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.

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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

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

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[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).