Consumer Risk Reduction Behavior of New Brand Purchase

Koichi Yonezawa* and Timothy J. Richards
Morrison School of Agribusiness and Resource Management
Arizona State University

Selected Paper prepared for presentation at the Agricultural & Applied Economics Association's 2012 AAEA Annual Meeting, Seattle, Washington, August 12-14, 2012.

* Corresponding author. Contact: Koichi.Yonezawa@asu.edu.

Consumer Risk Reduction Behavior of New Brand Purchase

Koichi Yonezawa and Timothy J. Richards
Arizona State University

Introduction

- Success in new product introduction is critical for firm's growth and prosperity. Booz, Allen, and Hamilton (1982) conduct a survey among more than 700 Fortune 1000 companies and estimate that new products provide over 30 percent of their profits from 1981 to 1986. However, nearly 50% of the new products that are introduced in the market place fail, causing considerable financial loss (Urban and Hauser 1993). These studies indicate that consumers are generally reluctant to accept new products and firm profits depend on how much the new products are accepted in the market place.
- One of the reasons for the consumer's low acceptance of new products is the asymmetric information on the quality of new products. When consumers purchase a new product, they are uncertain about its product quality such as flavor, aroma, efficacy, usability, and durability and involved in a risk of purchasing a new product which may not fit their tastes. One of the ways to reduce such a risk is to use quality signals. The other way is to change purchase quantity on their initial, or trial purchase of a new product. Many authors demonstrate the former effects by estimating models which use rich household-level data. For example, Erdem (1998) finds that the perception of a parent brand signals the quality of the umbrella brand. Erdem, Keane, and Sun (2008) demonstrate how price and advertisement signal uncertain product quality. However, very little is known about the latter effect.
- Purchase quantity is an important decision variable for consumers purchasing a new product. They are uncertain about new product quality and do not prefer investing a large amount of money on a product which may not fit their tastes. Accordingly, they tend to purchase a smaller than usual quantity on their trial purchase of a new product (Shoemaker and Shoal 1975). By doing so, consumers can minimize the risk of loosing their valuable money caused by purchasing the new product which they may find unsatisfactory in the following usage occasions.

Research Objectives

- The goal of this research is to examine how consumers decide purchase quantity of a new brand as a risk reduction behavior.
- The other goal is to reveal heterogeneity of this risk reduction behavior across brands.
- For these purposes, we use the multiple discrete continuous extreme value (MDCEV) model developed by Bhat (2005, 2008).
  - The MDCEV model allows consumers to purchase either many units of a single brand or a bundle of brands on a single purchase occasion.
  - The MDCEV model captures structural changes of the utility function when consumers make a trial purchase of the new product.
  - The MDCEV model takes into consideration consumers' demographic attributes which may influence the quantity decision of a new product purchase.

Hypothesis

- If consumers purchase a smaller quantity at a purchase occasion, they can minimize their risk of using this disappointing brand in the following usage occasions. This implies that if consumers face diminishing marginal utility for the brand, their utility function may become more concave rather than linear and satiation occurs at a smaller quantity when consumers purchase the new brand on a given purchase occasion.

Econometric Model

- The utility function that results from household *h* purchasing a certain amount of a brand *i* (numeraire good if *i*=1) at occasion *j* is described as:

$$u_{ij}^h = \frac{1}{\alpha_1} exp\left(\varepsilon_{1j}^h\right)\left(q_{1j}^h\right)^{\alpha_1} + \sum_{i=2}^{I} \left(\frac{\gamma_i}{\alpha_{ij}^h}\right) \varphi_{ij}^h \left\{\left(\frac{q_{ij}^h}{\gamma_i}+1\right)^{\alpha_{ij}^h} - 1\right\},$$

where

q_{ij}^h: amount of brand *i* purchased by household *h* on occasion *j*,

ϵ_{ij}^h: brand-, occasion-, and household-specific random term,

φ_{ij}^h: baseline utility of brand *i* on occasion *j* by household *h* that represents marginal utility at the point of zero purchase of brand *i*,

α_{ij}^h: satiation or concavity parameter of brand *i* on occasion *j* by household *h*,

γ_i: product-specific utility translation parameter that defines both asymptotes and slope of the indifference curves.

- The baseline utility (φ_{ij}^h) and satiation parameter (α_{ij}^h) are specified as:$\varphi_{ij}^h = exp\left(\beta_i + \epsilon_{ij}^h\right)$ and $\alpha_{ij}^h = 1 - exp\left[-\left(\psi_i + \eta_i NB_{ij}^h + \zeta_i D^h\right)\right]$ where β_i is a product specific intercept term for baseline utility, ψ_i is a product specific intercept term for satiation parameter, NB_{ij}^h is a new brand vector which takes one if brand *i* is a new brand for household *h* at occasion *j* and takes zero otherwise, and D^h is a vector of demographic attributes describing the household, including household size, income, purchase cycle, and education.
- The new brand is defined as a brand which a household *h* did not purchased for more than one year.
- The hypothesis suggests if a new brand purchase makes the utility function more concave, then it is expected that $\eta_i < 0$.
- We solve the constrained utility maximization problem using the Kuhn-Tucker approach. With the assumption that ϵ_{ij}^h are distributed iid extreme, the probability that any *M* of the *I* brands are chosen is given by:

$$P\left(q_{1j}^h, \cdots, q_{Mj}^h, 0, \cdots, 0\right) = \frac{1}{\sigma^{M-1}}\left(\prod_{k=1}^{M} g_k\right)\left(\sum_{k=1}^{M} \frac{p_k}{g_k}\right)\left(\frac{\prod_{k=1}^{M} exp\left(v_{kj}^h/\sigma\right)}{\left(\sum_{i=1}^{I} exp\left(v_{ij}^h/\sigma\right)\right)^M}\right)(M-1)!,$$

where $V_{ij}^h = \varphi_{ij}^h + (\alpha_i - 1) ln\left(\frac{q_{ij}^h}{\gamma_i}+1\right) - lnp_i (i \geq 2); V_{1j}^h = (\alpha_1 - 1) ln\left(q_{1j}^h\right)$ and $g_i = \frac{1-\alpha_i}{q_{ij}^h + \gamma_i}$

Data

- Household-level panel scanner data in a US major city for two years.
- Inside goods: major 5 yogurt brands.
- Numeraire good: expenditure on other food categories.
- 592 households and 17,235 purchase occasions.

Table 1: Purchase volume at all purchase occasions and new brand purchase occasions

	All Purchase Occasions			New Brand Purchase Occasions		
Brand	Obs.	Mean	Std. Dev.	Obs.	Mean	Std. Dev.
Average	18,881	38.387	28.837	433	30.259	25.125
Brand A	7,236	42.376	31.398	103	36.641	30.789
Brand B	6,038	41.947	28.515	102	36.480	26.416
Brand C	3,921	33.104	24.174	114	30.517	20.539
Brand D	1,084	17.517	12.840	57	13.333	11.768
Brand E	602	26.731	23.594	57	24.000	20.442

Table 2: Incidence of demand for variety

Brand Purchase	Frequency
1-brand Purchase	91.471%
2-brand Purchase	7.653%
3-brand Purchase	0.731%
4-brand Purchase	0.145%
5-brand Purchase	-

Results

- The MDCEV model is estimated using the maximum likelihood method. The estimation results are shown in Tables 3 and 4.

Table 3: MDCEV model with homogeneous satiation parameters across brands

Parameter	Brand	Symbol	Estimate	Std. Err.
Baseline Marginal Utility	Brand A	β_A	6.486*	0.034
	Brand B	β_B	6.358*	0.035
	Brand C	β_C	6.028*	0.036
	Brand D	β_D	5.558*	0.051
	Brand E	β_E	5.473*	0.060
Satiation Parameter 1: Intercept	-	ζ	-2.388*	0.009
Satiation Parameter 2: New Brand Purchase	-	η	-0.156*	0.017
Satiation Parameter 3: Household Size	-	θ	0.100*	0.019
Satiation Parameter 4: Income	-	κ	-0.182*	0.006
Satiation Parameter 5: Purchase Cycle	-	ν	0.398*	0.024
Satiation Parameter 6: Education	-	ξ	0.021*	0.005
Translation Parameter	Brand A	γ_A	1 (fixed)	
	Brand B	γ_B	1 (fixed)	
	Brand C	γ_C	1 (fixed)	
	Brand D	γ_D	1 (fixed)	
	Brand E	γ_E	1 (fixed)	
Scale Parameter	-	σ	1 (fixed)	
Log-likelihood Value			18,528	
χ^2			37,055	
AIC			-2.150	

Table 4: MDCEV model with heterogeneous satiation parameters across brands

Parameter	Brand	Symbol	Estimate	Std. Err.
Satiation Parameter 2: New Brand Purchase	Brand A	η_A	-0.144*	0.036
	Brand B	η_B	-0.170*	0.029
	Brand C	η_C	-0.075*	0.032
	Brand D	η_D	-0.244*	0.045
	Brand E	η_E	-0.017	0.056

Note: An asterisk indicates significance at a 5% level.

Conclusions

- The hypothesis of this study is that satiation occurs at a smaller quantity when consumers purchase a new brand. In order to test this hypothesis, we use the MDCEV model developed by Bhat (2005, 2008). With this approach, the model is able to test the degree of satiation which is the focus of this study. The estimation result shows that when consumers purchase a new brand, their utility function becomes more concave and satiation occurs at a smaller quantity, which supports the hypothesis of this study. This suggests that consumers reduce the risk of a new brand by purchasing a smaller than usual quantity on their trial purchase. Moreover, consumers exhibit heterogeneous magnitude of this risk reduction behavior across brands. Consumers become more risk averse when purchasing some brand than others. Identifying consumer's decision of purchase quantity as a risk reduction strategy of a new brand and revealing heterogeneity of this risk reduction strategy is the main contribution of this research.

Future Research

- It is important to examine heterogeneity of the risk reduction behavior across consumers. For this purpose, the model can be extend to a mixed multiple discrete continuous extreme value model (MMDCEV).