Transportation Research Part D 17 (2012) 237–242

Contents lists available at SciVerse ScienceDirect

Transportation Research Part D

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

Effective environmental marketing of green cars: A nested-logit approach

Shyamani Siriwardena, Gary Hunt, Mario F. Teisl *, Caroline L. Noblet

School of Economics, University of Maine, USA

ARTICLE INFO

Keywords:
Eco-marketing
Green cars
Nested logit model
Quasi-experimental design
Modal shift

ABSTRACT

Using market data, we assess the effectiveness of an eco-marketing campaign on purchases of 'green' vehicles. The eco-marketing was designed as a quasi-experiment, having one region exposed to the marketing while the other region was the control. A two-level nested-logit model consistent with utility maximization reveals the campaign had short-term positive effects on green-car sales. Results also indicate green-car buyers come from highly educated communities. Age has a positive but non-linear effect on green car sales.

1. Introduction

The widespread use of eco-marketing indicates this technique is viewed as effective in altering consumption behavior, and market studies indicate their effectiveness at least for frequently purchased, less-expensive goods. An open question is whether these approaches are successful with more-expensive, durable, less frequently purchased, products, such as vehicles. Besides obvious differences in the products, there are different information environments for more expensive durables. For example, vehicle purchasers obtain a lot of product information from manufacturers (e.g., product brochures), trade-related publications/websites, consumer guides (e.g., consumer reports) and friends/relatives. Importantly, dealerships, where vehicle eco-labels would be displayed, are often not visited until later in the car-buying process, after buyers have narrowed their choice set down to only a few vehicles, and used only to gather monetary (e.g. price and trade-in value) and 'experiential' information (test drives) (Teisl et al., 2004).

Here we analyze the effectiveness of the Maine Clean Car Campaign, (the "campaign") on green vehicle choice among Maine consumers. This small-scale campaign comprised of two main parts: eco-labels providing information at the point of purchase and eco-marketing providing information through mass-media. Although the eco-labels were distributed at no cost to dealers, few dealers voluntarily participated in the campaign; in turn, testing the effects of the campaign primarily tests the effectiveness of the eco-marketing. The marketing was administrated in a quasi-experimental design with a treatment and control area, where radio and newspaper advertisements were only administered in the treatment area.[1] This design facilitates identification of the effect of this marketing campaign on green vehicle choice.

We use market data to evaluate the effect of the campaign on actual behavior by estimating a nested logit model that assesses the likelihood of purchasing eco-friendly, "green" vehicles by Maine buyers. Unlike previous studies that generally analyze green vehicle choice in terms of hybrid or alternative fuel vehicles, we consider purchases of more prevalent gasoline vehicles as defined by US Environmental Protection Agency (EPA)'s SmartWay[SM] designation. To obtain a SmartWay[SM] designation the vehicle must obtain at least a greenhouse gas (GHG) and air pollution (APS) score of 6 (on an ascending scale of 1–10) and a combined score of 13.[2]

* Corresponding author. Tel.: +1 2075813162; fax: +1 2075814278.
E-mail address: teisl@maine.edu (M.F. Teisl).

[1] See Teisl et al. (2009) for more information on the campaign.

[2] http://www.epa.gov/greenvehicles/Aboutratings.do#aboutgreenhouse.

1361-9209/$ - see front matter
doi:10.1016/j.trd.2011.11.004

2. Conceptual model

The utility of choosing a green vehicle can be specified as a function of the perceived vehicle attributes (e.g., environmental attributes such as emission levels and non-environmental attributes such as safety) and individual characteristics. For example, the demand for hybrid and alternative fueled vehicles is positively affected by increased income and education (Erdem et al., 2010; J.D. Power and Associates, 2008), or decreased costs (Potoglou and Kanaroglou, 2007) and emission rates (Potoglou and Kanaroglou, 2007; Bhat et al., 2009). Eco-marketing campaigns can, by altering the perceptions of some vehicle attributes, affect choice and utility (Noblet et al., 2006).

We model the individual's indirect utility, V_i, as:

$$V_i = v(\boldsymbol{M}, \boldsymbol{D}, \boldsymbol{B_i}, F_i, P_i, Y) + \varepsilon_i \tag{1}$$

where $\boldsymbol{M}$ is a vector of eco-marketing variables; $\boldsymbol{D}$ is a vector of individual characteristics such as gender and education; $\boldsymbol{B_i}$ is a vector of vehicle attributes other than environmental attributes (e.g., safety, comfort, size); F_i and P_i are operating and purchasing cost variables respectively, Y is household income and ε_i is an unobservable random component.

We use a nested logit (NL) model that represents the choice of a vehicle in a hierarchical manner (Fig. 1). The NL model is chosen over the multinomial logit (MNL) because it accommodates the correlations among the alternatives (makes/models) in a given subset or nest while maintaining the Independence of Irrelevant Alternative (IIA) property across nests (Heschner and Greene, 2002).

We use the EPA SmartWay^{SM} definition to represent the nests for vehicle makes/models. This definition makes two disjoint subsets of makes/models, $S_k(k \in \{sw, nsw\})$ where sw and nsw represent SmartWay^{SM} and non-SmartWay^{SM} nests, respectively, and an individual chooses a make/model from one of the two nests.

The indirect utility of choosing the ith vehicle in the kth nest can be written as follow.

$$V_{ki} = v_{ki}(\boldsymbol{M}, \boldsymbol{D}, \boldsymbol{B_{ki}}, F_{ki}, P_{ki}, Y) + \varepsilon_{ki} \tag{2}$$

We assume $\boldsymbol{M}$ and $\boldsymbol{D}$ affect the green vehicle choice while non-environmental vehicle attributes and other individual-specific variables affect both green vehicle and make/model choices.

$$V_{ki} = \alpha_0 + \boldsymbol{\alpha}_1\boldsymbol{M} + \boldsymbol{\alpha}_2\boldsymbol{D} + \boldsymbol{\beta}_1\boldsymbol{B_{ki}} + \beta_2F_{ki} + \beta_3P_{ik} + \beta_4Y + \varepsilon_{ki} \tag{3}$$

where $\boldsymbol{\alpha}$ and $\boldsymbol{\beta}$ are parameters to be estimated. The expected maximum utility the individual obtains by choosing an alternative in nest k is given by the Inclusive Value for that nest (IV_k).

$$IV_k = ln\sum_j \exp(\boldsymbol{\beta}_1\boldsymbol{B_{ji}} + \beta_2F_{kj} + \beta_3P_{kj} + \beta_4Y) \tag{4}$$

Utility maximization requires the inclusive value lie between 0 and 1; if equal to zero then the alternatives in the nest are perfectly correlated; if equal to one, they are independent and NL collapses to the MNL model (McFadden, 1978).

3. Data

The primary data set was created by Bacani (2008) and contains new gasoline powered vehicle purchases obtained from Maine Vehicle Registration records for 2004–2007. For each year the previous year's registration data was pulled from state records in May; e.g., the 2004 data runs from the first week of May 2003 to the first week of May 2004. The records include purchased vehicle information (such as Vehicle Identification Number, make, model, body style, odometer reading and list price) and buyer information (such as name, date of birth, and address). Records with incomplete information and records of non-passenger vehicles, homemade vehicles, commercial vehicles and out-of-state addresses were eliminated when creating the data set. In order to compile additional information, fill in missing records and standardize the records, Bacani (2008)

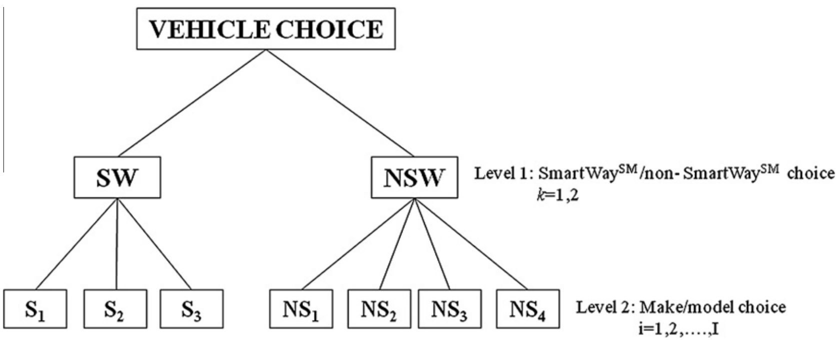

Fig. 1. General tree structure for the two-level nested logit models.