calculation of the psychological functionings.

3.1. Survey design and data collection

Our empirical data are taken from a large-scale contingent valuation study with a representative sample of the Portuguese population. The good being valued is the protection from commercial tourism development of the Recreation Areas and Wilderness Areas in the Alentejo Natural Park,

situated along the southwest coastline of Portugal and covering about 180 miles of coastline. As described in the previous section, there were three versions of the questionnaire, focusing on the Recreation Areas protection program (RA); the Wilderness Areas protection program (WA); and the joint Wilderness and Recreation Areas protection program (WA+RA) respectively. Since non-use values play a crucial role in the evaluation of the various scenarios, the CV method suggested itself.

Table I. Survey descriptive statistics

The results were obtained by a nationwide survey conducted in mid September 1997 by the Survey Department of the Portuguese Catholic University. Use was made of oral interviews with trained interviewers. A two-stage area probability sample was set up - see Thompson [19]. In the first stage, 37 parishes across Portugal were selected. In the second stage, a set of housing units was drawn.[3] The interviewer teams paid visits to 3597 households but 21% of them could not be reached because the residents were not at home. From the households that were successfully contacted, we received a total of 1678 completed interviews, corresponding to a participation response of approximately 60%. Table I provides descriptive statistics for a selected set of variables. A comparison of the data of our survey with demographic statistics available from the last Census data for Portugal (1991) indicates that the different demographic clusters of the Portuguese population are well covered in our sample.

The payment vehicle as described in the questionnaire was either a voluntary contribution in the form of a one-time lump-sum payment to a trust fund, or a tax. It was explained that the money collected in the trust fund or by the tax would only be used to finance the efforts of the Natural Park's management agency to protect the coastline. Inspection reveals that there were only minor

differences between the two versions - see Nunes [15]. To structure the willingness-to-pay question we used the double bounded dichotomous choice elicitation question format described by Hanemann et al. [7]. Pictures of animals and landscapes (before and after tourist development) were used as visual aids.

3.2. Consumer motivations

While the collection of the willingness-to-pay data through contingent valuation has become quite standard - and we followed the current best practice in the field - a more innovative aspect of our survey is the attempt to measure consumer motivations towards the protection of nature in general, and towards the act of giving in particular. Therefore, we introduced into the questionnaire a list of 26 attitudinal questions[4] to be answered by the respondents on a five point Likert-scale [13], with values ranging from 1 (for "I disagree completely") to 5 (for "I agree completely"). These items were formulated so as to capture the warm glow, use and existence motivations.

In order to get internally coherent measures of these motivations we used factor analysis as a variable reduction method - see Harman [8]. This technique enables us to identify and measure the underlying *latent* motivation structure on the basis of the correlations between the responses on the specific individual items. The underlying hypothetical variables or factors are constructed in such a way that the observed responses are linear combinations of the underlying factors. The so-called *factor loadings* then give the product-moment correlation between the individual responses and these underlying latent factors. The latter are scaled to have mean zero and variance equal to 1. To get a clear picture we choose an orthogonal factor representation, implying that the factors are uncorrelated and hence that the basic consumer motivations do not overlap[5], and we opted for the varimax rotation procedure, which maximizes the variance of the squared loadings of the different items on the factors. The factor loadings after varimax rotation are shown in Table II.

9

Printed results are multiplied by 100 and rounded to the nearest integer. The asterisks denote values above 0.45.[6]

Table II. Factor loadings after varimax rotation

Although the interpretation of the factors remains somewhat subjective the overall pattern seems clear. The main items loading on a given factor share the same conceptual meaning and items that load on different factors are associated with different conceptual meanings. The items loading on *factor 1* relate to the direct consumption of the natural park for recreational use.[7] Therefore, this latent variable is interpreted as the consumer 'use/recreation' motivation. *Factor 2* is associated with items that underpin a respondent's feeling of well being or satisfaction generated by the act of giving. We interpret it as the consumer 'warm glow' motivation.[8] *Factor 3* is associated with items indicating the respondent's ethical and moral considerations with respect to the conservation of nature, independent of its human use and we interpret it as the consumer 'non-

[9]

After having defined the content of the factors, the next step is to determine the position of the individuals on these factors, i.e. the vectors $m_i = (m_{wg,i}, m_{u,i}, m_{ex,i})$. These are given by the standardized *factor scores* (again with mean zero and variance equal to 1 - see Harman, 1976). A higher value for $m_{u,i}$ (i.e. a larger factor score for Factor 1) indicates that the respondent has a stronger propensity for recreation and other use values. Higher values for $m_{wg,i}$ (Factor 2) and $m_{ex,i}$ (Factor 3) reveal that the respondent is more sensitive to a warm glow of giving and is more concerned with the protection of nature and no-extinction of wildlife respectively. These factor scores will play a crucial role in the testing for the warm glow effect and the computation of dry

measures in section 5.

4. Testing for the scope effect in a univariate setting

As a first approach we will calculate the mean WTP for the different protection scenarios in a simple univariate setting, i.e. neglecting the information on demographic, socioeconomic and psychological characteristics of our respondents. We introduce the statistical model in section 4.1 and the results in section 4.2.

4.1. The econometric model

With our double bounded dichotomous choice elicitation question format the individual consumer WTP responses are not given directly, i.e. WTP_i^r is not observed. To estimate the mean willingness-to-pay we assume that WTP_i^r follows a particular statistical distribution function $F(.)$, characterized by a location parameter b_0 and a variance parameter s. In the present analysis we only report the results for the case in which $F(.)$ is a lognormal distribution.[10] We denote the initial, lower and higher bids used in the survey by b_i, b_h and b_l respectively. Following the censored threshold approach as proposed by Cameron and Quiggin [4], an individual respondent is considered to answer "yes" ("no") on the willingness-to-pay question if her true, and unobserved, WTP is greater (less) than the randomly assigned bid amount. Therefore, in the double bounded case we face for each respondent four possible response outcomes: "yes/yes", "no/no", "yes/no" and "no/yes". Define the binary indicators $r_{nn}{}^i$, $r_{ny}{}^i$, $r_{yn}{}^i$ and $r_{yy}{}^i$ to indicate this response pattern: as an example, a "no-no" response corresponds to $r_{nn}{}^i = 1$ and $r_{ny}{}^i = r_{yn}{}^i = r_{yy}{}^i = 0$. The contribution to the log likelihood function from observation i is then

$$r_{nn}{}^i \ln F(b_l) + r_{ny}{}^i \ln\left[F(b_i) - F(b_l)\right] + r_{yn}{}^i \ln\left[F(b_h) - F(b_i)\right] + r_{yy}{}^i \ln\left[1 - F(b_h)\right] \qquad (4)$$

To estimate b_0 and s we maximize the global log likelihood function, i.e. the sum of the expressions (4) for all individuals over the sample, subject to the constraint that F is a lognormal distribution.

4.2. Empirical results

The estimates of the location and scale parameters $\hat{b}_0$ and $\hat{s}$ of the lognormal distribution for the WTP of the WA, RA and (WA+RA) protection programs are given in table III. The standard errors indicate that these estimates are rather precise. On the basis of these results we computed the mean and median WTP for the different programs and the corresponding 90 percent confidence intervals.[11] They are also shown in table 3 and represented in Figure 1. The means for the WA, RA and (WA+RA) protection programs are 9800, 7600 and 9300 escudos respectively.[12] The estimated medians are significantly smaller. This reflects the asymmetric shape of the lognormal probability distribution. The mean estimates are particularly sensitive to the right-hand-side of the distribution, and thus to the respondents who say "yes/yes" to the higher stated bid amounts. The median estimates are particularly sensitive to the left-hand-side of the distribution, and thus to the respondents who say "no/no" to the stated bids. Since a great deal of respondents say "no" to both WTP questions, this drags down substantially the median estimates (when compared to the mean values) and we get median estimates that vary from 2200 escudos for the RA protection program to 2700 escudos for the WA protection program.

Table III. Estimation results for the univariate case

Figure 1. Mean and median WTP estimates

These results are in line with those found in other studies. The mean WTP for the protection of the Wilderness Area is similar to the results obtained by Diamond et al. [6] in their empirical study on embedding. We follow their procedure for testing hypotheses (H1a) and (H1b). Estimation of a pooled model for WA and (WA+RA) and computing the likelihood ratio test for the restriction of identical location and variance parameters yields a value for the test statistic of 2.66. The same exercise for RA and (WA+RA) gives a value of 2.92. Both values are well below the critical value of 5.02 (Chi-square distribution with two degrees of freedom). We can therefore conclude that the empirical evidence does not reject hypothesis (H1a) and (H1b): the WTP for WA is approximately the same as the WTP for (WA+RA), and the WTP for RA is approximately the same as the WTP for (WA+RA). In other words, the test results suggest

Finding 1. There is an embedding problem. The *reported* WTP-measures fail the scope test (H1 is not rejected).

As said before, this result can be interpreted in two possible ways. A first possibility is to see the recreational use and the nonuse characteristics as pure substitutes. This does not seem to be a very realistic hypothesis in our context, where the wilderness areas and the recreational areas provide clearly different benefits to the survey respondents. A second possible interpretation introduces the idea of the warm glow effect of giving. We can directly test the relevancy of this second hypothesis by exploiting our information on the motivational structure of the respondents.

5. Computing the dry willingness in a multivariate setting

We will first introduce some interindividual variation in the estimation of the reported willingness-to-pay measures. In a second step we compute the "dry" WTP (by cooling-off the warm glow) and repeat the scope test for these corrected measures.

5.1. Explaining the interindividual variation in the WTP

To estimate the full model with all explanatory variables included, we maximize the likelihood function derived from (4), but now with a complete multivariate specification as described in (2). A large number of possible predictors are available to be integrated in the valuation function. In table IV we show the results for a specification in which the explanatory variables are the individual motivational factor scores, as computed in section 3 and various series of dummy variables to represent the age of the respondent, his/her occupation/job, his/her educational level. The reference individual is between 60 and 70 years old, has completed a medium level of secondary studies and is now retired. We also include the number of individuals living in the household and net household income. Finally we include indicators for the payment vehicle as described in the survey instrument (taking the value 1 for a voluntary contribution) and for the protest bidders.[13]

Table IV. Explaining interindividual variation in the WTP

Depending on the respondent's characteristics, the mean WTP for the protection programs varies widely. Let us illustrate this by the results for the wilderness area where WTP estimates in our sample range from about 200 escudos (for a low income worker of more than 50 years old without university degree and with a low value for the existence motivation) to about 31,000 escudos (for a young high income respondent with a university degree and with a large value for the existence motivation). While most of the results reported in table 4 speak for themselves, we focus particular attention on the effects of the motivational factor scores.

The overall pattern is remarkably sensible. Respondents with a higher value on the "use" motivation reveal a higher willingness-to-pay for the RA program. Differences in the existence value motivation have a significant effect in all three programs, but most strongly in the WA

scenario. Most remarkably, the estimated coefficients regarding the 'warm glow' motivational factor are statistically significant (p-value lower than .05) in all protection programs. Therefore, we are able to reject Hypothesis (H3):

Finding 2. Our empirical evidence confirms the presence of a significant warm glow effect in the WTP responses. Respondents who are more sensitive to warm glow (or less resistant towards social pressure) *ceteris paribus* **reveal a higher willingness to pay.**

At first sight the estimates in table IV suggest that the warm glow effect is different for the different protection programs, i.e. for different valuation objects. Indeed, the warm glow marginal effect seems to be somewhat weaker in the (WA+RA) scenario. However, formal testing does not corroborate that impression. The likelihood ratio test statistic for the restriction of equal warm glow effects in the three equations is 0.048, well below the 5% critical level of the chi-square distribution with 2 degrees of freedom. This result suggests that the individual respondents get, at the margin, the same moral satisfaction from each escudo contributed, independently of the public good they are evaluating.

5.2. Computing the dry willingness to pay

The results in the previous subsection pave the way for the final step in our exercise: the calculation of the "dry" measures. As we have seen the respondent's motivational factor scores are computed on the basis of her answers upon the motivational questions using a five point semantic differential scale "I completely agree ", "I agree", "Sometimes I agree, sometimes I disagree", "I disagree" and "I completely disagree". For the warm glow the main motivational items are M8, M12, M15, M20 and M23 (see appendix and table 2). Let us now take the position of a Mr. Scrooge, who is completely insensitive to the warm glow effect: he will answer "I completely disagree" on all these five motivational items. We define the resulting factor score for the warm glow effect as m_{wg}^{dry}, the

score that would characterize a respondent whose motivation profile is free from any feeling of well being or satisfaction generated by the act of giving. Assuming that all the respondents share Mr. Scrooge's warm glow motivation, we can use equation (3) to predict a mean WTP measure free from any embedding due to warm glow feelings, i.e. a *dry* WTP value.

Figure 2. Mean WTP versus mean *dry* WTP estimates

The *dry* WTP estimation results are plotted against the original reported estimates in Figure 2. It is immediately obvious from these results that drying the stated WTP responses from warm glow does induce a significant reduction of the final mean estimates. Our procedure also leads to better results concerning the scope test (H4a) and (H4b). We use the Wilcoxon-Mann-Whitney test assuming that the two distributions, the sum of the individual WTP measures and the joint WTP measure, have the same general shape, but that one of them is shifted relative to the other by a constant amount under the alternative hypothesis[14]. Both hypotheses (H4a) and (H4b) are significantly rejected (*P*-values smaller than .01). We can therefore now go further and also test the (stronger) adding-up hypothesis (H5). According to the same Wilcoxon-Mann-Whitney test the *P*-value is 0.72, well above the 5% cutoff. We cannot reject the hypothesis that the mean dry WTP value attached to preserving the WA and RA jointly is equal to the sum of the mean dry WTP values attached to preserving the two areas individually. Therefore we can summarize our results as

Finding 3. The dry WTP-measures, i.e. after correcting for the warm glow-effect, satisfy both the scope test and the adding-up test.

6. Conclusion

Let us first take an ambitious position with respect to our results. In an optimistic mood, we could

claim that the use of motivational information has enabled us to show that the embedding problem in CV applications is linked to the warm glow effect. Moreover, our procedure to operationalize and estimate a *dry* WTP, i.e. a WTP measure for the case in which all respondents would be free from a general feeling of well-being or satisfaction generated by the act of giving, has worked reasonably well. The *dry* WTP estimates are lower than the original estimates and formal testing has shown that they do not violate the adding-up property.

If one accepts the view that the original WTP estimates do not reflect "economic preferences" because they contain an altruistic motive and should therefore not be used for cost-benefit exercises [14], this procedure of "drying" out the altruistic motive might offer a way-out. Further refinement of our method could even lead to a better distinction between the different components of "altruism". On the other hand, it seems also possible to take the position that our results indicate the existence of a stable and measurable warm glow component in individual preferences and that this evidence offers a satisfactory explanation for the problems with the embedding effect. In a certain sense this explanation paves the way for the direct use of the uncorrected original WTP measures. After all, at least since Arrow [3] the modern theory of social choice has emphasized that it was immaterial whether individual's preferences reflected selfish interest or moral judgement: *"The individual may order all social states by whatever standards he deems relevant"*.

Caution is needed, however, and we would argue in favor of a less ambitious interpretation of our results. Since this paper is one of the first attempts to introduce attitudinal information into the analysis of CV answers, our results for the scope and the adding-up effect with the dry measures must rather be seen as provisional. Conclusions on the usefulness of CV methods and on the so-called "economic" nature of the resulting preferences must therefore be drawn cautiously. It is not obvious that similar results would be found with other samples, other questionnaires and for other

environmental commodities. However, even in this more cautious interpretation, it still seems fair to claim that the methodology we propose to measure and incorporate motivational information has worked reasonably well and is promising. Moreover, the evidence that the warm glow effect has an important influence on the WTP answers seems to be rather robust. The use of direct attitudinal information may play a crucial role to get a better understanding of the real content of CV answers.

Acknowledgments

References

1. Andreoni, J., Giving with impure altruism: applications to charity and Ricardian equivalence, *Journal of Political Economy 97*(6), 1447-1458 (1989).

2. Andreoni, J., Impure altruism and donations to public goods: a theory of warm-glow giving, *Economic Journal* 100, 464-477 (1990).

3. Arrow, K., "Social choice and individual values", New York: Wiley (1951)

4. Cameron, T., Quiggin, J. Estimation using contingent valuation data from a dichotomous choice with follow-up questionnaire, *Journal of Environmental Economics and Management* 27, 218-234 (1994)

5. Carson, R., Contingent valuation surveys and tests of insensitivity to scope, in Kopp, R. et al. (eds.), "Determining the value of non-marketed goods", The Netherlands: Kluwer Academic Publishers, chapter 6 (1997)

6. Diamond, P., Hausman, J., Leonard, G., Denning, M., Does contingent valuation measure preferences? Experimental evidence, in Hausman, J. (ed.), "Contingent valuation: a critical assessment", New York: North-Holland, 41-85 (1993)

7. Hanemann, W., Loomis, J., Kanninen, B., Statistical efficiency of double-bounded dichotomous choice contingent valuation, *American Journal of Agricultural Economics* 73(4), 1255-1263 (1991)

8. Harman, H., "Modern factor analysis", Chicago: Chicago University Press (1976).

9. Hausman, J. (ed.), "Contingent valuation: a critical assessment", New York: North-Holland (1993).

10. Johnson, N., Kotz, S. "Continuous univariate distributions", New York: Wiley (1970).

11. Kahneman, D., Knetsch, J., Valuing public goods: the purchase of moral satisfaction, *Journal of Environmental Economics and Management* 22, 57-70 (1992).

12. Lehmann, E., "Nonparametrics: statistical methods based on ranks", San Francisco: Holden-Day (1975).

13. Likert, R. The Method of Constructing an Attitude Scale, in Fishhbein (ed.), "Readings in , 90-95. Originally in Archives of Psychology,140, 44-53, Columbia University Press (1967).

14. Milgrom, P., Is sympathy an economic value? Philosophy, economics and the contingent valuation method, in Hausman, J. (ed.), "Contingent valuation: a critical assessment", New York: North-Holland, 417-435 (1993).

15. Nunes, P., "Contingent valuation of the benefits of natural areas and its warmglow component", Katholieke Universiteit Leuven: Ph.D. thesis (2000).

16. Schkade, D., Payne, J., Where do the numbers come from? How people respond to contingent valuation questions, in Hausman, J. (ed.), "Contingent valuation: a critical assessment", New York: North-Holland, 271-293 (1993).

17. Schkade, D., Payne, J., How people respond to contingent valuation questions: a verbal protocol analysis of willingness to pay for an environmental regulation, *Journal of Environmental Economics and Management* 26, 88-109 (1994).

18. Schokkaert, E., Van Ootegem, L., Preference variation and private donations, in Gérard-Varet, L.-A., Kolm, S.-C., Mercier-Ythier, J. (eds.), "The economics of reciprocity, giving and altruism", London: Macmillan, 78-95 (2000).

19. Thompson, S., "Sampling", New York: John Wiley (1992).

APPENDIX

1. *My family and I would have great pleasure in knowing that the SIC, RTP and TVI together have agreed in introducing in their TV schedule more documentary films about wildlife and its natural habitats.*
2. *My family and I think that the preservation of the Alentejo coast line is important because this is a place which all of us can visit and where we can see very beautiful natural landscapes. ('use')*
3. *My family and I like to see the Portuguese government giving more support to the national organizations that are promoting work in the field of environment conservation. ('warmglow')*
4. *My family and I think that the preservation of the Parks is important because these are privileged places where everybody may enjoy a walk or a picnic in a relaxed environment. ('use')*
5. *My family and I take great satisfaction in knowing that it is today guaranteed that our children, and future generations, will continue to have the possibility of observing wildlife in its natural habitat. ('use')*
6. *Despite the fact that my family and I may never see an otter in its natural habitat, we would be very worried if the total population of otters in Portugal became extinct. ('existence')*
7. *My family and I like to spend the weekends at home or going to the movies rather than going out for a walk in the countryside or by the beach. ('use')*
8. *Our family admires the individuals who, on voluntary basis, participate in collecting donations for national programs for social aid and solidarity. ('warmglow')*
9. *My family and I take great pleasure in knowing that we are still able to visit villages in Alentejo which keep their true identity and their typical houses, facades and streets. ('use')*
10. *Despite the fact that my family and I may never see an Iberian lynx in its natural habitat, we are very happy to know that we have the guarantee that the lynx is kept safe from extinction in Portugal. ('existence')*
11. *My family and I think that the preservation of the natural areas is important since they are privileged sites for recreational activities like sightseeing or biking in a natural environment. ('use')*
12. *There are some funding campaigns to which my family and I feel very close and therefore we do not hesitate to contribute a donation. ('warmglow')*
13. *Despite the fact that my family and I may never visit a Natural Park, we are very happy to see these natural areas protected so that other Portuguese citizens may also have the possibility to observe wildlife in its natural habitat.('use')*
14. *My family and I think that the preservation of the Alentejo coast line is important because this is a privileged place where all of us may enjoy going to the beach in a relaxed environment and being in contact with nature. ('use')*
15. *It is difficult for me to decline my help to other individuals who, either in the streets or at my door, beg for charity. ('warmglow')*
16. *Whenever I am approached by identified personnel, it is not difficult for me to refuse to make a financial contribution to a national fund raising campaign. ('warmglow')*
17. *The protection of the forests is very important because for Portugal they are a very important source of wealth. ('use')*
18. *With the increasing use of the media in our elementary schools as well as an increasing number of school visits to the Zoo, it will no longer be important to take the children on educational trips to the Natural Areas. ('use')*
19. *Sometimes our help in national fund raising campaigns is explained because we come under observation and feel "socially-pressed" to contribute, and therefore we do not decline to make a contribution. ('warmglow')*
20. *I am happy with myself whenever I give a financial contribution to national fund raising campaigns. ('warmglow')*
21. *With the Portuguese participation in the EU, the preservation of our national diversity is no longer so important since we are constructing a common and shared European culture.('existence')*

22. *Despite the fact that my family and I may never observe an eagle in nature, we take great pleasure in knowing that the eagles are kept safe from extinction. ('existence')*
23. *My family and I like to contribute to good causes such as the protection of the environment, and whenever we can afford it, we do not decline our help to such fund raising campaigns. (warmglow)*
24. *Giving blood is giving life. ('warmglow')*
25. *During the holidays, my family and I prefer to stay home or to go to the beach rather than travelling around Portugal visiting our traditional villages. ('use')*
26. *My family and I think that the preservation of the Alentejo coast line is important because in this way we are protecting a typical lifestyle of the local inhabitants, which belongs to our national identity. ('use')*

Table I. Survey descriptive statistics

Respondent age (years)	20-29	30-39	40-49	50-59	60-69	+69
(%)	19	20	22	17	14	8
Household size	One	Two	Three	Four	Five	> 5
(%)	7.5	21.8	26.9	29.1	14.0	0.0
Schooling years	< 4	5-6	7-9	10-11	12	>12
(%)	11	39	21	10	11	8

Table II. Factor loadings after varimax rotation

Attitudinal items	FACTOR 1	FACTOR 2	FACTOR 3
M14	70 *	21	18
M2	67 *	19	15
M4	63 *	16	14
M11	63 *	16	27
M13	61 *	19	25
M9	58 *	17	26
M26	58 *	17	20
M5	56 *	4	19
M1	47 *	13	19
M12	18	60 *	13
M23	25	58 *	10
M20	14	57 *	3
M8	8	56 *	6
M15	6	47 *	4
M10	36	8	71 *
M22	35	15	66 *
M6	29	9	62 *

Note: the exact wording of the items is given in the Appendix.

Table III. Estimation results for the univariate case

	WA Protection Program		RA Protection Program		(WA+RA) Protection Program	
	Estimate	Standard Error	Estimate	Standard Error	Estimate	Standard Error
Location	7.918	0.092	7.710	0.094	7.751	0.077
Scale	1.598	0.096	1.577	0.100	1.662	0.084
Log-likelihood	-515.25		-488.62		-807.72	
Mean	9 800 [6 700 - 14 600]*		7 600 [5 200 - 11 700]*		9 300 [6 600 - 13 300]*	
Median	2 700 [2 400 - 3 200]*		2 200 [1 900 - 2 600]*		2 300 [2 100 - 2 600]*	

* 90% confidence interval

Figure 1. Mean and median WTP estimates
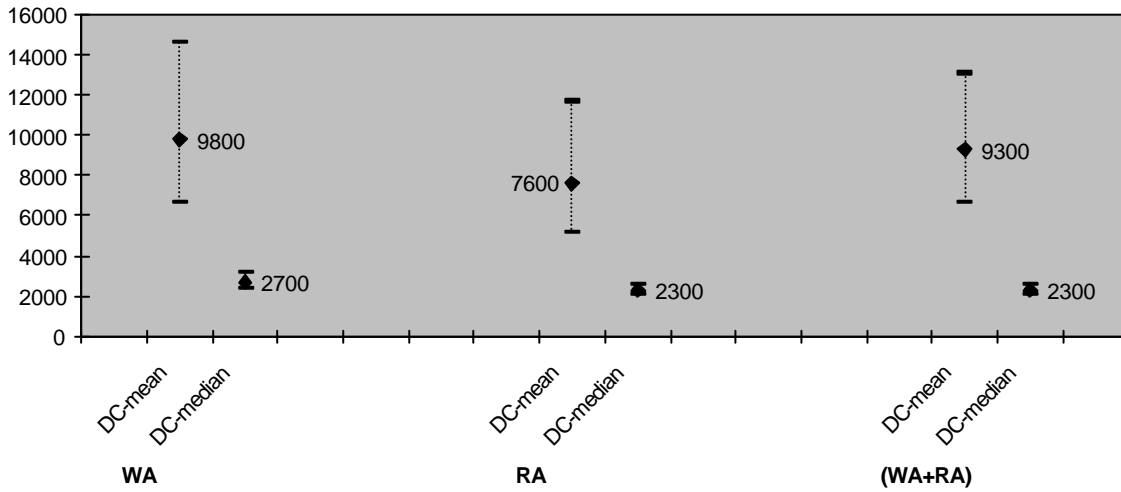
Table IV. Explaining interindividual variation in the WTP

Parameters	WA Est.	WA Sd. Er.	WA p-val.	RA Est.	RA Sd. Er.	RA p-val.	(WA+RA) Est.	(WA+RA) Sd. Er.	(WA+RA) p-val.
	Protection Programs								
factor scores									
'use'	.091	.12	.47	.291*	.13	.02	.165	.11	.13
'warm glow'	.536*	.14	.00	.448*	.12	.00	.238*	.11	.04
'existence'	.438*	.12	.00	.254*	.14	.08	.233*	.11	.03
area									
'rural'	.390	.33	.23	-1.04*	.37	.00	.019	.29	.94
'urban'	.148	.23	.53	.336	.21	.12	.094	.18	.60
age									
20's	.710	.48	.14	1.403*	.50	.00	.774*	.40	.05
30's	.956*	.49	.05	1.447*	.46	.00	.655*	.36	.07
40's	.279	.48	.56	.885*	.44	.04	.431	.35	.22
50's	.242	.41	.56	.954*	.41	.02	.225	.33	.44
70's	-.388	.47	.41	.034	.45	.93	-.598	.42	.15
occupation									
executives	.891	.68	.19	-.964	.63	.12	-.565	.53	.29
scientists	.330	.58	.57	-.341	.59	.56	-1.51*	.54	.00
technicians	-.006	.50	.98	-.736	.48	.12	-.121	.42	.77
administrative	.729	.50	.14	-.751	.46	.10	-.269	.42	.52
sales services	-.899*	.51	.08	-.496	.46	.28	-1.04*	.43	.01
Farmers, fishers	.242	.72	.73	-1.09	.77	.37	-2.68*	1.28	.03
Craftsmen	.295	.47	.54	-.615	.46	.18	-.170	.39	.66
Assembly work	-1.045*	.61	.08	.081	.59	.89	.047	.60	.93
Unskilled work	.020	.66	.98	-.723	.61	.24	-1.39*	.58	.01
Housekeepers	-.295	.45	.51	-.790*	.45	.07	-.314	.36	.39
Work students	-1.683*	.87	.05	-.305	.77	.69	-.986	.77	.20
Education									
Primary (freq.)	.057	.62	.92	.201	.60	.73	-.521	.59	.38
primary	1.045*	.52	.04	.318	.47	.50	-.751	.52	.15
Secondary: low	1.262*	.51	.01	.171	.45	.14	-.770	.49	.11
Secondary: high	.963*	.53	.07	-.087	.44	.84	-.258	.50	.61
University	1.000*	.45	.02	-.000	.54	.99	.871*	.51	.09
Payment vehicle	-.094	.20	.64	-.370*	.19	.05	-.311	.20	.12
Net income	.157*	.09	.09	.291*	.10	.00	.017	.08	.82
Household	-.124	.11	.25	-.082	.09	.38	.099	.08	.22
Protesters	-1.79*	.31	.00	-2.02*	.32	.00	-1.38*	.27	.00
Intercept ($\boldsymbol{b}$)	6.589			6.899			8.243		
Scale ($\boldsymbol{s}$)	1.292			1.195			1.576		
Log-Likelihood	-305.06			-279.10			-573.12		

* Significant at 10%

Reference group: respondent in her 60s, with a medium level of secondary studies, now retired.

Figure 2. Mean WTP versus mean *dry* WTP estimates
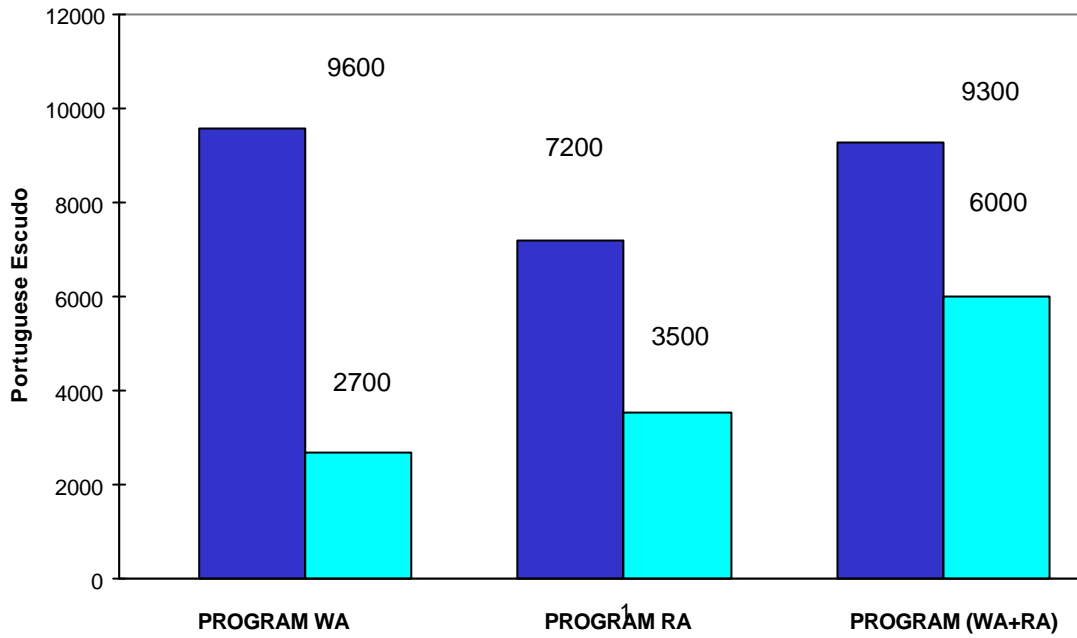
End notes:

[1] But this is not always the case! Carson [5] reviews over 30 studies using split-sample tests, which all clearly reject the hypothesis that respondents are insensitive to the scope of the good being valued.

[2] Schkade and Payne [16, 17] analyze the verbal protocols of a CV-study and find that some respondents vocalize a parallel with charitable contributions when answering the WTP survey. Moreover, the variables from the verbal protocol show a significant relationship with the WTP-answers.

[3] More detailed information on the questionnaire and the sample design can be found in Nunes [14].

[4] See the Appendix for the exact wording of the attitudinal items.

[5] This way we avoid potential multicollinearity problems when estimating equation (2).

[6] The factor loadings are analogous to standardized regression coefficients. Dropping for our interpretation attitudinal items which do not score above 0.45 - to be seen as a kind of minimum correlation bound - means that we follow an exploratory rule based on the magnitude of the estimated regression coefficients. Items that have a low correlation with the common factors are not taken into consideration.

[7] The two largest ones are M14 ("Preservation of the Alentejo coast line is important because this is a privileged place where all of us may enjoy going to the beach in a relaxed environment and being in contact with nature") and M2 ("…because this is a place which all of us can visit and where we can see very beautiful

[8] The two main items are M12 ("There are some funding campaigns to which my family and I feel very close and therefore we do not hesitate to contribute a donation") and M23 ("My family and I like to contribute to good causes such as the protection of the environment and whenever we can afford it, we do not decline our help to such fund raising campaigns").

[9] The largest loading is for item M10 ("Despite the fact that my family and I may never see an Iberian lynx in its natural habitat, we are very happy to know that we have the guarantee that the lynx is kept safe from extinction in Portugal"). Items M22 and M6 convey the same idea for the eagle and the otter.

[10] Nunes [14] compares the results for the lognormal distribution with those for the Weibull, the exponential and the loglogistic function. Although the Weibull distribution provides the best fit according to the Akaike Information Criterion, the lognormal distribution does not do much worse and is preferred for interpretational reasons.

[11] For the lognormal distribution, the mean WTP is given by $\exp(b + 0.5s^2)$ and the median by $\exp(b)$. For a detailed discussion refer to Johnson and Kotz [10] Calculations are performed using *SAS*® programming.

[12] Which corresponds to 48, 36 and 45 Euro, respectively.

[13] All individuals with no/no answers were asked about their reasons for this answer. Those who answered that they did not want to pay because "they do not believe in the described tax scheme/national fund campaign "do not agree with this type of question", "believe that this questionnaire is not the best way to approach the topic" and "do not accept any increase in taxes/any participation in a funding campaign" were considered to be protest voters - see Nunes [14] for more details.

[14] For a detailed discussion of this test refer to Lehmann [12].