Resource and Energy Economics 39 (2015) 89–107

Contents lists available at ScienceDirect

Resource and Energy Economics

journal homepage: www.elsevier.com/locate/ree

Modeling non-compensatory preferences in environmental valuation

Thuy D. Truong*, Wiktor L. (Vic) Adamowicz, Peter C. Boxall

Department of Resource Economics and Environmental Sociology, University of Alberta,
515 General Services Building, Edmonton, AB T6G2H1, Canada

ARTICLE INFO

Article history:
Received 1 April 2013
Received in revised form 2 December 2014
Accepted 9 December 2014
Available online 18 December 2014

JEL classification:
C51
Q28
Q40
Q51

Keywords:
Environmental valuation
Stated preference
Choice model
Non-compensatory preference
Cutoff

ABSTRACT

While the compensatory model of choice dominates the environmental valuation literature, non-compensatory models, where individuals do not tradeoff one attribute for another, are sometimes found to be better representations of choice behavior. Most non-compensatory models employ "cutoffs", the point at which utility abruptly changes. But cutoffs are usually elicited directly from respondents using a stated preference question. Such elicitation could be inaccurate and might introduce bias to the decision process. In this article, we develop a model that estimates cutoff levels endogenously. Our model has two error components, one for the utility function and another for the cutoff function. This facilitates the estimation of the cutoff as a function of individual specific variables. We estimate the model by maximizing the log-likelihood function that involves the weighted sum of the two error components. We test the model using synthetic data and find that estimated parameters are close to the true parameters. When applied to actual empirical data, our model appears to be a better fit than the compensatory preference model; however it is somewhat different than the self-reported cutoff model, highlighting the need for an approach that does not rely on stated cutoff information.

---

* Corresponding author. Present address: Department of Economics, University of Economics, Ho Chi Minh City, Viet Nam.
E-mail addresses: truong@dangthuy.net (T.D. Truong), vic.adamowicz@ualberta.ca (W.L. Adamowicz), peter.boxall@ualberta.ca (P.C. Boxall).

http://dx.doi.org/10.1016/j.reseneeco.2014.12.001

1. Introduction

The compensatory preference model has been dominant in environmental valuation and more generally in choice modeling as it is straightforward to estimate and interpret. This model assumes that subjects evaluate all attributes of alternatives presented and that a change in one attribute can be compensated for by a change in another attribute. However, non-compensatory preferences may better reflect some choice behavior. There could be cases where an alternative with an attribute that has not satisfied a certain level (a “cutoff”) will always be rejected regardless of the levels of other attributes. This is an example of a conjunctive decision rule originally proposed by Coombs (1964) and Dawes (1964). The presence of non-compensatory decision processes has been empirically tested by many authors, including Bettman and Park (1980), Gensch and Svetska (1984), Lussier and Olshavsky (1979), Einhorn et al. (1979), Payne (1976), Grether and Wilde (1984), Klein (1983), Klein and Bither (1987), Huber and Klein (1991), Cascetta and Papola (2001), Swait (2001) and Martinez et al. (2009). In many cases, the non-compensatory models are found to provide better representations of choice behavior in terms of explanatory power and model prediction success (Swait, 2001).

In almost all of the studies employing non-compensatory frameworks, however, a cutoff is typically elicited directly from respondents (e.g. “I would pay no more than $X.”). In other words, respondents are asked to state cutoffs along with their choices of alternatives in stated preference tasks. While asking subjects for their own cutoff levels may be straightforward, such elicitation could be suspect as subjects may be unable to report their decision strategies accurately (Nisbett and Wilson, 1977), or may adapt their strategies to fit the choice context (Payne et al., 1988). In addition, the methods of collecting these data might introduce bias to the decision process (Elrod et al., 2004).

Parameters on self-reported cutoffs are also subject to endogeneity as there is possible correlation between reported cutoffs and the error term of the utility function. There is evidence that assuming cutoffs to be exogenous may be inappropriate. Ding et al. (2012) tested for endogeneity by comparing models with predicted cutoffs (from regressions of self-reported cutoffs on demographics) to models with self-reported cutoffs and found that endogeneity affected some of the estimated parameters. Klein and Bither (1987) found that cutoffs are affected by various factors including utility level, context and setting of the choice problem, and at times, respondents were willing to violate their stated cutoffs. Therefore, cutoffs may be correlated with the error terms of the utility function and assuming exogenous cutoffs may be incorrect.

In this paper we develop a model that can be used to estimate cutoff levels endogenously. Our model employs “soft” cutoffs, which imply that alternatives that violate the cutoff will be penalized in terms of utility rather than being eliminated from the choice set. Many of those using self-reported cutoffs also observed that subjects violated their self-reported cutoffs (e.g. see Klein and Bither, 1987; Huber and Klein, 1991; Swait, 2001). Thus, a soft cutoff may be a more appropriate way to model choice behavior. The model with soft cutoffs is also more flexible – if the penalty on a cutoff violation is zero, it collapses to a perfectly compensatory model; if the penalty is large enough, it effectively works as a hard cutoff model. The soft cutoff is characterized by a kinked utility function and indifference curve.

Assume an individual must choose one from a set of goods. Based on Swait (2001) the individual is assumed to maximize an objective function consisting of regular utility from a vector of attributes associated with an alternative and utility penalties in the case of cutoff violations. The lower cutoff violation is defined as the positive difference of the lower cutoff compared to the attribute level; and the upper cutoff violation is defined as the positive difference of an attribute compared to its upper cutoff level. In addition to preference parameters associated with the vector of attributes of an alternative, parameters on the cutoff violations are also estimated describing the penalty in utility terms associated with cutoff violations. If the decision maker applies a conjunctive strategy, for example, the parameters on cutoff violations are marginal penalties for violations of cutoffs and should be negative.

In our approach the error terms of the cutoff function are modeled explicitly. As a result, the model has two error components: one for the utility function which is the commonly assumed Gumbel distributed error, and one for the cutoff function. This facilitates the estimation of the cutoff directly as a function of individual specific variables (which are assumed to be exogenous). To the best of our knowledge, this approach to estimating cutoffs directly has not been employed in the literature.