Stability of Willingness-to-Pay for Coastal Management: A Choice Experiment Across Three Time Periods

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A B S T R A C T

A key assumption of stated preference methods is that individuals have well-formed preferences that are robust over time. Both the discovered and constructed preference perspectives imply this is not necessarily the case. There can be a large situational component to expressed preferences that add to the uncertainty of sampling error. Most non-market valuation studies only collect data from one point in time so the degree of temporal variability cannot be tested. Test-retest studies that provide data from two points in time generally find significant differences in preference structure and willingness-to-pay (WTP). In this study we test stability of WTP for beach erosion management using a fully ranked discrete choice experiment survey with not one but two retests over a six month period. We find that stability does not improve with the additional repetition as the preference discovery hypothesis implies it might. WTP confidence intervals overlap but the models are significantly different at each point in time, even after allowing for variation in choice error. Either the survey did not facilitate sufficient preference discovery or preferences were reconstructed. However, respondents with high scores of self-reported certainty in their choices in the first survey had significantly more stable WTP estimates.

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1. Introduction

When using stated preference methods to learn about preferences for the environment we ask people to explore and state their willingness-to-pay (WTP) for hypothetical alternatives. An important issue in stated preference research is whether these hypothetical decisions are reliable. Results may be used today from studies conducted years ago in both policy design and benefit transfer. In these cases a fundamental maintained assumption is that these values are robust over time (Brouwer, 2006). It is important for decision makers and practitioners to know to what degree this is the case. Rational choice theory allows WTP to vary for reasons such as changes in the choice context or changes in individual circumstances. Individuals who gain new consumptive experience such as experiencing a change in environmental quality may alter their preferences (McConnell et al., 1998). But are preferences stable in the aggregate?

1.1. Evidence on Stability

Discrete choice experiments (DCEs) allow explicit testing of the stability of the utility function and choice consistency. There does not appear to be any difference in reliability compared with other stated preference

elicitation methods such as contingent valuation (Liebe et al., 2012). Some DCE studies use repeated choice questions within the same survey, which provide clues about choice reliability in the very short term. Choices have been shown to vary over the duration of a single survey due to learning (about the choice task) or fatigue (Hess et al., 2012), but in other cases due to strategies (Day et al., 2012). Attrition is a major problem in longitudinal studies, so most stated preference studies merely provide information from one point in time. Some use different samples (e.g. Bliem et al., 2012), but it is then impossible to control for unobservable sample differences. However, there are examples in the literature where a re-test was conducted either weeks or months after the original survey.

Several DCE studies report 60–80% congruent choices for retests within weeks or months of the first test in the area of health economics (Bryan et al., 2000; Ryan et al., 2006; Skjoldborg et al., 2009) and food preferences (Carlsson et al., 2012; Rigby and Burton, 2011). Unlike healthcare or food, environmental quality is typically a public good with components of non-market and non-use value and may have greater WTP variability (Carlsson, 2010). Bliem et al. (2012) report that WTP for water quality varied by up to 39% using two independent samples a year apart. Liebe et al. (2012) find preferences for wind farms are significantly different after eleven months, but assert WTP reliability is "fair to moderate" based on a complete combinatorial test of means. Schaafsma et al. (2014) report 57% choice congruency for land use changes after a year and "very good agreement" for WTP based on overlapping confidence intervals but mean WTP varied by minus 527 to plus 160% for some attributes. Lienhoop and Volker (2016) found that WTP for German forests

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did not vary significantly after a delay of one week. Czajkowski et al. (2016) report that WTP parameters for public forest management were significantly different after a 6 month delay, but that means were "relatively" stable. In contrast, Lew and Wallmo (2017) found no significant change in WTP for endangered species after 17 months. To summarise, stability of stated WTP for the environment appears to be the exception rather than the norm. It is apparent that utility maximisation theory provides only limited insight into these findings.

1.2. Constructed Versus Discovered Preferences

There are two perspectives in behavioural decision research that can provide insight into apparent preference instability: discovered versus constructed preferences. The discovered preference hypothesis (DPH) was proposed by Plott et al. (1996), who stated that when people have to make decisions about an unfamiliar issue or in an unfamiliar environment, their initial responses may be impulsive. As they learn about the decision environment (institutional learning) and their own attitudes (value learning), their decisions begin to exhibit less randomness and greater rationality. Preference discovery requires repetition, feedback on consequences and belief that those consequences are real. The requirement for feedback is important and some systematic biases have been reported to persist unless people experience a loss as a result of their choice (Braga and Starmer, 2005). However, it is problematic to provide feedback on consequences for environmental changes that may take years to eventuate. Lienhoop and Volker (2016) suggest that group discussion and reflection time may provide feedback and lead to more preference discovery than simple repetition, although they were not able to detect a statistically significant increase in preference adjustment. In our study about beach management preferences, DPH implies we might expect some institutional learning and a corresponding decrease in choice error in retests similar to that found in within-survey choice task repetition (Hess et al., 2012). "On the other hand we may not find any increase in value learning because our experiment did not include any mechanism by which respondents could gain feedback on the implications of their choices".

The alternative constructed preference perspective is that preferences for the unfamiliar are often constructed, not merely revealed, when a decision is required (Gregory et al., 1993). This view rejects the usual presumption that stable and context-free preferences exist independently of the elicitation process and has been criticized for undermining the foundations of rational choice theory (Plott et al., 1996). However, consumers and voters make real-life decisions about unfamiliar products and issues regularly. Unfamiliarity, complex information, and public good character can cause instability in real-world choices as well as stated preferences (Carlsson, 2010), so a lack of pre-existing preferences does not necessarily invalidate SP methods. Similar to the ways by which authorities attempt to educate stakeholders during a policy consultation process; the role of the non-market valuation researcher is to ensure respondents have all the relevant information and make decisions with a high standard of reasoning (Gregory et al., 1993). When preferences are constructed rather than pre-existing they tend to be more strongly influenced by situational and framing effects, such as presentation order (Krosnick and Alwin, 1987) or arbitrary anchors (Ariely et al., 2003). Preferences may be constructed using a variety of simplifying strategies rather than expected utility maximisation. The result is that constructed preferences may be confined in scope (e.g. to a specific elicitation format) and transient – soon to be forgotten (Simon et al., 2008). The constructed perspective implies that preferences may not necessarily stabilise with repetition, especially if a time delay means that respondents don't remember their exact choices from the previous task.

The work presented in this paper is based on a fully-ranked discrete choice experiment for erosion management options for beaches on the Coromandel Peninsula of New Zealand. We conduct not one but two identical re-tests, each spaced three months apart. Having three points in time allows a more robust assessment of individual stability of stated

WTP estimates in a manner that, as far as we are aware, no other study of environmental WTP has reported. Coastal landscapes are an important part of New Zealanders' identities (Collins and Kearns, 2010) and it is reasonable to assume respondents have pre-existing general preferences for coastal features and experience of beaches with the management options described. However, they have probably never been asked to make a specific trade-off between beach management and taxes, so it is difficult to say whether the discovered or constructed viewpoint is likely to be more applicable. Our first research question is: how stable is WTP in our specific context, and is this consistent with other test-retest studies? But the more interesting and unique question is: does stability improve between the first and second re-test? If so, it would be consistent with the concept of learning and preference discovery. If not, the results would be more consistent with the transience of preferences constructed on the spot. We also investigate to what degree choice consistency can be explained by individual-specific factors. If preference stability could be predicted this could improve confidence in one-shot experiments where retest is not an option.

2. Method

2.1. Random Utility Models

Management options for Coromandel beaches may be thought of as a bundle of characteristics that affect the aesthetics and use of the beach. As per random utility theory (McFadden, 1974) we assume the probability of a consumer choosing their preferred future state of a beach is a function of deterministic and random or unobserved components of utility. Since the purpose of this study is to test for stability of WTP over time, we use a random utility model specified directly in "WTP-space" (Train and Weeks, 2005) such that the attribute parameters are interpretable as marginal WTP for each attribute.

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In this study we obtained full rankings of six alternatives in each choice card. The choice probabilities are modelled using the standard exploded logit model (Lancsar and Louviere, 2008). The utility in WTP space that person n obtains from the alternative state j and measured in time period t is specified as follows:

$$U_{njt} = \lambda_{nt}(ASC_j + \omega_{nt}'\mathbf{x}_j - p_j) + \varepsilon_{njt} \tag{1}$$

where ASC is an alternative-specific constant for position on the choice card, $\mathbf{x}_j$ denotes the attribute levels of the non-price scenario, p_j is price, ε_{njt} is an i.i.d. extreme value type 1 error term, n are individual respondents and j are the alternatives. ω_{nt} is a vector of marginal WTP parameters specific to each individual n and assumed to be normally-distributed. λ_{nt} is a mixture of scale and cost coefficient with an