



Preference and WTP stability for public forest management



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ARTICLE INFO

Article history:

Received 25 September 2015

Received in revised form 16 June 2016

Accepted 19 June 2016

Available online xxxx

JEL classification:

D01

H4

Q23

Q51

Keywords:

Preference stability

Test-retest

Discrete choice experiment

Contingent valuation

Stated preferences

Forestry

ABSTRACT

The assumption of the stability of preferences is fundamental to consumer theory and the use of cost-benefit analysis. Many papers within the stated preferences literature have tested this assumption, and have found mixed results. Individuals may become more sure of their preferences as they repeat a valuation task or purchase decision; they may also learn more about prices and quantities of substitutes or complements over time, or about other relevant characteristics of both the good being valued, and alternatives in their choice sets. In this paper, we test for the stability of preferences and willingness to pay for attributes of forest management both within one survey and between two different moments of time. The “within survey” test compares a set of responses from individuals over the sequence of the first 12 and the second 12 choices in a stated preference survey. The “between two different moments of time” test compares responses from the same people over a period of 6 months. Non-parametric analysis reveals little clear trending in choices across these sets, although a higher consistency for status quo choices than for enhanced environmental management choices is apparent. Overall, we reject the strictest test of the equivalence of WTP distributions between choice sets. However, we also find that respondents' mean willingness to pay is fairly stable both within survey and between moments of time. Such differences as emerge are mainly driven by the changes in variances of WTP and by imperfect correlations of individual-specific WTP between choice sets.

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1. Introduction

Brouwer (2012) notes that while “... in micro-economic theory, it is assumed that individuals know their preferences and that these preferences are stable ...”, the consensus from behavioural psychology is that individuals are continually (re-) constructing their preferences in a context-dependent manner. This implies that preferences for the same good, and willingness to pay (WTP) for a particular change in that good, might well vary over time for an individual, even if the time span over which preferences are observed is very short. Standard economic theory allows for WTP estimates to change as variables which co-determine one's demand for a good change, or as one learns more about the characteristics of a good (Munro and Hanley, 2002) or one's preferences for experience goods (Czajkowski et al., 2014b). However, in the standard model of consumer choice, preference parameters are supposed to be stable (McFadden, 2001). This is a crucial assumption when valuation of a public good is conducted in order to inform policy makers. If preferences are unstable such that willingness to pay for a

specific change in the quantity of a public or private good varies even though there is no change in any of the standard economic drivers of welfare measures, then benefit-cost analysis is no longer informative as to the efficiency implications of policy change or changes in environmental management. For example, changes in stated willingness to pay due to variations in the emotional condition of a respondent would mean that the Kaldor-Hicks potential compensation test could no longer be applied (since whether gains exceeded losses would depend on un-observable variations in context). Our study sheds some light on validity of valuation methods with regard to preference stability assumption, since we test both the stability of an individual's willingness to pay for a good across a sequence of choice tasks in an initial survey, and across a 6-month period between this initial survey and a follow-up survey.

Specific tests for preference stability over environmental goods can be found in both contingent valuation (CV) and discrete choice experiment (DCE) settings. CV test-retest procedures were conducted by authors including Loomis (1989), Carson et al. (1997), Brouwer (2006) and Brouwer (2012). In all of these cases, two surveys were carried out over an interval ranging from two weeks to two years. The results indicate that average WTP is temporally stable.

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Test-retest procedures have also been applied within DCE. [Bliem et al. \(2012\)](#) estimate multinomial and mixed logit models on samples from two surveys of river restoration options in Australia, where the two surveys were undertaken one year apart. The model coefficients were compared using a Chow test. This indicated that there was no difference between preferences in these samples. [Liebe et al. \(2012\)](#) used an Error Component model to compare preference and WTP estimates in two samples collected 11 months apart. Choices over on-shore wind power options were reasonably consistent over the interval, but WTP estimates differed significantly for around half of the attribute values. [Schaafsma et al. \(2014\)](#) used a one-year interval to conduct a test-retest CE survey, and found that there were no significant changes in either preference parameters or WTP over this interval. However, the estimated error variance of choices fell over time. Most recently, [Mørkbak and Olsen \(2014\)](#) used DCE to compare responses over a 2 week period for a market good (apples) with “real economic incentives”. They thus sought to undertake a test-retest experiment in an incentive-compatible setting. They found “very good agreement” between the DCE estimates of preferences over this rather short time interval. However, their sample consisted of 25 persons only.

Further relevant contributions include [Dupont et al. \(2014\)](#), who compare estimates of WTP for health end points related to water quality in Canada between surveys undertaken in 2004 and 2012, using both CV and DCE. The health end points relate to illness and death cases from microbial infections and bladder cancer. They found that while there was a significant change in estimated WTP values across time when values were elicited using CV, there was no such significant change for the same values elicited using CE. A similar methodological comparison was undertaken by [Brouwer and Logar \(2014\)](#), who survey the same sample of people in Switzerland at a 6-month interval using both CV and CE. Their study relates to WTP for upgrading of waste water treatment plants in Switzerland to remove micro-pollutants. Some 20% of CE responses and some 30% of CV responses showed no change in preferences over the 6 month interval. There was no significant difference between WTP estimates over time for the sample as a whole, and no significant difference between CV and CE in this respect. Beyond environmental applications, [Ryan et al. \(2006\)](#) and [Skjoldborg et al. \(2009\)](#) provide test-retest analysis for preferences regarding health care.

Unfortunately, within-survey tests of preference stability within a DCE setting may also reflect fatigue or learning effects. As people progress through a series of choice tasks, they may learn more what they like or do not like, so that they become more precise in their preferences in the sense that the distribution of their preference type becomes narrower as experience in choosing increases ([Czajkowski et al., 2014b](#)). As people repeat choices, they may also find that a choice task becomes simpler; or else they may become bored and start using heuristics more frequently ([Swait and Adamowicz, 2001](#)). Any of these effects could show up as a change in the estimated values implied by choices, whereas in fact there has been no shift in underlying “true” preferences. Such fatigue or learning effects could also show up in the random component of utility ([Czajkowski et al., 2014a](#)). A review of multiple such “ordering effects” as well as their empirical testing can be found in [Day et al. \(2012\)](#). There have been a number of papers which also demonstrate a related “time to think” effect on WTP for changes in an environmental good ([Whittington et al., 1992](#); [MacMillan et al., 2006](#)).

In this paper, we conduct both within-survey and “between two different moments of time” tests of the stability of choices and estimated distributions of WTP. These tests are based on observations of the same individuals. The within-survey test considers responses to the first 12 and then second 12 choice questions in a survey on options for forest management. The between moments of time test compares these choices with responses from a similar (and for one subsample identical), 12-question DCE carried out six months later. This design provides a contribution to the test-retest literature, which as noted above has focussed on between moments of time tests only. In a

within-survey experiment, individuals may become more precise in stating their preferences, or may discover these preferences as they gain experience in choosing between different bundles of a good. This can confuse any signal about preference stability. This perspective stands in contrast to between moments of time tests, but here the researcher must confront a different set of problems, such as whether an individuals' socio-economic conditions changed, or where they may learn more about the good (rather than learning their preferences) over the interval. By investigating both issues jointly, our study provides an insight into the extent of the changes which may result from each of them. Although the two phenomena may be caused by different behavioural and economic effects, researchers' interest is basically the same in both cases – whether the hypothesis of stable welfare measures can be rejected, either within a sequence of choices in a survey or between two different moments of time.

2. Study design and data

2.1. The setting of the study – the Białowieża Forest

The Białowieża Forest in Poland is an ancient woodland straddling the border between Belarus and Poland, located in north east-central Poland. It is one of the last and largest remaining parts of the immense primeval forest which once spread across the European Plain. The Białowieża Forest is one of the most recognized and ecologically valuable forests in Poland ([Czajkowski et al., 2009](#)). Despite some visible signs of human activity, it is still commonly considered the last natural lowland forest in temperate Europe. It is especially regarded for its ecosystem dynamics as well as its species richness, and its ecological structures and functions ([Wesołowski, 2005](#)).

From the early 1990s, biologists, environmentalists and various NGOs have been trying to convince decision makers to enlarge national park designation to cover the entire territory of Białowieża Forest; so far, unsuccessfully. One of the aims of conducting our study was to provide evidence for public discussions regarding the enlargement of Białowieża National Park and possible changes in the forest management. In addition, our survey was constructed in a way which enabled the testing of preference stability, which is the main focus of this paper. A small number of one-to-one in-depth interviews were conducted by the research team members to fine-tune the survey instruments (structure, wording, visual materials – maps and photos). After consultations with biologists¹ working in the Białowieża Forests two possible management levels for the forests outside the national park and the reserve have been considered:

- 1) maintaining the current management typical for managed forest or
- 2) enlarging the passive protection zone, to allow rewilding² of the managed part of the Białowieża Forest.

It was explained that these options could result in low or high level of forest naturalness respectively. The differences between managed forests (low level of naturalness) and natural forests (high level of naturalness) were explained to the respondents using photographs, drawings and written descriptions, as presented in [Fig. 1](#).

The Białowieża Forest can be divided into three relatively homogeneous sections which differ in naturalness levels. The characteristics and possible changes in the future management in each section were explained to the respondents.

¹ We are very grateful to Prof. Bogdan Jaroszewicz a director of Białowieża Geobotanical Station for his comments on an early draft of our questionnaire.

² By rewilding we mean the whole process of returning ecosystems to a state of ecological health and dynamic balance, making them self-sustaining, without the need for ongoing human management ([Navarro and Pereira, 2012](#)).

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