Journal of Economic Behavior & Organization 119 (2015) 345–363

Contents lists available at ScienceDirect

Journal of Economic Behavior & Organization

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

Learning, fatigue and preference formation in discrete choice experiments☆

Danny Campbell[a,*], Marco Boeri[b], Edel Doherty[c], W. George Hutchinson[b]

[a] Economics Division, Stirling Management School, University of Stirling, Scotland, United Kingdom
[b] Gibson Institute, Institute for Global Security, School of Biological Sciences, Queen's University Belfast, Northern Ireland, United Kingdom
[c] J.E. Cairnes School of Business and Economics, National University of Ireland, Galway, Ireland

ARTICLE INFO

Article history:
Received 19 December 2014
Received in revised form 28 August 2015
Accepted 29 August 2015
Available online 16 September 2015

JEL classification:
C25
Q51

Keywords:
Discrete choice experiments
Learning and fatigue behavior
Preference formation
Probabilistic decision process model
Preference and variance consistency

ABSTRACT

While the repeated nature of discrete choice experiments is advantageous from a sampling efficiency perspective, patterns of choice may differ across the tasks, due, in part, to learning and fatigue. Using probabilistic decision process models, we find in a field study that learning and fatigue behavior may only be exhibited by a small subset of respondents. Most respondents in our sample show preference and variance stability consistent with rational pre-existent and well formed preferences. Nearly all of the remainder exhibit both learning and fatigue effects. An important aspect of our approach is that it enables learning and fatigue effects to be explored, even though they were not envisaged during survey design or data collection.

1. Introduction

Discrete choice experiments (DCEs) are a stated preference elicitation method, whereby respondents choose their preferred alternative among several hypothetical alternatives in a choice task (e.g., see Louviere et al., 2003; Hensher et al., 2005 for introductions to the method). The method is widely used for valuing environmental goods and services. In this study we explore preferences for preservation of several rare and endangered fish species in the Lough Melvin Catchment in Ireland using a DCE. As is common practice in DCEs, respondents were asked to consider a number of multidimensional alternatives and to identify their preferred alternative in a choice scenario (or task) where, in our case, different fish species were or were not protected. As in any DCE, in addition to the number of attributes and alternatives per choice task, we had the opportunity to assign the number of choice tasks. In an attempt to increase sampling efficiency we included a large number of choice tasks giving rise to a panel of repeated choice tasks to be completed by each respondent.

☆ The authors wish to acknowledge the funding provided by the EU INTERREG IIIA Programme for Ireland/Northern Ireland for data collection. The usual disclaimer applies.

* Corresponding author at: Economics Division, Stirling Management School, University of Stirling, Stirling FK9 4LA, Scotland, United Kingdom. Tel.: +44 017 8646 7277.
E-mail address: danny.campbell@stir.ac.uk (D. Campbell).

http://dx.doi.org/10.1016/j.jebo.2015.08.018
0167-2681/

A key advantage of using repeated valuation tasks is that they enable researchers to identify the extent to which respondents have clearly defined and established pre-existent preferences for the goods under consideration and the extent to which preferences are modified or even formed through the course of the elicitation process. Despite this, the issues and concerns relating to learning and fatigue are not routinely explored by researchers engaged in stated discrete choice analysis. In this paper we contribute to the literature by proposing a more flexible means for dealing with learning and fatigue in stated preference and more specifically in DCEs conducted in the field. In particular, we explore the extent to which respondents possess or form consistent preferences at different phases in the experiment and whether there is different variability of choice through identification of different scale parameters for each phase.

Our modeling approach builds on the standard multinomial logit (MNL) and random parameters logit (RPL) models, but, unlike previous studies, which have deterministically assumed that the same patterns of learning, fatigue or preference heterogeneity applies to the whole sample, we accommodate the fact that the patterns may be different across respondents. To achieve this we use a probabilistic decision process (PDP) model (e.g. Campbell et al., 2012; McNair et al., 2012; Hensher et al., 2013). This is similar in form to a latent class (LC) model, but the classes here are meant to describe a specific learning and fatigue behavior. The LC model is hence a tool to facilitate differences in learning and fatigue behavior across respondents. As a further departure from the standard LC specification, similar to Greene and Hensher (2013), we facilitate within class random taste variation to capture another layer of preference heterogeneity. We first use this approach to probabilistically determine the proportion of respondents who have consistent preferences as well as preferences that change due to learning or fatigue (or a mixture of the two). We then include scale-adjusted classes, as implemented in Magidson and Vermunt (2008) and Campbell et al. (2011), to ascertain probabilistically the share of respondents with a consistent error variance as well as those who's error variance is different (relative to the middle phase) in the early and/or late phases of the experiment. While both of these PDP models represent an improvement over the existing approaches, they both look at preference and variance consistency in isolation. To overcome this potential weakness, we propose an even more elaborate scale-adjusted PDP model that is aimed at uncovering both types of inconsistency simultaneously. The beneficial feature of this is that we can better disentangle the influence of learning and fatigue upon both the preference parameters as well as the scale parameter. Moreover, it offers a practical approach for DCE practitioners to investigate learning and fatigue, even though they were not considered during survey design or data collection.

Our results show that both learning and fatigue effects are present in this dataset. Our modeling results suggest that, while only a minority of respondents exhibit learning and/or fatigue behavior, expressions of utility (in terms of both preferences and variance) are different in the early and late phases of the experiment (relative to the middle phase) for those respondents identified as exhibiting signs of these patterns. Moreover, our final scale-adjusted PDP specification highlights the potential confound between the two types of inconsistency and, thus, the necessity for specifications that can accommodate both inconsistent preferences and error variance. Results from this model suggest that around two-thirds of respondents have consistent preferences and error variance across the sequence of choice tasks. The remaining respondents are shown to either adjust their preferences or choice variability in approximately equal proportions. Our results also show that model fit as well as marginal willingness to pay (WTP) are impacted by explicitly accommodating learning and fatigue effects on preferences and variability into our models. Our modeling approach also allows us to identify empirically the patterns of responses that may be exhibited in a repeat response DCE as outlined in Day et al. (2012, Table 1, p. 75). This application of the PDP model can be applied to field datasets to test for patterns associated with "standard" and "non-standard" preference formation. We find that in a large field dataset only a minority of respondents exhibit preference and variance instability but that patterns similar to those identified in Day et al. (2012) can be found. We find that two-thirds of respondents in our study appear to have *a-priori* well formed preferences in terms of demonstrating both preference and variance stability throughout the valuation sequence. One-third show instability of preference and scale throughout the sequence and appear to exhibit preference discovery between the early and middle phase or fatigue between the middle and late phase of the sequence or both. Empirical evidence from our findings suggests that the dominant form of preference and scale instability among this subset of respondents was the combination of preference learning in the early phase of the sequence combined with evidence of fatigue in the late phase.

The remainder of the paper is organized as follows. In the following section, we outline some background to learning and fatigue from a stated preference perspective. In Section 3 we detail our econometric approach and introduce our PDP model with random parameters specification to segment respondents based on their patterns of learning and/or fatigue. In Section 4 we briefly discuss the empirical case-study used to provide data for our analysis. Section 5 reports estimation and post-estimation results while, Section 6 discusses the implications of these findings and concludes.

2. Background

There is a well known theoretical and empirical literature suggesting that individuals may exhibit at least two forms of heterogeneity within the sequence of their choices. One type of heterogeneity has been attributed to engaging in some form of learning or discovery process when asked to identify preferences for a sequence of economic goods (see Bradley and Daly, 1994). One of the leading proponents of this learning effect within behavioral economics is Plott (1996), who coined the term "the discovered preference hypothesis". According to Plott, stable and theoretically consistent preferences are formed due to experience gained through practice and repetition and are not necessarily inherent within a decision-maker's initial choices. Plott and Zeiler (2005) demonstrate in a series of economic experiments how major preference