Testing for consistency in tourists' willingness to pay for new nature reserves in the Gulf of Morbihan (France)

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ABSTRACT

In this paper, we develop an empirical test of consistency in contingent willingness to pay (WTP) responses, which is based on the following *a priori* expectation. In economics, when an individual considers paying for public goods, his decision to pay, and his WTP are based on utility-maximising behaviour. Accordingly, supposing other factors are identical, if individual A expresses greater interest in paying for public goods in general than individual B, that is because A receives more benefits from the use and/or the non-use of these goods than B. Continuing with this logic, if both individuals are asked about their WTP for a precise public good, A should logically be more likely to pay and should be willing to pay more than B. Thus, the test consists in measuring the degree to which people are likely *to give money* for public goods in general, and including it as a covariate in WTP models for the specific public good. If this covariate is significantly positive, then WTP responses are considered consistent. If this is not the case, then future research might focus on motives behind inconsistent WTP responses. To assess the robustness of the test, we consider 3 situations 1) the covariate is exogenous 2) it is endogenous and uncorrelated with the choice to pay or not for the specific good 3) it is endogenous and correlated with this choice. Using a contingent valuation study estimating tourists' willingness to pay for future nature reserves in the Gulf of Morbihan, we find that WTP responses are consistent in all situations considered.

Keywords: *contingent valuation, consistency, endogeneity*
JEL codes: *C24; D12; Q26*

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1. Introduction

Several economic valuation methods have been developed to determine the monetary value for non-market goods and services. They are divided into two categories: revealed and stated preference methods. According to White and Lovett (1999), the former is based on how people actually behave, whereas the latter is based on how people say they would behave in a hypothetical situation. For example, when a study eliciting individuals' preferences for a new non-market good, such as a nature reserve, revealed preference methods may not be applied. The reason for this is that there is a lack of data about the use of the nature reserve or market goods that are its complements (Pouta, 2003). Since the proposed nature reserve is not yet established, only stated preference methods are suitable for estimating the benefits associated with it. Contingent valuation (CV) is one such method. In a CV survey, respondents are asked about their maximum willingness to pay (WTP) for a program providing the new good. In addition to the valuation question proper, they are asked other questions that aid interested parties in interpreting the WTP obtained (Pouta, 2004).

Because CV technique is based on simulated economic markets, many researchers are sceptical about its results (e.g. Hausman, 1993; Diamond and Hausman, 1994). Critics have questioned two aspects of the method, namely, *reliability* and *validity* (Venkatachalam, 2004). Reliability refers to the stability of estimated contingent values over time and populations (Reiling *et al.,* 1990; Whitehead *et al.* 1995), while the validity implies that CV estimate measures that it is theoretically supposed to measure (the Hicksian surplus) and that it changes in theoretically predicted ways (Lyssenko and Martínez-Espiñeira, 2009). A large number of studies have tested for the reliability (e.g.: Loomis, 1989; Reiling *et al.,* 1990; McConnell *et al.,* 1998) and the validity (e.g.: Bishop and Heberlein, 1986; Smith and Desvousges, 1986; Kahneman and Knetsch, 1992; Kramer and Mercier, 1997; Morrison *et al.,* 2000; Ryan and San Miguel, 2000; Ryan *et al.,* 2004; Kontoleon *et al.,* 2005) of contingent values. Several of these studies have successfully passed available *reliability* and *validity* tests, showing that CV results are both reliable and valid. However, the controversy is not necessarily closed; there are still some concerns about these concepts (González-Cabán *et al*. 2007).

Given this persistent scepticism, in this paper, we add to the literature on the accuracy of WTP experiments by looking at the consistency of responses. More precisely, we perform a simple test of *theoretical validity* (i.e. we examine whether results conform to the economic theory or *a priori* expectations) based on the following *a priori* expectation[1]. In economics, when an individual considers paying for public goods, his decision to pay, and his WTP, if he agrees, are based on utility-maximising behavior. Accordingly, assuming other factors are identical, if individual A expresses greater interest in paying for public goods in general than individual B, that is because A perceives more benefits from the use and/or non-use of such goods than B. Continuing with this logic, if both persons are asked their WTP for a particular public good, A should logically be more likely to pay and should be willing to pay more than B. Thus, one way of evaluating the consistency of WTP responses is to measure the degree to which subjects are likely *to give money* for public goods in general, and include this measure as a covariate in WTP models (both the decision to state or not a positive WTP model and the positive WTP stated model) for the specific public good evaluated. If the covariate is significantly positive in both models, this suggests that the stronger subjects' intention to engage in the financing of environmental goods in general, the more likely their intention to pay for the

[1] The validity is of three types: content validity, criterion validity and construct validity. The third has two forms: convergent validity and theoretical validity (see Bateman *et al.,* 2002, for more details).

particular good is and the more important their WTP for it are, all other characteristics being equal. Therefore, WTP responses can be considered "consistent". If the covariate is not significant and positive, future research might focus on motives behind inconsistent responses.

To carry out the test we use the data from a CV study measuring tourists' WTP for the creation of nature reserves in the Gulf of Morbihan (France). The current situation in this area is conducive to the exploration of many nature protection initiatives. Indeed, a program for a Nature Regional Park was recently given a favourable opinion by public authorities. One of its main objectives consists of "making its heritage an asset for the Gulf of Morbihan" by "preserving and safeguarding the region's biodiversity" (SIAGM, 2009). This means that, for reasons linked to the protection of natural environments, the park will formulate and facilitate the introduction of other schemes, such as new nature reserves[2]. At the same time, the gulf is one of the most popular tourist destinations in France. With approximately 1.2 million tourists a year (Queffelec and Philippe, 2008), in terms of overnight stays, it is part of the 4th largest department for tourism (CGM, 2005). The tourist economy currently accounts for 10% of GDP in the Morbihan (CCIM, 2008). This area owes its attractiveness mainly to its natural assets, which, according to the results of a survey carried out by MORGOAT (2005), is the second main reason given (39%) for organising a trip. In addition, the same source argues that 96% of tourists believe that its natural sites are a valuable asset for Morbihan, and more than 33% indicate that they have already visited at least one of these sites, which suggests that they place a high value on them. Therefore, as part of an *ex-ante* evaluation of the nature reserves, it is legitimate to ask tourists about the amount of money they are willing to pay in order to benefit from these areas.

The remainder of this paper is organized as follows. Section 2 presents the consistency test design. Section 3 contains a description of the survey and data. Results and discussion of the empirical test are provided in section 4, while section 5 concludes the paper.

2. Design of the consistency test

To perform the test we first need to measure the "intensity" of individuals' intention to financially support nature protection programs in general. To do this, tourists are asked to rate the probability that they will *spend money* on them on a four-point scale ranging from "very likely" (4) to "very unlikely" (1). On the basis of their responses, we create two groups of respondents by aggregating those who answer that they are very likely /likely to make a financial contribution towards nature protection programs in general on the one hand and those who are unlikely/very unlikely on the other. As the former show a strong intention to give money for such actions, they are called "Participants stated". On the other hand, since the latter express a weak intention, they are called "Non-Participants stated". To distinguish these two categories of tourists, we construct a dummy variable "*PARTICIPANT*" which takes on values of 1 or 0, 1 designating a "Participant stated" and 0 a "Non-Participant stated".

Once this "intensity" of individuals' intention is measured, it only remains to ask them about their preferences for the specific good. In the present paper, after being informed of the contingent program, individuals are asked to select their maximum WTP from a payment card ranged in € 5 bands from € 0 to €50 (see appendix for the CV program format). Dependent on

[2] Article 6 of Section 1 of the Charter report (SIAGM, 2009).

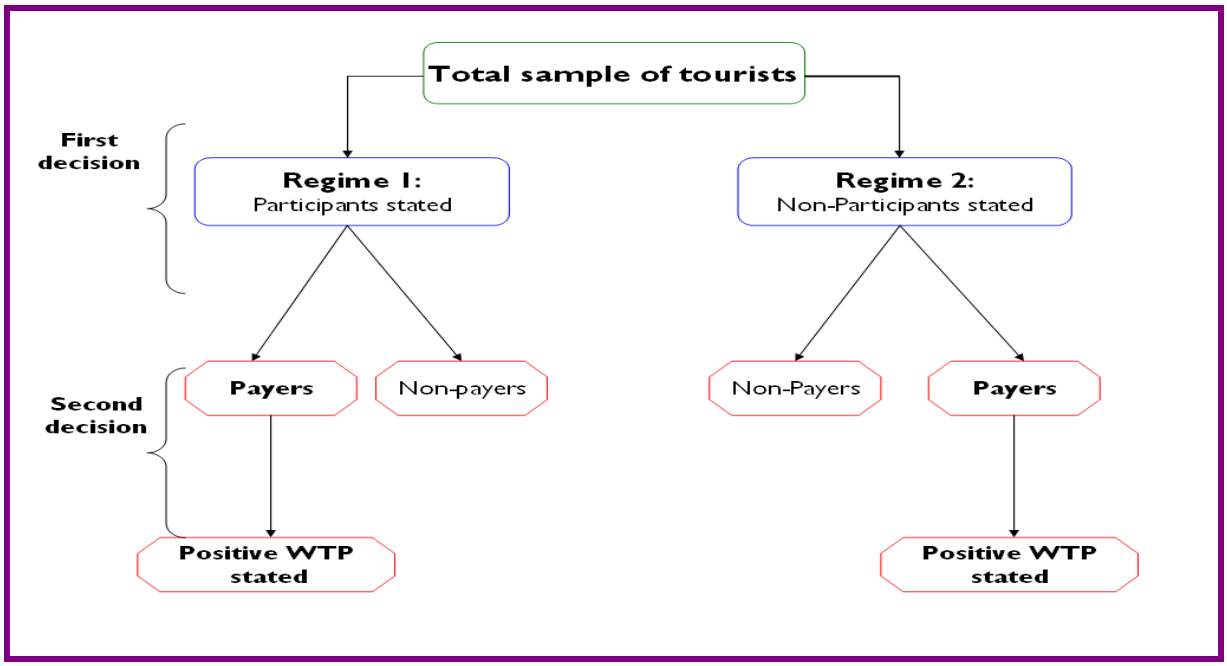
whether respondents indicate a positive or a zero amount, they are called "Payers" in the first case and "Non-Payers" in the second. Another dummy factor, namely, "PAYER" is created in order to distinguish these two categories. It is coded 1 for Payers and 0 for others.

Taken together, these qualitative variables, PARTICIPANT and PAYER, suggest that tourists make two decisions 1) to be a participant stated or a non-participant stated" 2) "to be a payer or a non-payer". Thus, a basic way of evaluating the consistency of WTP responses is to analyse the effect of the factor *PARTICIPANT,* and the direction of its effect on both people's decision to be a payer and positive amounts stated for reserves. In other words, this consists of applying the simple Heckman's 2 step method. The logic behind this is that the amount selected by someone results from a sequential decision making process: "to pay or not" is the first step, and, if participating, "how much" is the second. In such a model, we first estimate a *Probit* model to explain the choice to be a payer and then we report the inverse of Mill's ratio as an additional regressor in the *positive* WTP regression estimated by ordinary least squares (OLS) (Garcia *et al.*, 2009). The indicator "inverse Mill's ratio" allows us to detect, and if necessary, correct the sample selection bias due to the fact that only positive WTP are regressed. Using this procedure we conclude that WTP responses pass the test of consistency as proposed here, if the dummy variable "*PARTICIPANT*" included in both the Probit model and the OLS regression is significantly positive. As mentioned above, this indicates that the stronger respondents' intention to engage in the financing of nature protection programs in general, the more likely their intention to pay for the creation of nature reserves is and the more important their WTP for it are. If this factor is not significant and positive, then doubts may be reasonably expressed on the consistency of results, and thus on their use in a benefit-cost analysis of nature reserves and/or in the implementation of pricing strategies for these areas.

In the above approach "*PARTICIPANT*" is treated as an exogenous variable in the two models. To assess the robustness of our results, it is worth supposing that such a variable is endogenously determined, which means that interviewees who identify themselves as being *Participants* differ in a number of *measured* and *unmeasured* ways from those who consider themselves *Non-participants*, resulting in different WTP[3]. For example, the former may have a more favourable attitude towards paying for nature protection initiatives in general than the latter and thus state different amounts of money for nature reserves. Many CV studies dealing with the issue of the endogeneity of regressors show that this assumption is reasonable. Following these, individual observed behavioural decisions, in our case the behavioural decision to financially support nature protection programs in general, usually are endogenous (Alberini *et al*., 1997; Garcia *et al*., 2009; Lyssenko and Martínez-Espiñeira, 2009). Thus, testing for consistency in tourists' WTP for nature reserves as proposed here requires first to understand why subjects are Participants stated and what factors affect this choice. Miranda and Rabe-Hesketh (2006) explain that the potential problem of the endogeneity of dummy factors defining behavioural decisions, in our case PARTICIPANT, could be regarded as a problem of endogenous switching. According to the same source, in *endogenous switching models* the dependent factor (WTP) is a function of not only a set exogenous regressors, but also a binary variable "called regime-switch variable". Figure 1 describes the structure of the new procedure that is developped in what follows to test the consistency of CV WTP responses.

[3] Endogeneity occurs when an explanatory variable included in a model (ex.: WTP model) is potentially correlated with the error term of the same model.

Figure 1. **The structure of the approach developed to test the consistency of CV responses**



Formally, the general econometric model behind this new procedure can be expressed as follows:

- Tourists' first decision: The decision to be a "*Participant stated*"

$$\begin{cases} Participant_i^* = X_{iP}\delta + \mu_{iP} \\ Participant_i = 1 \quad \text{if} \quad Participant_i^* \succ 0 \\ Participant_i = 0 \quad \text{if} \quad Participant_i^* \leq 0 \end{cases} \tag{1}$$

- Tourists' second decision: The decision to be a "*Payer*"

$$\begin{cases} Payer_i^* = X_{iC}\omega + \mu_{iC} \\ Payer_i = 1 \quad \text{if} \quad Payer_i^* \succ 0 \\ Payer_i = 0 \quad \text{if} \quad Payer_i^* \leq 0 \end{cases} \tag{2}$$

where $Participant_i^*$ and $Payer_i^*$ are latent variables; X_{iP} and X_{iC} are, respectively, the determinants of the choice to be a "Participant stated" and the one "to be a Payer"; δ and ω are the vectors of associated coefficients to be estimated, while μ_{iP} and μ_{iC} are the random errors.

- Tourists' willingness to pay equations:

$$WTP_{1i} = \begin{cases} \beta_1 X_{1i} + \varepsilon_{1i} & Participant_i = 1 \text{ and } Payer_i = 1 \text{ (for Participants stated payers)} \\ & \text{if} \\ 0 & Participant_i = 1 \text{ and } Payer_i = 0 \end{cases} \tag{3}$$

$$WTP_{2i} = \begin{cases} \beta_2 X_{2i} + \varepsilon_{2i} & Participant_i = 0 \text{ and } Payer_i = 1 \quad \text{(for Non-Participants stated payers)} \\ & \text{if} \\ 0 & Participant_i = 0 \text{ and } Payer_i = 0 \end{cases} \quad (4)$$

where X_{1i} and X_{2i} are, respectively, the vectors of exogenous regressors of WTP equations 3 and 4; β_1 and β_2 are the associated vectors of parameters, while ε_{1i} and ε_{2i} are the error terms.

We suspect that Equations 3 and 4 are subject to a double selection bias. Indeed, by itself, the first is subject to the double selection bias in that data are "missing" on WTP_{1i} when both $Participant_i = 0$ and $Payer_i = 0$. Likewise, the second is subject to bias in that data are "missing" on WTP_{2i} when both $Participant_i = 1$ and $Payer_i = 0$. In such situations, an OLS estimation of WTP would result in inconsistent parameters estimates of β_1 and β_2. The appropriate procedure consists of applying the simple Heckman's 2 step method or its extension, as proposed by Ham (1982) and Tunali (1986), dependent on whether disturbances in equations 1 and 2, called selection equations, are assumed to be uncorrelated or correlated. The correct versions of WTP equations to be estimated individually are:

$$\begin{cases} WTP_{1i} = \beta_1 X_{1i} + \rho_{P1}\lambda_{P1} + \rho_{C1}\lambda_{C1} + \xi_{1i} & \text{(for Participants stated and payers)} \quad (5) \\ WTP_{2i} = \beta_2 X_{2i} + \rho_{P2}\lambda_{P2} + \rho_{C2}\lambda_{C2} + \xi_{2i} & \text{(for Non-Participants stated and payers} \quad (6) \end{cases}$$

where

$$Cov(\mu_{iP}, \varepsilon_{1i}) = \rho_{P1} \neq 0, \quad Cov(\mu_{iC}, \varepsilon_{1i}) = \rho_{C1} \neq 0, \quad Cov(\mu_{iP}, \varepsilon_{2i}) = \rho_{P2} \neq 0,$$
$$Cov(\mu_{iC}, \varepsilon_{2i}) = \rho_{C2} \neq 0, \quad Cov(\varepsilon_{1i}, \varepsilon_{2i}) = \rho_{12} = 0$$

λ_i are the inverse Mill's ratios and ξ_i are the new error terms with zero means.

If the error terms μ_{iP} and μ_{iC} are assumed to be uncorrelated, i.e. $Cov(\mu_{Pi}, \mu_{Ci}) = \rho = 0$, then the inverses Mill's ratios are:

$$\lambda_{Pi} \text{ and } \lambda_{Ci} = \begin{cases} \dfrac{\phi(X_{iP}\delta)}{\Phi(X_{iP}\delta)} \quad and \quad \dfrac{\phi(X_{iC}\omega)}{\Phi(X_{iC}\omega)} & \text{if } Participant_i = 1 \text{ and } Payer_i = 1 \\ \dfrac{-\phi(X_{iP}\delta)}{1-\Phi(X_{iP}\delta)} \quad and \quad \dfrac{\phi(X_{iC}\omega)}{\Phi(X_{iC}\omega)} & \text{if } Participant_i = 0 \text{ and } Payer_i = 1 \end{cases}$$

where $\phi(.)$ and $\Phi(.)$ are, respectively, the standard normal probability density function, and the standard normal distribution function. In a first stage, we estimate two independent *Probit* models of (1) and (2) to obtain consistent estimates δ and ω, which are then used to construct λ_{Pi} and λ_{Ci}. In a second stage, we estimate WTP equations (5) and (6) on the set of explanatory factors, including the inverses of Mill's ratios. Because the error terms of equations 1 and 2 are supposed to be independent, using this method allows us to only test whether Participants stated are WTP more than Non-Participant stated. In order to test whether the former are more likely to pay for nature reserves than the latter, we need to assume that $Cov(\mu_{Pi}, \mu_{Ci}) = \rho \neq 0$.

Under this hypothesis, an extension of Heckman's two step technique should be applied (see Ham, 1982; Tunali, 1986). Then the inverses of Mill's ratio become:

$$\lambda_{Pi} \text{ and } \lambda_{Ci} = \begin{cases} \dfrac{\phi(X_{iP}\delta)*\Phi(\hat{P})}{\Phi_2(X_{iP}\delta, X_{iC}, \rho)} \quad \text{and} \quad \dfrac{\phi(X_{iC}\omega)*\Phi(\hat{C})}{\Phi_2(X_{iP}\delta, X_{iC}\omega, \rho)} & \text{if } Participant_i = 1 \text{ and } Payer_i = 1 \\ \dfrac{-\phi(X_{iP}\delta)*\Phi(\hat{P})}{\Phi(X_{iC}\omega) - \Phi_2(X_{iP}\delta, X_{iC}, \rho)} \text{ and } \dfrac{\phi(X_{iC}\omega)*\Phi(-\hat{C})}{\Phi(X_{iC}\omega) - \Phi_2(X_{iP}, X_{iC}, \rho)} & \text{if } Particip. = 0, Payer_i = 1 \end{cases}$$

$$\text{with } \hat{P} = (X_{iC} - \rho X_{iP}) / \sqrt{1-\rho^2} \text{ and } \hat{C} = (X_{iP} - \rho X_{iC}) / \sqrt{1-\rho^2}$$

where $\Phi_2(.)$ and $\Phi(.)$ represent the bivariate and univariate standard normal cumulative distribution functions, while $\phi(.)$ is the standard normal probability density function. As in the preceding approach, we use a two-stage process to estimate Equations (5) and (6). First, we estimate a bivariate *Probit* model defined by Equations (1) and (2) to obtain consistent estimators of δ, ω and ρ. The estimated δ, ω and ρ are used to calculate λ_{Pi} and λ_{Ci}. In this stage what it is particularly interesting for us is to see whether ρ is significantly different from zero, and, if it is, the direction of its influence. In the framework of the test, tourists' responses relating to the decision to pay or not for nature reserves are "consistent" if only ρ is significantly positive, because this highlights the fact that subjects who are more likely to identify themselves as being Participants are also those who are more likely to be Payers. Finally, including the inverses of Mill's ratios as regressors, we estimate WTP equations (5) and (6) by OLS.

To investigate the consistency of tourists' WTP responses, this study uses a tree-stage process considering the choice to be a Participant stated or Non-Participant stated 1) exogenous to both decisions to be a Payer or not, and if Payer, the WTP stated; 2) endogenous and uncorrelated with the above decision; 3) endogenous and correlated with this.

3. Brief description of the questionnaire and data collection

The questionnaire consists of four major sections. Each interview begins by explaining the context of the survey, and checking whether or not the subject interviewed is a tourist. In accordance with the international definition of the "tourist" (see Cuvelier, 1998), only those respondents not resident in the gulf and spending at least one night there are selected. We ask, therefore, for the commune in which their main home is situated and for their duration of stay. The first section refers to questions about visit characteristics. The second section includes questions about individuals' environmental attitudes and behaviour, such as the question with regard to their choice to be a Participant stated or a Non-Participant stated. Section tree introduces the contingent program of the creation of nature reserves and the WTP questions. For credibility purposes, following the example of Richer (1995) and Bateman and Langford (1997), people are provided a map showing the areas concerned[4]. Then, they are introduced to the logic of the contingent market. Because the Gulf of Morbihan already has a nature reserve, called "Séné Nature Reserve", which is visited by purchasing an individual entrance fee, they

[4] Still using the same reasoning, the CV project was drawn up with the assistance of certain members of SAIGM.

are informed that the new nature reserves could be financed by this payment vehicle. Based on this, respondents are asked to select their WTP on the payment card previously presented in order to visit all the nature reserves over the period of a week[5]. Following standard practice in CV studies, those indicating a zero amount must explain their reason for doing so, and the question is used to differentiate between a true zero WTP and a protest response. The question is formulated as a series of proposals from which the interviewee has to choose the one that represents his main argument. Finally, as Bateman *et al.* (2002) suggest the section four includes questions relating to socio-economic and demographic characteristics.

The final version of the questionnaire is administered by face to face interviews of 498 tourists between July and August 2007. To avoid a selection bias in favour of those interested in natural environment, the survey is carried out at different points of the Gulf of Morbihan - including urban sites and "nature" sites selected after discussions with members of SIAGM and the Morbihan Departmental Tourism Authority (CDTM).

4. Main results of the consistency test and discussion

In what follows, we test for consistency in individuals' WTP for the implementation of nature reserves using successively both statistical and econometric approaches.

4.1. Statistical approach

Following the intuition behind the consistency test carried out here, respondents' WTP are "consistent" if only *Participants stated* are more likely to pay and are willing to pay more for nature reserves than *Non-Participants stated*. Thus, hypotheses to be tested are stated formally as:

First hypothesis

$$H_1^0 = PAR_{PARTICIPANTS\ \ STATED} = PAR_{NON-PARTICIPANTS\ \ STATED} \quad \text{and}$$
$$H_1^1 = PAR_{PARTICIPANTS\ \ STATED} \neq PAR_{NON-PARTICIPANTS\ \ STATED}$$

where PAR is the positive amount rate of money for the creation of nature reserves.

Second hypothesis

$$H_2^0 = \ddot{\wedge}WTP_{PARTICIPANTS\ \ STATED} = \wedge WTP_{NON-PARTICIPANTS\ \ STATED} \quad \text{and}$$
$$H_2^1 = \ddot{\wedge}WTP_{PARTICIPANTS\ \ STATED} \neq \wedge WTP_{NON-PARTICIPANTS\ \ STATED}$$

where $\ddot{\wedge}WTP$ is the mean amounts expressed by interviewees.

[5] The money amounts proposed (from €0 to €50, with €5 a range) are based on those received in a pre-test of the questionnaire carried out in November 2006. Like Bateman *et al.*, (1995), in this pilot study, tourists (30) are asked about their WTP using the open-ended approach.

In table 1 we present test results corresponding to the first hypothesis. As may be seen, there are as many Participants stated as Non-Participants stated (249 persons), which suggests that subjects are really heterogeneous with regard to the intention to financially support nature protection actions in general. On the other hand, as for the decision to pay or not for nature reserves, only small proportions of zero bids are formulated, showing that the two categories of people have a "participative" intention towards paying for the precise good evaluated[6]. This is particularly surprising with respect to Non-Participants stated, since these persons expressed a "non-participative" intention towards paying for general programs that enhance nature protection. However, results show that a larger portion of Participants stated (96%) accept to pay as compared to Non-Participants stated (90%). The chi-squared test indicates that this difference in response rates to the valuation question proper between these groups of tourists is signify-cant at the 1% level. This means that Participants stated are more likely to pay for the creation of nature reserves than Non-Participants stated. In other words, it seems that the two decisions are dependant, i.e., a strong intention expressed by individuals towards paying for nature protection programs in general necessarily imply a participative intention from these same individuals towards giving money for a specific program (creation of nature reserves). This finding is consistent with economic intuition behind the consistency test developed in this paper.

Table 1. **Response rates to the valuation question according to the decision to be a Participant stated**

	Participants stated	Non-Participants stated	N
Payers	240 (96.4%)	224 (90.0%)	464
Non-Payers	9 (3.6%)	25 (10.0%)	34
N	249	249	498
X^2 *value*		8.08***	

*** Significant at the 1% level

In table 2 we present the arithmetic means, and other statics, of positive WTP for both Participants stated and Non-Participants stated. Means of WTP for the former and the latter are €14.96 and €12.81, respectively. Because the null hypothesis that WTP amounts are normally distributed is rejected at the 1% level by the outcome of the Kolmogorov-Smirnov test, we use the non-parametric Mann-Whitney test to compare for difference observed (€2.15) in mean WTP values between sub-samples. The result shows that H_2^0 is rejected at the 5% level in favour of the alternative H_2^1, i.e., Participants stated are WTP more than Non-Participants stated.

Table 2. **Means positive WTP**

	€ Mean (S.D.)		Median
Participants stated	14.96 (8.96)		15.00
Non-Participants stated	12.81 (7.01)		10.00
Kolmogorov-Smirnov value		4.357***	
Mann-Whitney value		- 2.460**	

*** Significant at the 1% level, S.D Standard Deviation

[6] After studying reasons why respondents refuse to pay, we consider all zero WTP stated as protest responses.

Together, these tables demonstrate that Participants stated not only are more likely to pay, but also are willing to pay more than Non-Participants stated for the establishment of nanature reserves. Thus, following our consistency test, tourists' WTP seem to be consistent.

4.2. Econometric approach

Although statistical results reported above are consistent with our expectations, we believe that they are not robust enough to confirm whether WTP responses are consistent. Thefore, it is valuable to employ econometric procedures in order to further the analysis.

To investigate whether Participants stated are more likely to pay than Non-Participants stated, two categories of *Probit* models are estimated. The results are provided in Table 3. Before running these models, we compare sample characteristics between Participants stated and Non-Participants stated, on the one hand, and, between Payers and Non-Payers, on the other. This is in order to test whether subjects differ significantly in a number of characteristics. As Strazzera *et al.*, (2003) and Fonta *et al.*, (2009) note, any significant difference between the groups of tourists compared is an early indicator of the presence of sample frame bias, and thus justifies the application of models with self-selectivity. We use the Mann-Whitney test to compare for differences in means of all explanatory factors between these sub-samples. The null hypothesis is that there is no difference. Our results highlight significant differences in some variables. Consequently, only these characteristics are included in *Probit* models, except for the variable DPARTICIPANT used in Model 1, because it is our factor of interest.

Turning to the presentation of results, in Model 1 the decision to be a Participant stated (DPARTICIPANT) is treated as an exogenous variable. As expected, it is positive and significant, indicating that Participants stated are more likely to give a positive amount for the nature reserves than Non-Participants stated. Calculating its marginal effect, we find that the probability of a Participant stated being a Payer is 2.50% higher than a Non-Participant stated. This effect is significant at the 5% level. In Model 2 the two choices, Participant stated and Payer, are treated as correlated decisions. In this case, RHO becomes the factor of interest. Again, as expected, it is positive and significant. This means that once observable explanatory characteristics are controlled, the two decisions are positively dependent. In other words, tourists who are most likely to be Participants stated are also those who are most likely to be Payers. Thus, these findings are consistent with statistical results related to the first hypothesis.

The following analysis pertains to the comparison of WTP between Participants stated and Non-Participants stated. The results shown in Table 4 are based on OLS regressions with correction for selection bias discussed in the previous section. Model A corrects for selection bias related to the choice to be a Payer but considers the one to be a Participant stated (DPARTICIPANT) as exogenous. Model B takes into account the selection bias due to the two decisions but treats them as uncorrelated, while Model C considers them as correlated. Given that our particular interest is to verify whether Participants stated are WTP more than Non-Participants stated, we compute two means WTP according to whether interviewees are Participants stated or Non-Participants stated. Due to a right-skewed distribution, WTP amounts are transformed into their natural log form. Therefore, means WTP are estimated using this formula:

$Estimated\ \ WTP_{mean} = \exp\left(\bar{x}\hat{\beta} + \frac{\hat{\sigma}^2}{2}\right)$, where $\bar{x}$ is the vector of mean values of the explanatory variables, $\hat{\beta}$ the vector of estimated coefficients, and $\hat{\sigma}$ is the estimated σ.

Table 3. **Estimated Univariate and Bivariate Probit models**

	Model 1 UNIVARIATE PROBIT	**Model 2** BIVARIATE PROBIT	
VARIABLES	*PAYER = 1*	*PARTICIPANT = 1*	*PAYER = 1*
INTERCEPT	3.44 (0.493) ***	0.139 (0.239) ns	3.602 (0.529) ***
AGE	- 0.023 (0.007) ***		- 0.022 (0.007) ***
DCOUPLE		- 0.512 (0.156) ***	
DMALE	- 0.646 (0.229) ***		- 0.640 (0.228) ***
DREG_PARIS	1.126 (0.444) **		1.077 (0.417) ***
DBP_OUEST		0.394 (0.200) **	
DNATURE		0.360 (0.160) **	
DCULTURE		0.398 (0.164) **	
DMONUMENT		- 0.278 (0.131) **	
NB_SITVIS	- 0.229 (0.078) ***	0.099 (0.048) **	- 0.200 (0.082) **
DNEG_IMP		- 0.406 (0.125) ***	
DPARTICIPANT	0.419 (0.230) *		
DV_CONCERN	- 0.442 (0.212) **		- 0.436 (0.214) **
DPDAC_FIN		- 0.960 (0.160) ***	- 0.411 (0.242) *
DPDAC_IRRES	- 0.835 (0.200) ***	- 0.363 (0.140) **	- 0.719 (0.253) ***
DPUR_TICKET		0.258 (0.128) **	
DPR_HOME		0.520 (0.004) ***	
DURB_SITE	0.676 (0.204) ***		0.659 (0.213) ***
RHO		0.299 (0.140) **	
Log-likelihood	- 88.630	- 374.144	

***, **, and * indicate Significant at the 1%, 5% and 10%; ns Non significant and (.) Standard errors

Note : Variable names beginning with D are dummy variables.

AGE = age, in years

DCOUPLE = Respondent lives in a couple

DMALE = Male respondent

DREG_PARIS = Respondent lives in the Ile-de-France region

DBP_OUEST = Respondent lives in the Western Paris Basin

DNATURE = "Nature is very important in the choice of recreational activities". The scale was: *very much, much, not so much, not at all*

DCULTURE = "Culture is very important in the choice of recreational activities". The scale was: *very much, much, not so much, not at all*

DMONUMENT = "Visit of monuments or museums during the stay"

NB_SITVIS = Number of nature sites already visited in the Gulf of Morbihan or visited during the stay

DNEG_IMP = "Recreational activities have a negative impact on the nature". The alternatives were: *positive, no and negative impact.*

DV_CONCERN = "Very concerned by nature protection". The scale proposed is: *very, little, not so much, not at all*

DPDAC_FIN = Respondent is not at all agree with statement such as *"tourists should pay for nature protection in the regions that they visit.* The alternatives were: *very much, much, not so much, not at all*

DPDAC_IRRES = Respondent is not at all agree with statement such as *"tourists should pay for nature protection in the regions that they visit.* The alternatives were: *very much, much, not so much, not at all*

DPUR_TICKET = Respondent has already purchased an entrance fee to visit a protected are

DPR_HOME = Respondent stays in his own second home situated in the Gulf of Morbihan

DURB_SITE = Urban site (geographical indicator for the location of interviews). The second site was " nature" sites

Table 4. **Log WTP estimation results**

	Model A PARTICIPANT exogenous	Model B PARTICIPANT endogenous and uncorrelated with PAYER		Model C PARTICIPANT endogenous and correlated with PAYER	
Variable	***Payer***	***REGIME 1: Participants stated***	***REGIME 2: Non-Participants stated***	***REGIME 1: Participants stated***	***REGIME 2: Non-Participants stated***
INTERCEPT	1.734 (0.365) ***	1.513 (0.525) ***	2.389 (0.482) ***	1.415 (0.492) ***	2.419 (0.485) ***
AGE	- 0.004 (0.002) **	- 0.003 (0.002) ns	- 0.006 (0.003) **	- 0.003 (0.002) ns	- 0.006 (0.003) *
LOG. INCOME	0.148 (0.044) ***	0.174 (0.063) ***	0.118 (0.060) *	0.174 (0.063) ***	0.114 (0.061) *
DCOUPLE	- 0.136 (0.086) ns	- 0.142 (0.122) ns	- 0.146 (0.125) ns	- 0.155 (0.122) ns	- 0.146 (0.126) ns
DBP_OUEST	- 0.002 (0.077) ns	- 0.076 (0.113) ns	0.052 (0.103) ns	- 0.061 (0.115) ns	0.055 (0.102) ns
DPARTICIPANT	0.110 (0.050) **				
DVIS_SENE	- 0.001 (0.053) ns	- 0.031 (0.078) ns	0.001 (0.074) ns	- 0.019 (0.079) ns	0.008 (0.075) ns
DV_CONCERN	- 0.053 (0.050) ns	- 0.119 (0.070) *	- 0.027 (0.070) ns	- 0.117 (0.071) *	- 0.023 (0.070) ns
DV_FAVOURABLE	0.218 (0.049) ***	0.300 (0.072) ***	0.132 (0.070) *	0.309 (0.072) ***	0.131 (0.070) *
DWALK	- 0.211 (0.105) **	- 0.181 (0.148) ns	- 0.347 (0.144) *	- 0.187 (0.148) ns	- 0.348 (0.145) **
DFIRST_TIME	0.086 (0.055) ns	0.257 (0.077) ***	- 0.076 (0.076) ns	0.253 (0.077) ***	- 0.074 (0.076) ns
DRES_OTHER	- 0.140 (0.061) **	- 0.186 (0.090) **	- 0.086 (0.082) ns	- 0.191 (0.090) **	- 0.086 (0.082) ns
DURB_SITE	- 0.018 (0.058) ns	0.183 (0.071) **	- 0.230 (0.083) ***	0.180 (0.072) **	- 0.235 (0.084) ***
λ_{Ci}	- 0.262 (0.197) ns	- 0.095 (0.314) ns	- 0.367 (0.224) *	- 0.411 (0.379) ns	- 0.356 (0.215) *
λ_{Pi}		- 0.209 (0.125) *	- 0.081 (0.130) ns	- 0.114 (0.121) ns	- 0.095 (0.115) ns
Number	464	240	224	240	224
Adj. R_2	0.10	0.14	0.10	13.15	0.095
MEANS WTP	**PARTICIPANTS: €14.73 (2.73)** **NON-PARTICIP.: €13.20 (2.45)**	**€15.12 (3.75)**	**€12.93 (2.71)**	**€15.12 (3.69)**	**€13.00 (2.73)**

***, **, and * indicate Significant at the 1%, 5% and 10%; ns Non significant and (.) Standard errors

Note : Variable names beginning with D are dummy variables.

LOG. INCOME *= Logarithm of the income*
DVIS_SENE *= Respondent has already visited the Séné nature reserve*
DV_FAVOURABLE *= Respondent is very favourable to the creation of nature reserves.* The scale proposed is: *very much, much, not so much, not at all*
DWALK *= "Walk " as recreational activity practised during the stay*
DFIRST_TIME *= First-time visitors*
DRES_OTHER *= Respondent stays with relations / friends*. The reference is: stay in *market accommodation (hotel, camping, …)*

As may be seen, in Model A DPARTICIPANT is positive and significant. This indicates that Participants stated have higher WTP for new reserves than those of Non-Participants stated. The difference in means WTP obtained from this model is significant using the Mann-Whiney test at the 1% level. This tendency is similar in both Model B and Model C.

Although not the main focus of our article, some comments pertaining to the other explanatory factors should be made. First, turning to the *Probit* models (table 3), the signs of the coefficients estimated all make intuitive sense, except for the variable DV_CONCERN which suggests that tourists who say that they are very concerned by nature protection are less likely to be willing to pay for the new nature reserves. This is particularly surprising since such a variable is generally expected to have a positive effect on the probability of being willing to pay (Deronzier and Terra, 2006; Baral *et al.*, 2008). In order to explain this result, we analysed the various motives put forward by these tourists. It appears that they refuse to contribute additional amounts of money for the public good because they are opposed to the entrance fee. More precisely, the majority of these "protesters" state that this payment vehicle is unfair and discriminates against lower-income people. In short, they are unwilling to pay for reasons related to equity issues[7].

Second, turning to the regression results (table 4), analogous to the *Probit* models, the signs of the coefficients estimated are as expected, except for the same characteristic, namely, DV_CONCERN. This indicates that tourists who state that they are very concerned by nature protection are WTP less as compared to others. This finding may be seen as an indicator that these tourists announced an "*appropriate amount*" for new nature reserves but not their true value. This is for the same reasons related to equity issues[8]. Interestingly, annual income (transformed in its natural log form) is a significant predictor of WTP whatever the WTP equation considered. A one-percentage increase in income implies an increase in WTP about of 0.11 and 0.17 percen-tage points, following the WTP equation selected.

Third, it is important to note the influences of the additional regressors, namely λ_{Ci} and λ_{Pi}. Consider first the model B in which the decision to be a Participant stated is treated as an endogenous factor and uncorrelated with the one to be a Payer. The λ_{Pi} and λ_{Ci} coefficients are significant for Regime 1 and Regime 2, respectively. This shows that "To be a Participant stated" is really an individual endogenous decision and that, with regard to the Non-Participants stated, a self-selection arises when they provide a value for the new nature reserves. Together, these findings justify the use of models with self-selectivity in this paper. However, when we look at the model C in which the two decisions are supposed to be correlated the results reject the hypothesis that PARTICIPANT is endogenous, because the coefficient on λ_{Pi} is not significant. On the other hand, they confirm the selection bias related to the decision to pay. Thus, whereas Model B indicates that a simply WTP equation such as Model 1 is not appropriate for calculating WTP estimates, because ignoring the endogenous nature of PARTICIPANT, Model C suggests that it is unacceptable, because assuming that PARTICIPANT only impacts on the intercepts of the WTP regressions. As may be seen, under this hypothesis, λ_{Ci} in Model 1 is not significant, whereas under the assumption that the slopes of the two sub-groups WTP regressions are different (which, therefore, allows us to split the data set into Participants stated and Non-Participants stated), λ_{Ci} becomes significant.

[7] For example, see Reynisdottir *et al.*, (2008) and Wu (2010) for a summary about the user fee debate on nature protected areas.

[8] Appropriate amount can be interpreted as "a balance between fee revenue and the public concern for fairness, equity and others' ability to pay" (Richer and Christensen, 1999).

Finally, as noted in Winship *et al.* (1992) cited by Fonta and Omoke (2008), the Heckman's two-step approaches is subject to collinearity problems between the significant inverses Mill's ratios and the regressors of outcome equations (WTP equations). One way of detecting the problem is to regress by OLS the inverses Mill's ratios on the set of explanatory factors of the WTP. If $R^2 > 0.5$, there are no collinearity problems. Applying this procedure, we find that $R^2_{PARTICIPANT} = 16\%$ and $R^2_{PAYER} = 22\%$, concluding that our results from the Heckman's 2-step can be accepted[9].

5. Conclusion

This paper focuses on the issue of consistency in WTP experiments to elicit the economic value of environmental goods. This is especially important, given that individuals' WTP responses can be used in designing public policies. It is clear that in the absence of consistency in individual behaviour, WTP stated become questionable. In this paper, we perform a simple test of consistency based on the hypothesis that the stronger people's intention to engage in the financing of nature protection projects in general, the more likely their intention to pay for a particular project should be and the more important their WTP should also be. To carry out the test, we use a CV study estimating tourists' willingness to pay for the creation of nature reserves in the Gulf of Morbihan. We first measure the tourists' intention to *spend money* on nature protection programs in general. Following this, we identify two groups of tourists: those who have a strong intention, called "Participants stated", and those who have a weak intention, called "Non-Participant stated". Then, both categories of tourists are asked about their WTP for nature reserves. Observing that some express a positive amount, while others do not, we divide them into "Payers" (those who announce a positive WTP) and Non-Payers" (those who give a zero WTP). Thus, subjects make two decisions: "to be a Participant stated" and "to be a Payer. WTP responses are considered consistent if Participants stated are more likely to pay for nature reserves and are WTP more than Non-Participants stated.

Our investigation is conducted in a sequential manner. First, based on the statistical results, we obtain empirical evidence that tourists' WTP responses are consistent. Indeed, a chi-squared test shows that Participants stated are more likely to pay than Non-Participants stated, while the Mann-Whitney test suggests that the former are WTP more than the latter. Second, to confirm these results, three categories of econometric models are estimated, following that the decision to be a *Participant stated* is treated as an exogenous variable, an endogenous variable and uncorrelated with the decision to be a *Payer* and, finally, an endogenous variable and correlated with this decision. Our econometric results confirm the statistical findings whatever the model considered. Thus, we conclude that tourists' WTP responses for the creation of nature reserves in the Gulf of Morbihan are consistent. This means that their responses can be used in a cost-benefit analysis of these areas.

Finally, beyond the question of consistency in WTP responses, this article adds to the literature on the endogeneity bias in CV studies. To date, in environmental economics, only a few papers have explored the issue (Lyssenko and Martínez-Espiñeira, 2009).

[9] We also check for the presence of collinearity problems between the covariates of both Probit models and WTP equations. Correlation coefficients for the explanatory factors reported in both Tables 3 and 4 do not exceed 0.2.

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Appendix A. Contingent scenario

According to the results of a recent survey, over 95% of tourists appreciate the quality of Morbihan's nature sites. However, the major natural recreational sites risk becoming victims of the increasing number of tourist visits. Out of a concern to give better protection to the countryside and encourage more respectful recreational activities, local decision-makers are considering introducing a protection programme. This program consists of the following 3 actions:

Setting up 2 new nature reserves open to the public, one at the Gulf exit (including the Berder, Longue, Gavrinis islands, etc.), a second at the tip of the Ile aux Moines, and an *extension of the Séné nature reserve* due to its importance for nesting birds.

Development of initiatives to monitor and maintain these nature reserves

Introduction of awareness-raising and nature protection activities: organisation of guided tours, nature activities, production of brochures giving information to tourists about the Gulf of Morbihan's natural assets.