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Analysis

Respondent Uncertainty and Ordering Effect on Willingness to Pay for Salt Marsh Conservation in the Brest Roadstead (France)

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ABSTRACT

This paper explores the potential link between the sensitivity of willingness to pay (WTP) to the order of presenting bid amounts in contingent valuation questions (ordering effect) and respondent uncertainty. The resource being valued is a public project to protect salt marshes against the spread of an invasive aquatic plant in the Brest roadstead (France). Valuation uncertainty is captured through a variant of payment card format where respondents are given the opportunity to report their WTP as either a single value (Option A) or an interval of values (Option B). The ordering effect is tested using both parametric models that ignore and control for the potential sample selection bias related to the choice between Option A and Option B, as well as non-parametric models. The results suggest that (1) respondents place substantial WTP values on salt marsh conservation, and (2) the ordering effect is linked to respondent uncertainty since only uncertain respondents react differently to changes in the order of presenting bid amounts. Specifically, for uncertain respondents, putting bid amounts in ascending order yields lower welfare estimates than putting bid amounts in descending order or random order. Policy recommendations and options to deal with ordering effect are discussed.

1. Introduction

As part of Natura 2000 management approach and the application of the Habitats Directive, salt marsh natural habitats are known at European level as of major interest. However, they face several threats predominantly from human activity. In the Brest roadstead (France), one of the main threats to salt marshes is from the invasive aquatic plant, *Spartina alterniflora*. Coming from the Northeast coast of the United States and Canada (Géhu, 2008), it was introduced during the 19th century through ship ballast waters (Gross et al., 1986). A number of actions are under consideration to fight against the spread of this invasive species.

Economic analyses, mostly economic valuations, could play an important role in informing policymakers, guiding and supporting salt marsh conservation policies. One of the most widely used economic valuation methodologies is the contingent valuation (CV) method. Under this method, individuals are placed in a realistic, credible, but hypothetical, market transaction situation in which they are asked about their willingness-to-pay (WTP) for a change in the availability of a given commodity. The WTP is typically elicited via either open valuation questions (e.g. open-ended format) or "closed" valuation questions (e.g. dichotomous choice, iterative bidding and payment card formats). An open question directly asks respondents for their WTP, whereas a closed question presents respondents with predefined bid amounts from which they have to provide their WTP responses (Champ and Bishop, 2006). Due to several limitations, open valuation questions have been progressively abandoned in favor of closed valuation questions (Bateman et al., 2002).

One major strength of the CV method is flexibility (Whitehead et al., 2008), which renders it particularly relevant for *ex-ante* valuations of nature conservation policies and makes it the only method capable of capturing the non-use values (both bequest and existence values). This flexibility, however, may be a weakness as it exposes the CV method to various potential biases (for a review, see Mitchell and Carson, 1989). Though some of these biases are related to methodological flaws, others appear to challenge the economic theory underpinning this method (Bateman et al., 2002). The CV is deeply rooted in the theoretical body of neoclassic welfare economics, and one of the fundamental assumptions is that individuals have well-formed and stable preferences. The implication is that WTP values, the monetary indicator of preferences, should be insensitive to changes in irrelevant constituents of the hypothetical proposed transaction. From the standard economic theory, these refer to factors that are not expected to influence

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individuals' preferences. In the context of closed valuation questions, irrelevant factors are (among others) the order of presenting bid amounts (ascending, descending or random), the alignment format (horizontal, vertical or circular) and the presentation format (all bid amounts together on one sheet or each bid amount separately). Contrary to expectations from economic theory, CV studies show an ordering effect, with the ascending order format generating significantly lower WTP values than the descending or the random order format (e.g. DeShazo, 2002; Smith, 2006; Alberini et al., 2003; Wang et al., 2013). Likewise, they highlight an alignment effect, with the circular PC producing higher welfare estimates than the PC format where the bid amounts are vertically arranged (Chanel et al., 2016).

The existence of these effects is an important issue as it raises the question of the validity of WTP responses and consequently their use to help guide efforts related to nature conservation. It also raises the question of how mitigate such anomalies. Alberini et al. (2003) suggest that (but do not test whether) ordering effect is due to respondent uncertainty about their exact WTP values. In this paper, we empirically test their hypothesis in the context of the WTP survey for salt marsh conservation in the Brest roadstead. To the best of our knowledge, few CV studies have estimated the public WTP for salt marsh conservation (e.g. Udziela and Bennett, 1997; Bauer et al., 2004; Whitehead et al., 2006) and no studies have examined the potential link between respondent uncertainty and ordering effect. Consequently, our paper contributes to the literature on the economic valuation of salt marsh conservation and the sensitivity of WTP under irrelevant information conditions, in particular under changes in the order of presenting bid amounts.

The ordering effect is tested for two groups of respondents separately: respondents who are fully sure about their exact point value and respondents who are unsure about their exact point value. The test is carried out using the PC format, one prevalent closed elicitation formats used in CV studies (Champ and Bishop, 2006).[1] Recent examples of studies using such elicitation format include Lindhjem and Navrud (2011), Carlsson et al. (2012), Cook et al. (2012), Hoffmann et al. (2012), Huang et al. (2015) and Lo and Jim (2015). Valuation uncertainty is captured through a variant of PC valuation question where respondents have the option between reporting their WTP as either a single point value (if they are fully sure about the exact amount they would be willing to pay) or an interval (if they are unsure about their point value). This valuation format is based on the opinion that respondents only have a true point value in their mind, but some may be uncertain about their true WTP and can only place it within an interval (Hanemann et al., 1996; Håkansson, 2008; Hanley et al., 2009).

This paper aims at valuing respondents' WTP for salt-marsh conservation in the Brest roadstead (France). Furthermore, it provides the first exploration of the potential link between the sensitivity of WTP to the order of presenting bid amounts in contingent valuation questions (ordering effect) and respondent uncertainty. The results suggest that (1) respondents place substantial WTP values on salt marsh conservation, and (2) the ordering effect is related to respondent uncertainty in that fully sure respondents are insensitive to changes in the order of presenting bid amounts, whereas unsure respondents react differently to such changes. For this latter group, putting bid amounts in ascending order generates lower WTP values than putting bid amounts in descending order or random order. The paper is structured as follows: Section 2 presents the theoretical framework and hypotheses we set out to test, followed by a background of salt marsh conservation in the Brest roadstead in Section 3. Section 4 describes the data collection process. Section 5 explains the methodology used for data analysis, while Section 6 presents the results. Discussions and concluding comments are reported in Section 7.

2. Theoretical Framework and Hypothesis Formulation

Psychologists have long demonstrated that decision-making outcomes may be influenced by price ordering. In the pricing context, adaptation-level theory (Helson, 1964) suggests that consumers perceive purchase prices differently depending on whether they are preceded by higher or lower prices. In other words, when buyers encounter ordered prices, the first price serves as a reference point (an anchor) that influences their perception of other prices, therefore their purchase decision making (Monroe, 1990; Bennett et al., 2003). Della Bitta and Monroe (1974) test this theory by exploring the effect of the order of price presentation on consumers' judgments of the relative expensiveness of alternative prices. They find that common prices ($10 to $20) for the same product are perceived as being significantly more expensive by respondents evaluating them in increasing order than respondents evaluating the same prices in decreasing order. The conclusion is that when initially faced with high prices (low prices), people tend to perceive subsequent prices as less expensive (more expensive) than they would if they initially saw low prices (high prices) (Monroe, 1990).[2] This perceptual effect might explain why the ascending order format has a tendency to yield significantly lower welfare estimates than the descending format. The theory for reference prices, however, does not tell whether the perceptual effect occurs regardless of whether consumers are fully sure or unsure about the exact price that they are willing to pay for the offered product.

The economic theory of consumer behavior tells a different story that price ordering has no impact on purchasing decision as long as all relevant terms of exchange remain constant (Arrow, 1982). The rationale is based on the assumption of completeness, which states that consumers have well-defined preferences for any choice they are faced with (Pindyck and Rubinfeld, 2005). Empirical evidence contradicts this assumption by showing that some respondents are rather uncertain about their valuation responses (see Akter et al., 2008). Kahneman and Sugden (2005) argue that an anchoring effect can arise when respondents are uncertain regarding the value they place on a resource, implying that they could be sensitive to price ordering. Because they do not have well-formed preferences, uncertain respondents are more inclined than certain respondents to adjust their values depending on how the bid amounts are arranged. In other words, confronted with a closed valuation question, uncertain respondents are inclined to use the first offered bid amount as a focal point or an anchor, which is likely to affect their perception of subsequent bid amounts. In the case of a list of bid amounts arranged in ascending order, the first bid amount makes each subsequent amount like “much money”, which would lead the respondents to tick amounts located at the top of the list. The reverse phenomenon would occur in the case of a set of bid amounts arranged in descending order. This problem is termed “starting point bias” (Mitchell and Carson, 1989) and has been highlighted in previous studies (e.g. Herriges and Shogren, 1996; Alberini et al., 2003; Smith, 2006; Luchini and Watson, 2013).

Based on this background, we can formulate our first hypothesis. We hypothesize that ordering effect is related to respondent uncertainty in that only uncertain respondents are sensitive to the order of presenting bid amounts. For these respondents, we expect that the ascending order version yields significantly lower welfare estimates than the descending version.

It has been suggested that randomizing bid amounts might weaken the anchoring heuristic evident in the case of valuation questions presenting a list of ordered bid amounts (Covey et al., 2007). By randomizing the bid amounts, the analyst may hope to reduce the risk that the

[1] Although the dichotomous choice (DC) format has been endorsed by the NOAA panel (Arrow et al., 1993), Boyle (2003) claims that it is far from clear that DC represents the better elicitation format. In the same vein, other authors (e.g. Bateman et al., 2002; Champ and Bishop, 2006) argue that no one single format is problem free.

[2] Prospect theory also provides a basis for the reference price concept (see Kahneman and Tversky, 1979).

rank of bid amounts is perceived as conveying an implicit signal about the true value of the resource. In addition, the focus on the same first bid amount is attenuated, since each respondent in the sample is intended to receive a different randomized sequence. An opposite opinion is that the random order version makes the valuation task fundamentally more expensive in terms of cognitive effort (Andersen et al., 2006). In the context of the CV method, one way to evaluate the cognitive effort required by a valuation question refers to the protest response rate (Mitchell and Carson, 1989). For example, the open-ended format is considered to be more cognitively burdensome than the closed formats because it produces an "unacceptably" large number of protest responses (Mitchell and Carson, 1989). When the survey captures respondent uncertainty in terms of a valuation interval, in our view, another way to evaluate the cognitive effort refers to the interval response rate and/or reported degree of uncertainty. This corresponds to the size of the interval (Håkansson, 2008; Hanley et al., 2009). The intuition behind our view is that the harder a valuation question from a cognitive perspective, the less inclined respondents could be to examine their preferences at the moment of interview. Therefore, they would be more likely to report their values as an interval (since this valuation response option, presumably, requires less cognitive effort than the single point valuation option) and/or to report large size of interval. Thus, under our opinion, the random order version would yield a significantly higher protest rate, higher interval response rate and/or higher mean size of interval response than ordered versions.

Based on these conflicting opinions, we can formulate the following hypotheses. For uncertain respondents, if the opinion that the random version mitigates the perceptual effect is true (rather than the one related to the cognitive effort), we hypothesize that the random version yields welfare estimates falling between the welfare estimates of the ascending version and that of the descending version. In contrast, if the opinion related to the cognitive effort is true (rather than the one related to the perceptual effect), it is unclear how the random version would influence welfare estimates relative to ordered versions (since a higher protest response rate should produce lower welfare estimates, whereas a higher size of WTP interval should produce higher welfare estimates).

3. Salt Marshes in the Brest Roadstead

Covering >165 ha, salt marshes are one the main natural assets of the Brest roadstead. They play a critical role in the functioning of the coastal system (Radureau, 2005). They produce great amounts of organic matter, a part of which can be used directly by marine invertebrates. This organic matter mostly enriches mud flats of the roadstead, through phytoplankton, which feeds oysters, mussels, shells and many other wild invertebrates (Radureau and Loison, 2005). At high tide, some fish species are given the opportunity to feed with little crustaceans that are numerous in salt marshes. Due to their land-sea interface position, salt marshes contribute to regulating over floods, straining particles and nutriments from catchment areas. They also provide a habitat for wintering bird species. In addition, they shelter the lax-flowered sea-lavender, scientifically known as *Limonium humile*, which is one of the rarest protected plants on the French and Northwestern European coastlines. The Brest roadstead is the only French location sheltering such species. Finally, salt marshes support many professional and recreational activities undertaken in the roadstead, such as fishing, shellfish aquaculture, fish farming, hunting, hiking, water sports and naturalistic observations.

Salt marshes in the Brest roadstead are particularly threatened by an invasive alien species, *Spartina alterniflora*. A mapping carried out by the *Conservatoire Botanique National de Brest* in 2004 shows that 59% of salt marshes are invaded by the Spartina. Given the speed at which this invasive species expands, this number has probably increased. The potential consequences of *Spartina alterniflora* in terms of loss of and/or changes in the provision of ecosystem services have been widely documented (e.g., Hedge and Kriwoken, 2000; Stenzel et al., 2002; Lefeuvre et al., 2003; Neira et al., 2006). In the Brest roadstead, several studies have been undertaken on *Spartina alterniflora*, but the current state of knowledge does not allow to precisely measure its impact on salt marshes. Nevertheless, due to the extent of the spread and the resulting visual impact on the landscape, there is currently strong demand from stakeholders to fight against the spread of *Spartina alterniflora*.

As part of the European Natura 2000 network and the application of the Habitats Directive, the end of the Brest roadstead has been designated as Natura 2000 site in order to implement a management scheme to maintain this area in a satisfactory state of conservation. The Regional Natural Park of Armorique is operating this Natura 2000 site. A management document identifies several actions to undertake in order to locally limit the spread of Spartina. Since 2010, a number of them have been separately tested through experimental sites. Of these actions, two are considered to be the most efficient ones by the team of experts from the regional park (see Fig. 1). These actions will be jointly undertaken in a number of sites, in particular in the Troaon site. This site (located at the Commune of l'Hôpital-Camfrout) has been identified as being a priority site because salt marshes are still well-preserved, the spread of *Spartina alterniflora* is limited and a request was explicitly made from the municipality office to preserve this site (www.pnr-amorique.fr).

4. Survey Design and Data Collection

The CV questionnaire was designed in January 2013 and then pre-tested on a sample of 60 residents in the Brest roadstead under the same conditions to be followed in the final survey. The objective of the pre-test was (1) to examine whether the CV scenario as well as the payment method were understandable and credible; (2) to determine the most suitable number and levels of bid amounts in order to avoid the application of inappropriate range of values for the full sample in the main survey (Cameron and Huppert, 1989). To this end, an open-ended elicitation format was employed as suggested by Bateman et al. (1995).

Action 1. The use of a black sheet to stifle the invasive plant

Action 2. The digging of small tranches near the *Spartina alterniflora* area to avoid its spread

Fig. 1. The salt marsh conservation project.

4.1. The Contingent Scenario

The resource being valued was a public project to protect salt marshes against the spread of *Spartina alterniflora* in the Brest roadstead. The scenario began with defining the term "salt marsh" and showing a picture of salt marshes in the Brest roadstead so that all respondents knew what they were being asked to value. This was followed by a description of main ecosystem services provided by salt marshes in the roadstead. Next, respondents were informed about the growing threat from the Spartina. A picture depicting the spread extent was shown. At this stage, the two salt marshes conservation actions previously mentioned were described and visualized by respondents. Subsequently, they were told that these actions would be jointly undertaken in Troaon site as part of a salt marsh conservation program.

4.2. The Payment Vehicle

Initially, a special tax and a one-time donation were considered. Based on feedback from a focus-group, the one-time donation was selected. There seems to be a consensus among economists that donation should be used only when mandatory payment vehicles (e.g. tax) are awkward (Bateman et al., 2002). The reason is that the voluntary payment encourages free-riding and strategic behavior (Bateman et al., 2002). In our case, given the "small-scale public good" nature of the resource under valuation, the use of taxes is unfeasible (Champ et al., 1997; Champ and Bishop, 2001). In other words, it is highly unlikely, if not impossible, that such a funding mechanism is set up only at the Brest roadstead level. Other factors also motivated our choice. For example, donation is less prone to protest responses than the tax (Champ et al., 1997). It may be a better choice that the tax when the PC format is used (Champ and Bishop, 2006) in that it is usually associated with this elicitation format in actual donation programs. It may also be more credible than the tax as respondents are familiar with messages calling for donations to fund nature conservation programs. Finally, several studies have successfully implemented actual and contingent voluntary payment comparisons (see Champ and Bishop, 2001), and the donation remains one of the payment vehicle often used in stated preference studies valuing biodiversity conservation (e.g. Morse-Jones et al., 2012; Choi, 2013; Fleischer et al., 2013; Jobstvogt et al., 2014; Yang et al., 2014; Soy-Massoni et al., 2016).

4.3. The Payment Card Valuation Question Format

We adopted the classic and interval payment card (CIPC) format introduced by Voltaire et al. (2013) that allows for expression of uncertainty in terms of a valuation interval. However, the issue of uncertainty was made more salient in our survey through adjustments in the design of the card and the wording of the valuation question, so that uncertainty is the only major reason why respondents can choose to formulate their WTP as an interval (see Box 1). Our PC format consists of two options: Option A and Option B. Option A consists of a single sequence of bid amounts horizontally arranged and exposed all together on one sheet. Option B consists of two separate and similar sequences of bid amounts also horizontally arranged and exposed simultaneously to respondents. This contrasts with Smith (2006) where both the ascending and descending PC versions present the bid amounts together, whereas the random version presents the bid amounts on separate cards. The consequence is that differences observed in mean WTP across the versions might not be due to the only ordering effect; rather they would reflect the combined effect of the order formats and the use of separate cards. In our case, since the three PC versions only differ in terms of order formats, differences in welfare estimates, if any, would reflect the ordering effect.

While at the same time seeing the card, respondents were told that if they are completely sure about the exact point amount they would be willing to pay, they have to use Option A, i.e., to pick this amount from the card or report it in the blank box labeled "other amount" if this amount is not included in the card. If they have any doubt about their exact point amount, they have to use Option B, i.e., to indicate the interval in which their true WTP lies. In other words, they have to pick from the card or report in the blank box (if necessary) the lower and upper bounds of this interval. Based on results of the pre-test, we decided to use 12 bid amounts.

4.4. Sample and Survey Execution

Since 12 bid amounts were chosen, a sample of 12! respondents was needed for the random version to achieve all possible combinations. Given our budget limitations, we selected about 120 respondents for each PC version, giving a pooled sample of 364. Regarding the random version, the 122 sequences were generated using the functions ALEA and RANK in Excel. Given the very small number of sequences drawn relative to possible ones, we imposed two constraints during the randomization process to ensure that bid amounts are "shuffled" as best as possible: (1) each sequence generated is unique; therefore each respondent receives a distinct sequence; (2) each amount holds at least four times each rank on the card; that is, each amount has a non-zero probability of holding the rank j on the card, where $j = 1, \ldots, 12$.

Data was collected from July to August 2013 through face-to-face interviews by three well-trained enumerators. The different municipalities of the Brest roadstead were grouped into three zones on the basis of their geographical and socio-economic proximities. In each zone, interviews took place on weekdays and weekends at various distinct locations using a quota sampling with regard to age and gender based on the 2012 National Institute of Statistics and Economic Studies dataset. They were conducted on the same days at the three zones. Only residents in the Brest roadstead aged 18 years or older were surveyed. Respondents were randomly allocated to one of the three PC versions. A total of 361 individuals were surveyed. Table 1 presents the list of variables constructed from their responses.

5. Brief Description of Econometric Specification

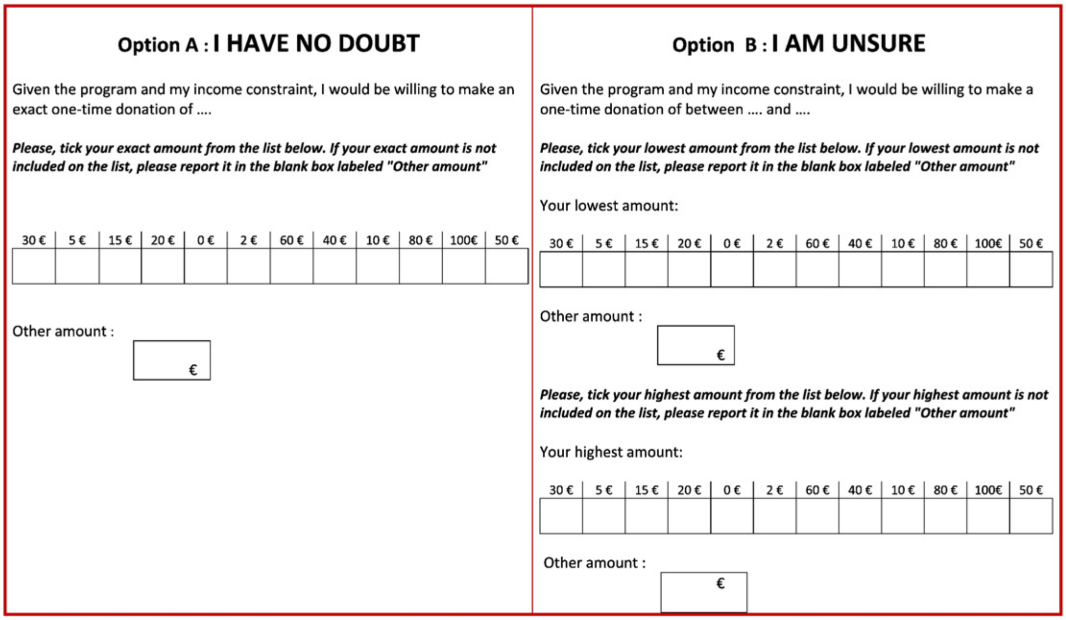
The WTP data is analyzed via parametric and non-parametric approaches. Because non-parametric estimators only impose monotonicity, they provide a good starting point to address our objective (Bateman et al., 2002).[3] For continuous data, the estimation of the non-parametric mean WTP is done through the Kaplan-Meier product limit estimator. For the interval data, the Turnbull's self-consistency algorithm is used as our PC valuation format produces overlapping intervals.

Non-parametric estimators, however, fail to account for some problems likely to bias mean WTP. In our case, since the decision to report a single point value or an interval is based on individual self-selection, a potential sample selection bias may occur. Consequently, sensitivity analysis of mean WTP to PC versions requires that such a problem should be controlled for, which may be done only through parametric models. We control for this using the maximum likelihood interval regression (Cameron and Huppert, 1989) with selectivity. This involves estimating interval regression models for each group of respondents separately (fully sure and unsure samples). The models include (in addition to regressors presented in Table 1) an additional one, the inverse Mills' ratio, that controls for the potential sample selection bias. It is estimated via parameters of a binary Probit model estimating the likelihood of being fully sure or not.

To allow WTP equations for fully sure and unsure respondents to be modelled using the same maximum likelihood framework, continuous

[3] Bateman et al. (2002) note that non-parametric estimation is an indispensable step in the analysis of CV data as long as one simply wants to estimate mean WTP or to explore the sensitivity of mean WTP to changes in the constituents of the proposed market transaction.

Box 1
A series of the payment card version.


Option A : I HAVE NO DOUBT

Given the program and my income constraint, I would be willing to make an exact one-time donation of ....

Please, tick your exact amount from the list below. If your exact amount is not included on the list, please report it in the blank box labeled "Other amount"

30 €	5 €	15 €	20 €	0 €	2 €	60 €	40 €	10 €	80 €	100€	50 €

Other amount : €

Option B : I AM UNSURE

Given the program and my income constraint, I would be willing to make a one-time donation of between .... and ....

Please, tick your lowest amount from the list below. If your lowest amount is not included on the list, please report it in the blank box labeled "Other amount"

Your lowest amount:

30 €	5 €	15 €	20 €	0 €	2 €	60 €	40 €	10 €	80 €	100€	50 €

Other amount : €

Please, tick your highest amount from the list below. If your highest amount is not included on the list, please report it in the blank box labeled "Other amount"

Your highest amount:

30 €	5 €	15 €	20 €	0 €	2 €	60 €	40 €	10 €	80 €	100€	50 €

Other amount : €

WTP data (data gathered from fully sure respondents) should be converted into interval data. The common practice is to treat the point value as a minimum indicator of the respondents' true WTP, which is assumed to lie between this point value and the next highest amount on the card. In our survey, however, since respondents had the choice between two WTP response options (single point or interval) and also had the opportunity to report their own amounts (if necessary), this assumption (typically made in the case of the traditional PC format) does not hold. Thus, we opted for converting each single point value to a tight interval bounded by this single point in the left side and by the same single point + 0.001€ in the right side.[4] Details about both approaches are provided in Supplementary material.

6. Results

6.1. Statistical Analysis

About 35% of respondents do not want to pay anything at all (i.e. lower value = upper value = 0). Of these people, the analysis of main reasons given for not wanting to pay leads to the identification of 59.4% of protest bidders and 40.6% of true zero bidders. Protesters are those respondents who state: "the payment mechanism is inappropriate"; "I have too little information about the project"; "it is not my responsibility to pay". Respondents treated as true zero bidders are those who state: "my income does not allow me to pay"; "it is not necessary to protect salt marshes"; "I have other priorities"; "I do not feel concerned". No significant differences are found about the distributions of non-payers across the PC versions using the Pearson χ^2 test. The same conclusion applies when focusing on the distributions of protest bidders (Table A in Supplementary material). In the following analysis, protest responses are excluded after ensuring that their exclusion does not change the results.[5]

About 59% of respondents are fully sure about their valuation as they report an exact WTP and 40.7% are unsure as they report an interval. Paired comparisons based on Pearson χ^2 test shows that the distributions of unsure respondents are statistically similar across the PC versions. This issue is further explored by considering the reported uncertainty level (single point bidders excluded), which is defined in terms of absolute difference between the bounds of the intervals. The results indicate no significant differences using the Mann-Whitney test. No significant differences are also found across the PC version when looking at the distributions of absolute differences using the Kolmogorov-Smirnov test (Table B in Supplementary material). Taken together, these results suggest that the random PC version is not cognitively more demanding than the ordered versions.

Significant differences are found between fully sure respondents and unsure respondents using the Mann-Whitney test. This suggests that we are confronted with two distinct groups of respondents, and as such they are likely to react differently to the order of presenting bid amounts. We also test for differences across PC versions for each group of respondents separately. The null hypothesis of equality is rejected in very few cases. We control for this via multivariate analysis. For more details about these results, see Supplementary material.

6.2. Econometric Analysis

The results of the parametric models are summarized in Tables 2, 3 and 4. The explanatory variables included in these models are selected after controlling for the multicollinearity problem. Table 2 provides the results of two Probit models, with Model 1 estimating the

[4] A somewhat similar strategy was initially developed by Welsh and Poe (1998) to allow single point data to be modelled with the same bounding framework used to analyze interval data.

[5] The rationale for this choice is that, by definition, protest bidders do not evaluate their value. Therefore, they cannot be considered to be sure about their zero responses. In addition, the results of a sample selection model to account for protest responses conclude that a sample selection bias associated with the decision to report a protest response is not a concern in our study, since the inverse Mills' ratio is not significant.

Table 1
Descriptive characteristics.

Variables	Description and coding	Mean, (Std. Dev.)
Contribution	1 if the respondent has already contributed for the realization of a nature conservation program through donations or voluntary work; 0 otherwise	0.21 (0.407)
Info_saltmarsh	1 if the respondent has already heard about salt-marshes; 0 otherwise	0.65 (0.479)
Aware_problem	1 if the respondent was aware of the salt-marsh conservation problem in Brest roadstead; 0 otherwise	0.24 (0.429)
Imp_scenario	Rating of the importance of the salt march conservation program for the respondent (1 = not at all important; 2 = somewhat important; 3 = important; 4 = very important)	2.99 (0.702)
Participants	Rating of the potential number of donors for the program (1 = very small; 2 = small; 3 = large; 4 = very large)	2.15 (0.638)
Prog_implementation	1 if the respondent thinks that the program would be implemented; 0 otherwise	0.15 (0.353)
Male	1 if male; 0 otherwise	0.46 (0.499)
Age	Age in years	48.90 (17.734)
Education	Level 0 = no diploma, …, level 6 = post graduate studies	3.28 (1.255)
Income	The midpoint of household income brackets in euros	2500.84 (1442.59)

probability of being fully sure and Model 2 estimating the probability of giving a protest response. Tables 3 and 4 present the results of the interval regression models. For each sample, the restricted model formally examines the ordering effect by using the dummy variables for the PC versions as the only regressors, as in Alberini et al. (2003), the unrestricted model without selectivity ignores the sample selection bias and the unrestricted model with selectivity accounts for this bias.

Starting with the fully sure sample (Table 3), the parameter for the descending and random versions are not significant in any of the three models, suggesting that these PC versions yield similar WTP values as compared to the ascending version. The null hypothesis of equality of parameters for the descending and random versions cannot be rejected ([χ^2 (1*df*) = 0.44, p-value = 0.50; χ^2 (1*df*) = 0.60, p-value = 0.44; χ^2 (1*df*) = 0.58, p-value = 0.45 for the three models, respectively), suggesting that respondents value the salt marsh conservation program in the same way when faced with a descending or randomized PC version. These results suggest that an ordering effect is not present for respondents who are fully sure about their valuation. We have a different story with regard to unsure respondents (Table 4): the descending and random versions lead to higher values as compared to the ascending version in both the restricted model and unrestricted model without selectivity, whereas only the parameter for the random version is significant in the unrestricted model with selectivity. Paired comparisons of parameters for the descending and random versions suggest no significant differences [χ^2 (1*df*) = 0.00, p-value = 0.98; χ^2 (1*df*) = 0.17, p-value = 0.68; χ^2 (1*df*) = 0.25, p-value = 0.61 for the three models, respectively]. The fact that at least one of the parameters for the PC versions is significant suggests that there is an ordering effect for respondents who are unsure about their valuation. The same conclusion applies when estimating linear interval regression models or OLS regression models where the midpoints of intervals are taken as approximations to the true WTP values of unsure respondents. The results are available upon requests.

Mean WTP estimates and associated 95% confidence intervals (CI) are reported in Tables 5 and 6. For the fully sure sample, the three PC versions statistically produce the same mean WTP whatever the estimation method used (i.e., parametric or non-parametric method), since the CIs overlap. In contrast, for the unsure sample, the mean WTP obtained from the ascending version is significantly lower than the mean WTP obtained from the descending version, since the CIs do not overlap, except for the unrestricted model with selectivity where the difference in mean WTP estimates is not significant. For both estimation methods used, the mean WTP estimate from the ascending version is significantly lower than the mean WTP estimate from the random version, since the CIs do not overlap, whereas the mean WTP estimates from the descending and random versions are statistically identical, since the CIs overlap. These results provide statistical evidence that an ordering effect is only present for unsure respondents.

Table 2
Probit model of being fully sure and (Model 1) and Probit model of protesting (Model 2).

	Model 1: fully sure = 1		Model 2: protest response = 1	
	Coefficients	p-Value	Coefficients	p-Value
Constant	−0.427 (0.533)	0.423 ns	−0.361 (0.587)	0.538 ns
Contribution	−0.127 (0.506)	0.506 ns	−0.022 (0.206)	0.916
Info_saltmarsh	−0.127 (0.190)	0.505 ns	0.174 (0.216)	0.421 ns
Aware_problem			−0.371 (0.202)	0.066*
Descending version	−0.161 (0.188)	0.391 ns	0.048 (0.194)	0.804 ns
Random version	−0.127 (0.183)	0.489 ns	−0.075 (0.200)	0.708 ns
Ascending versions	Reference		Reference	
Imp_scenario	−0.096 (0.118)	0.414 ns	−0.039 (0.116)	0.738 ns
Participants	−0.195 (0.121)	0.10*	−0.555 (0.144)	0.000***
Prog_implementation	0.323 (0.258)	0.210 ns	−0.395 (0.222)	0.075*
Male	−0.014 (0.154)	0.928	−0.018 (0.162)	0.912
Age	0.011 (0.005)	0.050**	0.015 (0.006)	0.010***
Income	−1.38e-04 (5.78e-05)	0.017**	4.84e-05 (5.98e-05)	0.418 ns
Education			0.060 (0.077)	0.430 ns
Log pseudolikelihood	−190.716		−162.336	
Wald Chi2	16.15*		47.85***	
Pseudo R2	0.0406		0.1284	
Observations	288		364	

Robust standard errors in parentheses, ns means non-significant.
*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.

7. Conclusions and Discussions

The objective of this research was to assess respondents' WTP for salt march conservation in the Brest roadstead. More specifically, we have tested the hypothesis that the WTP sensitivity to the order of presenting bid amounts is linked to respondent uncertainty about their true point values. An ordering effect was detected only for uncertain respondents. We can interpret this as good news for CV in that it provides evidence that fully sure respondents (respondents who have well-defined preferences for a good) may behave as economic theory predicts. In contrast, because they do not have well-defined preferences, uncertain respondents reacted differently according to whether they were confronted with bid amounts listed from low-to-high, high-to-low or randomly. Specifically, for uncertain respondents, we found that the ascending version resulted in significantly lower values that the descending version or random version, which is in line with our expectations. As stated earlier, the classic explanation for this difference is the starting point bias issue. Elicitation formats that present a panel of bid amounts have been developed to avoid this bias by reducing the focus on a single bid or on two sequential bids (Cameron and Huppert, 1989). Our results suggest that, when people do not have well-defined preferences for the resource being valued, even if all bid amounts are simultaneously exposed, the first bid amount still provides them a focal point or anchor, and therefore influences their perception of other bid amounts.

We also found some evidence that WTP values from uncertain respondents are statistically similar across the descending and random

Table 3
Interval regression models for fully sure respondents.

	Restricted model		Unrestricted model without selectivity		Unrestricted model with selectivity	
	Coefficients	p-Value	Coefficients	p-Value	Coefficients	p-Value
Constant	1.871 (0.209)	0.000***	−1.011 (0.898)	0.260 ns	−4.464 (1.529)	0.107 ns
Info_salt			−0.479 (0.286)	0.094*	−0.657 (0.292)	0.025**
Aware_problem			0.218 (0.286)	0.445 ns	0.169 (0.295)	0.567 ns
Descending version	−0.179 (0.323)	0.580 ns	−0.162 (0.313)	0.606 ns	−0.265 (0.322)	0.410 ns
Random version	0.040 (0.300)	0.895 ns	0.060 (0.282)	0.832 ns	−0.005 (0.277)	0.986 ns
Ascending version	Reference		Reference		Reference	
Imp_scenario			0.518 (0.155)	0.001***		
Prog_implementation			1.293 (0.539)	0.016**	1.993 (0.547)	0.000***
Male			0.050 (0.257)	0.846 ns	−0.022 (0.261)	0.931 ns
Age			0.009 (0.008)	0.283 ns	0.030 (0.011)	0.010***
Income			1.79e-04 (8.31e-05)	0.031**	−5.55e-05 (1.28 e-04)	0.665 ns
Education			−0.148 (0.109)	0.175 ns	−0.199 (0.109)	0.069*
Lambda					2.747 (1.211)	0.023**
Lnsigma	0.417 (0.030)	0.000***	0.329 (0.043)	0.000***	0.320 (0.046)	0.000***
Log pseudolikelihood	−1480.308		−1467.952		−1457.081	
Wald Chi2	0.49		33.99***		20.32**	
Observations	140		140		140	

Robust standard errors in parentheses, ns means non-significant.
*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$

PC versions. This works against our expectations expressed in Section 2. It suggests that the random version is as prone to starting point bias as ordered versions. Future research should investigate this issue. For example, one could compare the random version with the classic and interval open-ended format developed by Håkansson (2008). As this elicitation format directly asks respondents to state WTP as either an exact amount or an interval, it is intended to be free from starting point bias, and hence it is the "gold standard" for such type of comparison.

Having established a link between ordering effect and respondent uncertainty, one question that now arises is how to mitigate such bias. Our results provide two options. The first option would be to restrict the analysis to only respondents who are fully sure about their point values. This is valid only if the proportion of uncertain respondents is negligible, which may occur for familiar goods. However, for unfamiliar goods, a substantial proportion of respondents may be uncertain. In this case, removing uncertain respondents is likely to result in a final sample that is not representative of the whole target population, thereby weakening the justification for aggregating estimates of mean or median WTP. Sample selection bias might also occur if uncertain respondents are different from fully sure respondents. Thus, it may not be rationale from a point of view of validity to drop uncertain responses.

The second option would be to act on the causes of uncertainty to help respondents to become less unsure as possible, if not fully sure about their point valuation. For this purpose, the valuation exercise could be combined with participatory or informative approaches, such as the deliberative polling introduced by Fishkin (1988). Spash (2008) has termed this combined method as "deliberative monetary valuation (DMV)". The deliberative process allows for discussion and reflection upon all relevant aspects of the proposed hypothetical transaction, so that all respondents (in particular those who are initially uncertain) form preferences clear, reasonably stable, and as a result formulate robust WTP values.[6] The DMV may be one way of dealing with the issues and concerns about the CV method expressed (for example in Sagoff, 2000). However, these approaches coupled with economic valuation may be difficult to apply to some individuals potentially committed to the preservation of an environmental asset, such as the tourists, due to the specificity of this target population. Improving the familiarity of respondents with the good being valued through more complete information in the CV survey, allowing them to directly or indirectly experience the good prior to the valuation question, using cheap talk scripts are other means likely to alleviate respondents' preference uncertainty, and thus improve the quality of their responses.

Unfortunately, some uncertainty cannot be completely eliminated, especially when it is due to socio-economic and demographic factors. This leads us to the second question raised by our results, namely which one of the three PC versions should be preferred when dealing with all respondents regardless of their uncertainty. As stated earlier, the main argument against valuation questions where bid amounts are randomly exposed is that they are cognitively more expensive for respondents than questions using ordered bid amounts. Our results suggest that this argument does not hold when using the protest response rate and reported uncertainty level as indicators of cognitive effort. However, the issue of whether the random version is preferable to ordered versions requires that additional criteria should be considered (e.g., the ability of the random version to mitigate the perceptual effect and its compatibility with the different survey modes, including the internet survey). This issue is beyond the scope of our study. In the absence of justification for the superiority of one version over the other, we would be inclined to favor the version that gives the minimum value for the mean WTP, because a conservative estimate of non-market benefits is preferable for policy purposes. With this in mind, we estimate the mean WTP for the pooled sample for each PC version separately using the non-parametric approach. This provides the lower bound for the mean/median WTP (Bateman et al., 2002). The results indicate that the ascending version produces the lowest mean WTP value, which is about 13.06€. This value represents the lower bound of non-market benefits derived from the salt-marsh conservation project in the Brest roadstead.

It may be necessary to test the robustness of our results using (for example) other non-market goods, a vertical alignment of bid amounts,

[6] Fischhoff and Furby (1988) identify three relevant constituents of any proposed transaction: something being received (the good), something being given in exchange (the payment) and the social context within which the exchange would be enacted (the marketplace).

Table 4
Interval regression models for unsure respondents.

	Restricted model		Unrestricted model without selectivity		Unrestricted model with selectivity	
	Coefficients	p-Value	Coefficients	p-Value	Coefficients	p-Value
Constant	2.580 (0.106)	0.000***	1.437 (0.491)	0.003***	2.893 (0.569)	0.000***
Info_salt			0.396 (0.162)	0.014**	0.260 (0.170)	0.127 ns
Aware_problem			−0.101 (0.151)	0.505 ns	−0.076 (0.148)	0.607 ns
Descending version	0.318 (0.154)	0.039**	0.257 (0.154)	0.096*	0.206 (0.151)	0.174 ns
Random version	0.313 (0.152)	0.039**	0.318 (0.149)	0.033**	0.269 (0.145)	0.065*
Ascending version	Reference		Reference		Reference	
Imp_scenario			0.285 (0.132)	0.031**		
Prog_implementation			−0.125 (0.165)	0.451 ns	0.172 (0.203)	0.397 ns
Male			−0.099 (0.123)	0.419 ns	−0.108 (0.122)	0.374 ns
Age			0.237e-05 (0.004)	0.578 ns	0.015 (0.006)	0.012**
Income			5.79e-06 (4.50e-05)	0.898 ns	−1.52e-04 (8.57e-05)	0.076*
Education			0.036 (0.051)	0.481 ns	0.023 (0.051)	0.657 ns
Lambda					1.917 (0.834)	0.022**
Lnsigma	−0.307 (0.0605)	0.000***	−0.387 (0.058)	0.000***	−0.391 (0.058)	0.000***
Log pseudolikelihood	−244.751		−233.652		−233.043	
Wald Chi2	5.75*		28.27***		30.74***	
Observations	148		148		148	

Robust standard errors in parentheses, ns means non-significant.
*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.

Table 5
Predicted mean WTP and associated confidence intervals for fully sure respondents.

	Fully sure sample			
	Parametric estimation			Non-parametric estimation
PC versions	Restricted model Mean WTP (€)	Unrestricted model without selectivity Mean WTP (€)	Unrestricted model with selectivity Mean WTP (€)	Mean WTP (€)
Ascending version	19.53	15.84	16.51	13.84
95% CI	[10.33–30.75]	[10.07–23.62]	[10.49–25.27]	[9.37–18.31]
Descending versions	16.17	13.33	12.72	15.11
95% CI	[8.64–25.71]	[8.57–20.09]	[8.05–19.39]	[8.19–22.04]
Random version	20.37	16.88	16.79	14.25
95% CI	[10.75–31.99]	[10.70–25.07]	[10.43–25.14]	[9.66–18.85]

separate cards and/or a mandatory payment vehicle. As we earlier mention, the voluntary payment vehicle provides incentives to free-riding or strategic response. However, there is reason to believe that the free-riding critic is not persuasive if we refer to the parameters for the variable "Participants". In Table 2 (Model 2), it is significantly negative, indicating that the more respondents believe that others will donate for salt-march conservation, the lower the likelihood of protesting (i.e., the higher the likelihood of participating in the market). A similar negative effect (not reported here) was found when recoding the dependent variable as 1 if the respondent does not want to pay anything at all and 0 otherwise. A positive effect would have suggested a free-riding problem (the more the respondents believe that others will donate, the higher the likelihood of avoiding to pay). Though these results do not provide a firm evidence of the absence of free-riding/strategic behaviors, they allow us at least to be reasonably confident.

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Table 6
Predicted mean WTP and associated confidence intervals for unsure respondents.

	Unsure sample			
	Parametric estimation			Non-parametric estimation
PC versions	Restricted model Mean WTP (€)	Unrestricted model without selectivity Mean WTP (€)	Unrestricted model with selectivity Mean WTP (€)	Mean WTP (€)
Ascending version	16.31	15.95	16.55	12.23
95% CI	[14.95–19.67]	[14.86–19.04]	[15.39–19.71]	[9.95–14.50]
Descending version	22.80	20.91	20.57	19.18
95% CI	[20.55–27.05]	[19.21–24.61]	[18.91–24.23]	[15.06–23.31]
Random version	22.69	22.29	21.96	18.65
95% CI	[20.46–26.93]	[20.42–26.17]	[20.13–25.79]	[14.72–22.59]

Supplementary data

Supplementary data to this article can be found online at http://dx.doi.org/10.1016/j.ecolecon.2017.02.029.

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