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Reference-dependent preferences on smart phones in South Korea: Focusing on attributes with heterogeneous preference direction

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ABSTRACT

Consumers observe reference-dependent comparative attribute levels rather than absolute attribute levels of a product in their actual purchasing process. As the reference-dependent effect is important, many consumer preference studies in psychology and behavioral economics have perceived the reference-dependence as a general assumption. Nonetheless, few studies utilize standard economic models such as the discrete choice model, which is useful for analyzing demand forecasting in the marketing sector, and have used a reference-dependence utility function. Moreover, these studies analyze attributes only with the identical consumer preference directions, such as time and cost. Therefore, this study proposes an advanced discrete choice model that analyzes asymmetry preferences for attributes with heterogeneous preference direction as well as reference-dependence effect. It also investigates empirically the usefulness of the model on the market for smart phones. Based on this approach, we find wide disparities in consumer asymmetry preferences and loss aversion parameters in accordance to the existence of market experience and product attributes.

1. Introduction

The discrete choice model is a widely adopted methodology that analyzes consumer product preferences using discrete choice experiment data. In particular, the discrete choice experiment enables a simulated environment similar to the real purchase process of consumers with hypothetical alternatives consisting of product attributes (Train, 2009). As such, many studies have adopted the discrete choice model in areas such as marketing, energy, environment studies, etc. (Hong, Koo, Jeong, & Lee, 2012; Lee, Choi, & Cho, 2011, 2012; Qian & Soopramanien, 2015; Woo, Choi, Shin, & Lee, 2014).

General assumptions of standard economic models, including discrete choice models for consumer choice, indicate no relation between the consumer choice and reference point or status quo (Carson & Groves, 2007; Hardie, Johnsom, & Fader, 1993; Tversky & Kahneman, 1991). However, it is observable from the real consumer purchase process that consumers are heavily influenced by conditions of products they are currently possessing and experiences from using them (Koo, 2012). Additionally, consumers determine their gains and losses by comparing with the reference point (Kahneman & Tversky, 1979; Van Osch, Van den Hout, & Stiggelbout, 2006) [1]. In other words, consumers choose products by considering comparative attribute levels depending on reference point instead of simply considering absolute product attribute levels (Hess, Stathopoulos, & Daly, 2012).

However, despite the importance of the effect in consumer choice, few studies apply it to discrete choice experiments models. A small number of studies (Hess, Rose, & Hensher, 2008; Masiero & Hensher, 2010) use a discrete choice experiment to investigate asymmetric preferences of multiple attributes in the area of transportation (Hess et al., 2012). They analyze asymmetric preferences for attributes such as time and cost that could be assumed to have identical consumer preference direction. Yet, in some cases, consumer preference direction toward product attributes is heterogeneous rather than identical.

Therefore, our study suggests an advanced discrete choice model to analyze asymmetry preferences for attributes with heterogeneous preference direction using reference point. As such, this study enables researchers to remove attribute selections, in that it allows them to consider attributes with heterogeneous preference direction when applying the discrete choice model with reference-

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dependent effect. Our analysis process consists of two steps as follows. In the first step, we analyze consumer preferences for each attribute of the product using a Bayesian mixed logit model, which is the model that reflects consumer heterogeneity among discrete choice models. Based on the results in step one, we categorize individual consumer preferences for each attribute into *preference direction* and *nonpreference direction*. In the second step, we first set for each attribute levels of consumers' currently owned products as reference points and combine them with the result from the first step; subsequently, we perform asymmetry preferences analysis for each attribute. Using the suggested model, we investigate asymmetry preferences for each attribute of the smart phone selected for empirical analysis.

The remainder of the paper is structured as follows: section 2 reviews literature on discrete choice models applying reference-dependent utility function; section 3 proposes an advanced discrete choice model considering consumer heterogeneity and reference-dependent effect; section 4 provides the results of empirical data collection for smart phones and the estimation results; and section 5 discusses conclusions and implications of this study.

2. Literature review

There are numerous studies that support the superiority of the reference-dependence model compared to the standard economic models for consumer preferences analysis (Bateman, Day, Jones, & Jude, 2009). In addition, a psychological analysis result of a value-oriented study has proven that the reference point plays a critical role in determining preferences (Tversky & Kahneman, 1991). Therefore, studies in behavioral economics recognize the reference-dependence effect as a general assumption in consumer preference analysis (Dellavigna, 2009), and they explain risk aversion through asymmetry preferences derived from applying a reference-dependence utility function (Fehr & Goette, 2007).

However, there exists a small number of studies that use reference-dependent utility function to investigate multi-attribute asymmetry preferences. While past studies applying the theory of reference-dependence utility focus either on single attributes or the entire value, Tversky and Kahneman (1991) extended the theory to explain multiple attributes. Hardie et al. (1993), in particular, developed a multivariate logit model applying the reference-dependence effect to indicate the brand effects on consumer choices, and introduced a model that reflects loss aversion and reference-dependent effects from brand selection. Therefore, the assumptions of the study are: (1) brand selection is influenced by brand positions, and (2) consumers, when making a decision, put more weight on losses than on gains for identical distance from the reference points. It is important to identify individual reference points for reference-dependent and loss aversion models, because it allows marketing strategists in-depth understanding and specific action planning, compared to general methods in brand preference studies.

In the study of Hess et al. (2008), attributes associated with trip routes included free flow time, slowed down time, trip travel time variability, vehicle running cost (essentially fuel), and toll cost. These five attributes and the variation of attribute levels are combined to provide two alternatives. Subsequently, respondents are asked to choose from two alternatives and current routes with 16 replications of choice set, where the current route is defined as reference. Using four attributes (except for trip travel time variability), the level difference between the four attributes, and the attributes of counterpart reference alternatives, two classifications are identified in the analysis: increase and decrease of levels. The results indicate that the asymmetry preferences appear in cases where time and cost increase and decrease compared to the reference point, and magnitudes were not consistent. In other words, loss aversion parameters are either greater or smaller than one. When the loss aversion parameter is larger than 1, consumers become more sensitive to giving up that particular attribute.

In a later study, Masiero and Hensher (2010) investigate loss aversion and diminishing sensitivity on freight transport framework using a reference pivoted choice experiment. In this study, three alternatives of choice experiment are road, piggyback, and combined transport. The road alternative is defined as reference alternative and is composed of attributes of cost, time, and punctuality. As a result, asymmetry preferences appear in the case where time and cost either increase or decrease compared to reference points, and magnitude appears to be large in the case where increase signifies losses. This means that the loss aversion parameter is larger than one for time and cost. In addition, the loss aversion parameter of punctuality was the highest and most significant.

The studies of Hess et al. (2008), and Masiero and Hensher (2010) apply the reference-dependent effect to their choice models and observe loss aversion parameters. They also analyze trade-offs between attributes by observing consumers' loss aversion to each attribute. However, these studies first assume the identical consumer preference direction for the most critical attributes of transportation, that is, time and cost, subsequently analyzed by a simple binary approach of increase and decrease of time and cost compared to the reference point.

3. Model specification

In order to propose an advanced discrete choice model considering heterogeneous consumer preference direction and reference-dependence effect for each attribute, we follow two steps. In the first step, we analyze consumer preferences on attributes using mixed logit model. This model is based on the random utility theory. The utility, U_{nj}, that a consumer n obtained from the alternative j in the random utility model can be explained by the following equation (McFadden, 1973; Train, 2009):

$$U_{nj} = V_{nj} + \varepsilon_{nj} = \beta'_{n,k} X_k + \varepsilon_{nj},\ \beta_{n,k} \sim N(b, W). \quad (1)$$

The utility, U_{nj}, can be subdivided into the deterministic term, V_{nj}, and the stochastic term, ε_{nj}. Here, the deterministic term is composed of the vector X_k multiplied by the coefficient vector $\beta_{n,k}$, where X_k denotes an attributes of an alternative j and $\beta_{n,k}$ denotes a value that consumer n assigns to each attribute of the alternative. That is, the deterministic term signifies the parts that can be explained, such as attributes of product, while the stochastic term signifies parts that cannot be explained, such as characteristics that individual consumers have (Train, 2009). In this study, we assume the coefficient vector $\beta_{n,k}$ to follow a normal distribution, with mean b and variation W. In addition, the discrete choice model can also be classified by the assumption of the stochastic term, and we assume the stochastic term ε_{nj} to follow i.i.d. type I extreme value distribution, which is mutually independent and identical.

After finding individual preferences on each attribute in the first step, a reference-dependence utility function is applied to the discrete choice model in the second step. According to Dellavigna (2009), follow-up studies that are based on the prospect theory of Kahneman and Tversky (1979) consider two specifications of the models as follows. First, value function, v, is defined by the difference from the reference points rather than referring to the entire wealth. Second, the curve of value function, $v(x)$, has an inflection point at the reference point and interval loss, $(x < r)$, has a steeper curve than gain interval, $(x > r)$. Consequently, value function $v(x|r)$