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Decision uncertainty in multi-attribute stated preference studies

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ABSTRACT

Econometric modelling of decision uncertainty has received extensive attention in the contingent valuation literature, but these methods are not directly transferable to the realm of multi-attribute stated preference studies. In this paper, an integrated choice and latent variable model tracing the impact of decision uncertainty on the valuation of flood risk reductions in the Netherlands is developed. The proposed model structure is not subject to the potential endogeneity bias and measurement error issues associated with most applied methods. The driving factors of decision uncertainty are identified through stated choices and a set of self-reported decision uncertainty follow-up questions. The model simultaneously accounts for the impact of decision uncertainty on individual choices and welfare estimates. In the presented case study uncertain respondents are found to make more random choices and select the opt out option more often. Willingness-to-pay for flood risk reductions increases after accounting for these behavioural responses to decision uncertainty.

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1. Introduction

Interest in the impact of decision uncertainty on welfare estimates obtained from stated preference (SP) surveys dates back to the period in which the contingent valuation method (CVM) was the most widely applied non-market valuation method (see Samnaliev et al., 2006; Shaikh et al., 2007; Akter et al., 2008, for overviews). The capability of respondents to order alternatives in a choice set or to express their willingness-to-pay according to their preferences depends on the extent to which they are familiar with the presented trade-offs and the degree of experience they have in making such trade-offs. A bias in welfare estimates may arise when the underlying econometric model does not account for any form of decision uncertainty respondents experience throughout the decision process.

Within the CVM literature, specifically the dichotomous choice (DC) response format, various survey formats and econometric approaches have been developed to account for the impact of decision uncertainty on willingness-to-pay (WTP) estimates (e.g. Li and Mattsson, 1995; Manski, 1999; Vazquez et al., 2006; Brouwer, 2011; Kobayashi et al., 2012). The implementation of these econometric methods in the context of multi-attribute stated preference (MASP) studies is not straightforward. Several MASP studies have measured decision uncertainty by positioning a follow-up question directly after each choice task (e.g. Lundhede et al., 2009; Brouwer et al., 2010; Beck et al., 2013; Hensher and Rose, 2012; Hensher et al., 2012; Olsen et al., 2011). The treatment of self-reported decision uncertainty has, however, been limited from a methodological perspective. Firstly, some papers (e.g. Olsen et al., 2011) assume decision uncertainty is a result of utility differences across the alternatives in the choice set without recognising decision uncertainty itself may influence response patterns and consequently the estimated utility functions and welfare implications. Secondly, other work has used the self-reported decision certainty responses as an explanatory variable in the choice model (e.g. Lundhede et al., 2009; Beck et al., 2013) putting the analyst at risk of endogeneity bias as well as measurement error (see Section 2.2).

Integrated Choice and Latent Variable (ICLV) models (e.g. Ben-Akiva et al., 1999) offer an intuitive solution to these two problems. ICLV models treat decision uncertainty as a latent construct *simultaneously* affecting choice and the response to the follow-up question. Correlation between the implicit representation of decision uncertainty in the choice model and its explicit representation in the follow-up question is introduced by making the utility function and the measurement equation (which explains the reported degree of (un)certainty) a function of the same latent variable 'decision uncertainty'. Directional effects are therefore no longer pre-imposed in the ICLV model; endogeneity and measurement error issues are circumvented by treating the follow-up responses as a dependent variable; and the welfare implications of decision uncertainty can be traced through the impact of decision uncertainty on the choice model.

In this paper, we explore whether the conceptual benefits of ICLV models outweigh the increase in computational costs relative to the criticised approach of using self-reported decision uncertainty as an explanatory variable in the utility function. Comparisons are conducted at the level of welfare estimates given that measures of model fit are hard to compare between traditional choice models and ICLV models. Our results reveal respondents with a higher level of (latent) decision uncertainty tend to make more random decisions, and they adopt a simplifying choice heuristic making them more likely to select the status quo (i.e. opt out) option. This particular choice heuristic causes choice models not accounting for decision uncertainty to underestimate welfare effects. Models treating self-reported decision uncertainty directly as an exogenous variable, however, provide comparable welfare estimates to the more complex ICLV model. The advantage of the ICLV model is that in addition to tracing the impact of decision uncertainty on choice and welfare estimates, it also explains the driving factors of decision uncertainty across respondents.

Our MASP study is conducted in the context of flood risk exposure in the Netherlands in the face of climate change. The public nature of Dutch flood risk policy and absence of private flood risk insurance causes most people to be unfamiliar with trade-offs regarding their own flood risk exposure. This is a natural application to test our model of decision uncertainty. Many alternative applications are likely to exist in the context of resource and energy economics. MASP surveys in the context of e.g. wind turbines (Landry et al., 2012) and water quality improvements (Schaafsma et al., 2014; Meyerhoff and