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Consumer Preferences for Less Packaging: A Stated Preference Study*

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Abstract

This study estimates the willingness-to-pay (WTP) for packaging with less material by using contingent valuation. We found that people who care about the environmental friendliness of a product, who have a positive perception of less packaging, and who live in a municipality implementing unit-based pricing of waste have a higher WTP. Use of economic instruments potentially affects the purchase of products with reduced packaging. However, when unit-based pricing is combined with plastic separation for recycling, it reduces the WTP. This suggests the possibility that the effect of economic instruments on source reduction of waste is weakened by the recycling policy.

Keywords Less packaging; Contingent valuation; Unit-based pricing

JEL Classification M31, Q51, Q53

1 Introduction

The amount of municipal solid waste final disposed of in Japan gradually decreased over the last decade, dropping from 109 million tons in 2000 to 51 million tons in 2009 (Japanese Ministry of the Environment 2011). This was presumably due to the implementation of several laws concerning the recycling of materials. As a result of such legislation, the amount of recycled municipal solid waste showed a steady increase from 70 million tons in 2000 to 95 million tons in 2009. While recycling can reduce the amount of waste finally disposed of, it requires energy and labor input. This leads to the assertion that in waste management more attention should be paid to the source reduction. In comparison with recycling activities, there seems to have been less activity aimed at source reduction of waste. For this reason, it is important to understand what problems are connected with source reduction and how we can better promote it.

Buying commodities packaged with less material is one of the significant ways of practising source reduction of waste. Dewees (1998) reviews the regulation of packaging waste in Canada and finds that source reduction has reduced the disposal of soft drink packaging waste more than either mandatory deposit-refund programs or household recycling. He concludes that, except for refillable beer bottle, Canadian consumers have rejected refillable beverage containers and that source reduction has been achieved mainly by manufacturers as a market-driven measure.

When it comes to green packaging, a broader concept than less packaging, several studies have investigated consumer perceptions and behavior. Bech-Larsen (1996)

investigated Danish consumers' attitudes to food packaging by using several questionnaire surveys. His results indicate that a number of consumers are concerned about the environmental consequences of packaging waste, though their perceptions seldom affect actual purchasing behavior. Furthermore, it seems that consumers do not think that they are able to solve the packaging waste problem. Bech-Larsen suggests that environmental information should stress, by means of shelf labeling, shop signs, and other forms of communication at the place of selection, the positive contribution to environmental quality that consumers can make.

Rokka and Uusitalo (2008) investigate Finnish consumers' preference for recyclable packaging by using a choice-based conjoint analysis. Their results indicate that consumers evaluate recyclable packaging positively, as well as the resealability of packages. They also identified various distinctive consumer segments in the market. Contrary to previous studies, they found that the largest consumer segment favored environmentally labelled packaging as the most important criteria in their choice.

This paper focuses on less packaging and studies how consumers evaluate it by using the stated preference approach. By examining consumer preferences, we can empirically investigate the potential demand for products with less packaging and its price competitiveness as compared to the products with conventional packaging.

Estimation of willingness-to-pay (WTP) for less packaging has significant implications for designing an adequate waste policy. First of all, a higher WTP for such a qualitatively different goods means that it would be possible to promote these goods

to green consumers. If products with less packaging are attractive enough, they can increase their market share without need for any policy intervention. Secondly, the WTP would be affected by various factors such as consumers' demographic characteristics and their perception of the pros and cons of less packaging. Understanding the characteristics of consumers who prefer less packaging would provide significant hints for effective green marketing. Furthermore, we also investigate the effect of policy instruments relating to waste management on the promotion of products with less packaging. Economic instruments like the unit-based pricing of waste collection might induce a higher WTP for less packaging due to higher disposal costs. On the other hand, the separation of waste for recycling might reduce WTP for less packaging, since source reduction becomes less attractive when people believe that recycling is preferable.

We use a bidding game contingent valuation method in our survey. In the bidding game format, respondents are iteratively asked whether they would be willing to pay a certain amount to acquire the product. The amounts are raised or lowered, depending on the response to the previously offered amount. This process allows researchers to estimate the individual WTP of each respondent more efficiently. It has been pointed out, however, that this approach may suffer from starting point bias, and so we prepare scenarios with three different starting bids and examine if there is or is not a starting point bias.

The aim of this paper is twofold. First, it is to investigate consumers' WTP for less packaging. Although there have been several studies on consumer perceptions

and their behavior in regard to green packaging (Bech-Larsen 1996; Rokka and Uusitalo 2008; Matsumoto 2011), no attempt has been made to study WTP for less packaging and analyze the individual characteristics that affect how much people are willing to pay. Secondly, it is to investigate the effect of policy instruments on consumer preference for less packaging. Previous studies on green packaging tend to emphasize the effect of environmental information provided at the store shelves, whereas this study looks at the interaction between waste policies and green marketing. From both the theoretical and empirical point of view, we investigate how waste policies would affect the consumer preference for packaging with less materials.

The reminder of this paper proceeds as follows. We develop a simple model of consumer preference in Section 2. Section 3 describes the survey design and the data. Following that, econometric models are provided in Section 4. Section 5 summarizes the empirical results of our estimation. Section 6 discusses the implication of those results. Section 7 presents our conclusions.

2 A model of consumer preference

Our theoretical model is based on Björner et al. (2004); for the sake of simplicity we omit the choice of an optimal quantity of products and restrict our attention to the marginal purchasing decision. We assume a linear utility function

$$U_i = \alpha_i + \beta X_i + \gamma(M - p_i), \tag{1}$$

where subscript $i = l, c$ represents a type of the product (l is a product with less packaging and c is a product with conventional packaging), X_i is a vector of observable good attributes, M is exogenously given income, p_i is the price of the products, α_i captures the utility effect of unobserved type specific attributes, β is the vector of parameters for observable good attributes, and γ is the marginal utility of income.

A consumer will prefer a product with less packaging rather than a product with conventional packaging when

$$U_l > U_c. \tag{2}$$

If a consumer switches his/her choice at $p_l - p_c$, the willingness to pay for less packaging can be defined as

$$p_l - p_c = WTP = \frac{\alpha_l - \alpha_c + \beta(X_l - X_c)}{\gamma}. \tag{3}$$

When there is a unit-based pricing policy for waste disposal, households have to pay tZ_i, where t represents a disposal fee per volume of waste and Z_i represents the volume of waste from consuming the product. The WTP for less packaging under a unit-based disposal fee now takes into account the difference in the fee payment:

$$WTP^t = \frac{\alpha_l - \alpha_c + \beta(X_l - X_c)}{\gamma} - (tZ_l - tZ_c). \tag{4}$$

Since $tZ_l < tZ_c$, WTP^t should be higher than WTP. So there is a higher WTP for less packaging when there is a unit-based pricing policy.

When plastic separation for recycling is implemented in the municipality where the consumer lives, the consumer would engage in recycling activities to some extent. We use r to indicate the ratio of separation and assume that it is motivated mainly by the social norms of the consumer and is not influenced by the type of products. Therefore, the expected WTP for less packaging under a plastic separation policy can be expressed as the weighted sum of two kinds of WTP, thus:

$$WTP^{\rho} = (1-r)WTP + rWTP^{s} \tag{5}$$

$$= (1-r)\frac{\alpha_l - \alpha_c + \beta(X_l - X_c)}{\gamma} + r\frac{\alpha_l^s - \alpha_c^s + \beta^s(X_l - X_c)}{\gamma} \tag{6}$$

where fraction $(1-r)$ is emitted as a waste and fraction r is emitted as recyclable plastic. WTP is the willingness to pay for less packaging when it is treated as waste and WTP^s the willingness to pay for less packaging when it is treated as recyclable. If an individual believes that recycling is environmentally at least as good as source reduction, the difference in evaluation between a product with less packaging and a product with conventional packaging becomes smaller. That means that the final term of equation (6) becomes smaller. In that case, WTP^{ρ} is lower than WTP: waste separation for recycling might reduce WTP for less packaging.

When there is a combination of a unit-based pricing policy and a plastic separation policy, there is an incentive for the consumer to avoid the payment of a disposal fee by separating the waste, since typically there is no charge for recyclables. Thus, the separation ratio r' under the combined policy would be higher than r. We express the expected WTP for less packaging under a combined policy as

$$WTP^{t\rho} = (1 - r')WTP^t + r'WTP^s. \tag{7}$$

As long as WTP^s is small, $WTP^{t\rho}$ is lower than WTP^t. That is, WTP for less packaging under the combined policy might be lower than that under the unit-based pricing only. Furthermore, the difference between $WTP^{t\rho}$ and WTP^t is larger for a higher r'. When the consumer is more likely to avoid the payment of a disposal fee by separating the waste, the effect of the combined policy to reduce the WTP becomes stronger.

3 Data

3.1 Survey Design

The survey was implemented in December 2010, after several pretests with a small number of respondents to refine survey wording and to reduce scenario rejection. We sent e-mails to registered monitors of a survey company to invite them to answer on-line questionnaires. Among 10,717 persons who received the e-mails, 2,411 completed the questionnaire (the response rate was 22.5 percent). After incomplete answers were rejected, 2,214 responses remained for analysis.

The survey instrument is divided into four sections. The first section asks about respondents' daily shopping behavior, such as their degree of concern about the price, quality, brand, and environmental friendliness of body care products. The second section consists of contingent valuation (CV) questions on reduced packaging. We

use a bidding game type of CV question with pairwise comparison of products. The reason for using the bidding game format is that it enables us to estimate an individual's WTP more precisely. In addition, pairwise comparison is useful when we ask a consumer to choose, for example, between a bottle shampoo and a refill-pack shampoo on a retailers shelves. The third section includes questions about factors that might affect the WTP of respondents: for example, we ask their views on less packaging and whether or not there is a unit-based pricing of waste collection in their municipalities. Questions on socio-demographic characteristics are asked in the last section.

In the CV section we described two products (bottle shampoo and refill-pack shampoo) with prices indicated and asked respondents to answer which would be preferable if they were to choose. We explained that these products are identical in quality and quantity but are different with respect to their packaging. The bottle shampoo is packaged in a plastic bottle; the refill-pack shampoo is packaged in a plastic film and consumers usually pour it into an empty bottle before use. An example of a question in that section is given in Figure 1.

//Figure 1//

//Figure 2//

Figure 2 shows the structure of the bidding process. We indicate the price of the bottle shampoo as p_l^i and the price of the refill-pack shampoo as p_c^i, where i represents the stage of the bidding game. In the first stage, the respondents are asked to choose one from two products that are the same price ($p_l^1 = p_c^1$). This

initial bid for a respondent is determined by his/her answer to the question on the price range of shampoos that he/she usually buys. We used the median value of the price range as the starting bid. After the respondent's choice in the first stage, the price of the product chosen increases by 25 Japanese yen in the second stage, while the price of the unchosen product remains the same as in the first stage (1 Japanese yen = 0.0119 US dollar as of 1 December 2010). The bidding is iterated until the respondent switches his/her choice of the preferred product. Since it seems unreasonable to expect respondents' WTP to be 50 % higher than the average price of the product, the maximum iteration is set at 13 times.

To detect any starting-point bias, we prepare subsamples whose starting bid on the refill pack is higher or lower by 50 Japanese yen compared to the base case (p_l^1+50 or p_l^1-50). The difference between these subsamples is only the first bid. The price change in each bidding sequence is always kept at 25 Japanese yen. We also prepare subsamples that face a decreasing, instead of an increasing, price in the course of the bidding game. For these subsamples, the price of the unchosen product in the first stage decreases by 25 Japanese yen in the second stage, while the price of the chosen product is same as the first stage. By comparing respondents' WTP with the base case, we can examine if the direction of the bidding sequence affects the result. In summary, there are six different scenarios, depending on differences in the starting bid between products and on the directions of the bidding sequences (Table 1).

//Table 1//

3.2 Perceptions of Less Packaging

After the CV questions, we asked respondents their perceptions of refill-pack shampoo, using a four-point Likert scale. The four possible responses range from "strongly agree" to "strongly disagree". Items evaluated are; It is compact (Percep1); It is environmental friendly (Percep2); It is unpleasant when the container gets old (Percep3); Refilling is troublesome (Percep4); and Waste separation is easy (Percep5).

//Figure 3//

Figure 3 shows the summary of the responses. Many respondents admit the environmental friendliness of the refill pack, while many people also agree that the container looks unsightly when it gets old. Responses to the statement that the refilling is troublesome were divided roughly in half. Correlations between these perception scores are not very high, as the highest correlation is -0.281 between "environmental friendliness" (Percep2) and "waste separation" (Percep5).

3.3 Descriptive Statistics of Variables

Descriptive statistics are reported in Table 2. The demographic variables of respondents are gender ($Gender$), age (Age), size of household ($Faminumb$), type of the dwelling ($House$), education ($Univ$), and annual income ($Income$).

We asked respondents their consciousness of four attributes when buying body-care products from "very important" to "not important at all". The four attributes are price ($Cprice$), quality ($Cquality$), brand name ($Cbrand$), and environmental

friendliness ($Cenv$). These scores are useful to investigate how what respondents look for when shopping could affect their WTP for reduced packaging.

There are differences in the prices of the shampoo that respondents usually purchase, and this might affect their WTP. We divide prices into five ranges: below 300 yen (base), 300 yen to 500 yen ($Up300$), 500 yen to 700 yen ($Up500$), 700 yen to 900 yen ($Up700$), and above 900 yen ($Up900$). This information is used to set the starting bid in the CV questions. $Urefill$ is a dummy variable that takes 1 when the respondent usually purchases the refill-pack shampoo. This variable is not included in the WTP model; instead, it is used as a dependent variable to examine the determinants of the usual purchase behavior of refill-pack shampoo.

To consider the influence of policies by municipalities regarding containers and packaging on the WTP for reduced packaging, we added a question on the implementation of unit-based pricing of waste ($Paypbag$) and implementation of separate collection of the plastic containers and packaging ($Plastic$). While it is expected that the unit-based pricing will increase the WTP for less packaging, the effect of separation of plastics is indeterminate, since separation would be necessary for both plastic bottles and plastic films if such a policy were implemented. WTP for less packaging would be reduced by the introduction of plastic separation for recycling, if the consumer believes that recycling is a better option than source reduction. $Paypla$ is the interaction term of $Paypbag$ and $Plastic$. When unit-based pricing is combined with plastic separation, WTP for less packaging would become lower than that when there is unit-based pricing only. This is because recyclables are typically

collected without a fee and consumers can avoid unit-based pricing by separating plastic containers and packaging.

//Table 2//

4 Econometric Models

4.1 Interval Regression Model

Since the responses to the bidding game are censored data, we use the interval regression model for estimating the WTP (Cameron and Huppert 1989). If the responses change at a certain range of the suggested bid, the WTP of individual i lies in the interval between the lower bid (t_{li}) and the upper bid (t_{ui}).

$$WTP_i = x_i'\beta + \varepsilon_i, \tag{8}$$

where ε_i is normal distribution with N(0, σ). The probability that WTP_i lies between the interval is

$$\Pr(WTP_i \subseteq (t_{li}, t_{ui})) = \Pr((t_{li} - \beta X_i)/\sigma < z_i < (t_{ui} - \beta X_i)/\sigma), \tag{9}$$

where z_i is the normal random variable. Let z_{ui} and z_{li} represent the upper and lower limits in the above equation, respectively. Then for a given observation, it can be written by using $\Phi(z_{ui})$ and $\Phi(z_{li})$, where Φ is the cumulative standard normal density function. The joint probability density function for n independent observation is defined by the following log-likelihood function:

$$\log L = \sum_{i=1}^{n} \log[\Phi(z_{ui}) - \Phi(z_{li})]. \tag{10}$$

4.2 Purchase Behavior Model

The purchase behavior model examines the determinants of behavior to buy the refill shampoo, using the binary choice model and taking $Urefill$ as the dependent variable. Independent variables are the same as the WTP models except for variables with respect to the settings of the CV questionnaire (Pr_{up}, $Patpl50$, and $Patmn50$). The utility function is defined as

$$U_{ki} = \beta X_{ki} + \varepsilon_{ki}, \tag{11}$$

where the subscripts $k = l, c$ denote the refill shampoo and bottle shampoo, respectively. The dependent variable $Urefill$ is unity if $U_{li} \geq U_{ci}$, while $Urefill$ is zero if $U_{li} < U_{ci}$.

5 Empirical Results

5.1 Results by Interval Regression Model

Table 3 shows the estimated results by three interval regression models with different explanatory variables included. Model 3 contains the full set of variables with area fixed effect. The area variable divides Japan into ten groups, each composed of several prefectures: Hokkaido, Tohoku, Kanto, Koshin, Hokuriku, Tokai, Kansai, Chugoku, Shikoku, and Kyushu.

//Table 3//

Consciousness of Attributes

We asked respondents regarding their consciousness of four attributes in purchasing body-care products: price, quality, brand, and environmental friendliness. The positive and significant coefficient of environmental friendliness ($Cenv$) suggests that respondents who care about the environmental impact of a product have a higher WTP. Other coefficients of variables related to consciousness are not significant.

Perception on Refill-Pack Shampoo

Respondents have various perceptions regarding refill-pack shampoo, and these factors might have an impact on their WTP. Among the perception variables, $Percep1$ (compact), $Percep2$ (environmental friendliness), $Percep5$ (waste separation) have positive and significant coefficients. On the other hand, the coefficients of $Percep3$ (containers looks unsightly when it gets old) and $Percep4$ (refilling is troublesome) are negative and significant.

Policy Instruments for Waste Management

A positive and significant coefficient for $Paypbag$ suggests a higher WTP by respondents who live in a municipality implementing a unit-based pricing of waste collection. Because the unit-based pricing increases the cost of disposal, the demand for less packaging becomes higher. A policy intervention through economic instruments potentially affects the purchase of products with reduced packaging. Plastic separation ($Plastic$) is positive and significant in two models. Therefore,

less packaging would be evaluated positively although its statistical significance is weak even under the plastic separation policy. $Paypla$ is negative and significant. When combined with unit-based pricing, plastic separation reduces WTP for less packaging. This suggests the possibility that the effect of economic instruments on promotion of source reduction is weakened by the existence of a recycling policy.

Starting Point Bias and Bidding Scheme

The coefficients of $Patpl50$ are positive and those of $Patmn50$ are negative. Statistical significance suggests the existence of a starting point bias in this sample. Increasing sequence (Pr_{up}) is not significant and this implies that the bidding scheme does not affect the WTP. This suggests that there is no framing effect and respondents appropriately recognize the difference in prices between two substitutes regardless of the sequence of bidding.

The WTP for Reduced Packaging

The mean WTP is estimated as 2.469 [-3.378, 8.315] Japanese yen (approximately 2.5 US cents) when the starting bid is zero, that is, when there are no price differences between conventional packaging and less packaging in the first question (the numbers in square brackets mean a 95% confidence interval). The mean WTP becomes 14.122 [7.646, 20.599] Japanese yen when the starting bid is 50 Japanese yen and -7.495 [-13.144, -1.846] Japanese yen when the starting bid is minus 50 Japanese yen . On average, consumers are willing to pay a very small amount for less packaging. When the starting point is negative, it can become even negative. In the next section,

we consider models that explain the usual purchase behavior of products with less packaging.

5.2 Usual Purchase Behavior

Taking $Urefill$ as a dependent variable, we can estimate a model that explains the usual purchase behavior of refill shampoo. Table 4 shows the estimated results in logit and probit models. When the results is compared with that of the interval models of WTP, differences can be found in the determinants.

//Table 4//

First, consciousness of quality is significant in the purchase behavior model while it is not significant in the WTP model. On the other hand, consciousness of environmental friendliness is not significant in the purchase behavior model but it is significant in the WTP model. These differences suggest that even though consciousness of environmental friendliness contributes to a higher WTP, it does not necessarily explain the actual behavior of purchasing a refill pack. In general, refill-pack shampoos are sold at retailers with cheaper prices than bottle shampoos. This means that consumers are motivated to buy a refill pack even if they are not concerned about the environmental friendliness of the products. The significant coefficient of the consciousness of quality supports this supposition, since a focus on quality naturally means attributing value to the content of products, not to the packaging. The insignificance of the coefficient for perception of environmental friendliness ($Percep2$) in the behavior model also cofirms this interpretation.

Second, all coefficients for price ranges ($Up300$, $Up500$, $Up700$, $Up900$) are statistically significant in the purchase behavior model, while some of them are not significant in the WTP model. Moreover, the size of the coefficient estimated in the behavior model is lower for the higher price range. While this can be interpreted as a natural result of the fact that refill packs are sold at lower prices, it might be a reflection of the possibility of choice at the store shelves. When there are constraints facing consumers who want products in the higher price range, e.g., the unavailability of refill-pack variants, consumers would have no choice but to purchase a bottle shampoo.

The policy variables ($Paypbag$, $Plastic$, $Paypla$) are not statistically significant in the behavior model. This is in contrast to the theoretical and empirical investigations in earlier sections suggesting that WTP for less packaging would be affected by unit-based pricing and waste separation. A part of the reason might again be the price difference between refill-pack and bottle shampoos. When the difference is large enough, even consumers who have a negative WTP would buy a refill pack. The impact of policy instruments might not be detectable from actual behavior when the price effect is strong.

6 Discussion

Many studies have confirmed that consumers are willing to pay some premium for environmental attributes of products. Examples include agricultural products produced with environmentally sound production and management techniques (Moon

et al. 2002), environmentally certified forest products (O'Brien and Teisl 2004), and organic fibers embodied in apparel goods (Nimon and Beghin 1999). The motivation for accepting the premium on green products has been analyzed within the framework of internalized moral norms (Nyborg et al. 2006) or conformity to other people's behavior (Carlsson et al. 2010).

Despite the studies suggesting a willingness to pay some premium for green products, this study find the WTP for less packaging of shampoo items is a very small amount (2.469 Japanese yen, approximately 2.5 US cents) and can be negative when the starting bid for a refill pack is negative. This result might be attributed to two distinct characteristics of this particular type of green product. The first is that the refill-pack shampoo is sold at a lower price than bottle shampoo. As WTP for hypothetical products is influenced by the starting bid, the WTP for less packaging in the real market would be influenced by this reference point. Although many consumers are choosing refill-pack shampoo, the estimated results of the behavior models suggest that the motivation behind the choice may not be concern for the environment. This is a virtue of less packaging, since green products is promoted through price incentives even if people are not environmentally conscious.

The second characteristic is the negative perceptions connected with the products with the less packaging. Estimation results suggest that $Percep3$ (container looks unsightly when it gets old) and $Percep4$ (refilling is troublesome) are negative and significant. This negative characteristic of a refill pack contrasts with green products evaluated in previous studies. In most of those studies, the sole difference

(other than price) between green products and conventional products is the positive contribution of the former to the environmental quality. Reducing these negative perceptions by technological innovation and providing more information regarding the environmental friendliness of less packaging would contribute to increase WTP and strengthen the competitiveness of products.

7 Conclusion

We investigated the WTP for reduced packaging products by using the bidding game combined with a web-based survey. Estimated results showed that the average WTP for eco-friendly packaging is roughly 2.5 Japanese yen for the base case of the starting bid. The individual characteristics that significantly affect WTP were: concern for the environment in daily shopping; perceptions regarding refill-pack shampoo; and the implementation of unit-based pricing of waste collection.

Our results suggest that there is an interaction between waste policy and green marketing. Because the unit-based pricing increases the cost of disposal, the demand for less packaging becomes higher through the use of economic instruments. However, when unit-based pricing is combined with plastic separation, it reduces WTP for less packaging. This suggests the possibility that the effect of economic instruments on promotion of source reduction is weakened by the existence of a recycling policy.

Since the estimated WTP is low and depends on the starting bid, the current situation of the difference in price between bottle shampoos and refill-pack shampoos

would serve as a reference point that leads to negative WTP. Nevertheless, if the environmental friendliness of less packaging were emphasized in sales promotion, this would highten the WTP and strengthen the competitiveness of the product.

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Table 1: The numbers of respondents in subsamples

	p_l^1	p_l^1+50	p_l^1-50	Total
Increasing sequence	310	313	309	932
Decreasing sequence	301	309	366	976
Total	611	622	675	1,908

Table 2: Descriptive Statistics

Variables	Mean	Std.Dev.	
Gender	0.403	0.491	1=Male, 0=Female
Age	46.127	14.088	Years
Faminumb	2.901	1.298	Size of a household
House	0.563	0.496	1=Detached house, 0=Multiple dwelling house
Univ	0.583	0.493	1=Bachelor's or higher degree, 0=Others
Income	584.801	278.799	Annual income (in 10 thousand yen)
Cprice	3.394	0.634	Consciousness on price
Cquality	3.256	0.586	Consciousness on quality
Cbrand	2.745	0.726	Consciousness on brand
Cenv	2.462	0.726	Consciousness on environmental friendliness
*Up*300	0.410	0.492	Price range of usual purchase: 300-500 yen
*Up*500	0.225	0.418	Price range of usual purchase: 500-700 yen
*Up*700	0.085	0.280	Price range of usual purchase: 700-900 yen
*Up*900	0.132	0.339	Price range of usual purchase: above 900 yen
*Percep*1	2.777	0.803	Perception of refill pack (It is compact.)
*Percep*2	3.227	0.696	Perception of refill pack (It is environmentally friendly.)
*Percep*3	2.927	0.781	Perception of refill pack (Container looks unsightly when it gets old.)
*Percep*4	2.540	0.819	Perception of refill pack (Refilling is troublesome.)
*Percep*5	2.889	0.783	Perception of refill pack (Waste separation is easy.)
Paypbag	0.614	0.487	Implementation of unit-based pricing of waste collection
Plastic	0.764	0.425	Implementation of separate collection of the plastic containers and packaging
Paypla	0.488	0.500	Paypbag * Plastic
Urefill	0.782	0.412	1=usually purchases refill pack, 0=Others

[continued on the next page]

Variables	Mean	Std.Dev.	
Pr_{up}	0.488	0.500	1=Increasing price sequence, 0=Decreasing price sequence
$Patpl50$	0.326	0.469	1=Starting bid is +50, 0=Otherwise
$Patmn50$	0.354	0.478	1=Starting bid is -50, 0=Otherwise

Table 3: Estimated results of interval model

Variables	Model 1	Model 2	Model 3
Constant	-11.268 (26.268)	-21.461 (25.983)	-37.101 (26.679)
Cprice	2.136 (3.488)	-0.845 (3.555)	-1.291 (3.500)
Cquality	-3.060 (3.545)	2.412 (3.577)	2.523 (3.551)
Cbrand	0.465 (2.639)	-1.256 (2.812)	-1.303 (2.815)
Cenv	10.237*** (2.694)	11.735*** (2.808)	11.930 *** (2.800)
Pr_up	-1.912 (3.181)	-2.069 (3.252)	-2.179 (3.255)
*Percep*1	9.302*** (2.293)	7.464*** (2.330)	7.370*** (2.338)
*Percep*2	5.335* (3.025)	5.839* (2.992)	5.860** (2.962)
*Percep*3	-11.102*** (2.314)	-8.837*** (2.405)	-9.044*** (2.395)
*Percep*4	-11.396*** (2.294)	-10.427*** (2.361)	-10.130*** (2.356)
*Percep*5	9.288*** (2.256)	10.581*** (2.233)	10.924*** (2.239)
Paypbag	15.98*** (5.562)	16.931*** (6.063)	21.814*** (6.529)
Plastic	7.051 (3.374)	9.108* (5.185)	10.142* (5.225)
Paypla	-13.534* (7.196)	-14.438** (7.290)	-18.599** (7.529)
Gender	-2.948 (3.509)	-4.358 (3.786)	-4.178 (3.774)
Age	-0.451*** (0.131)	-0.363*** (0.139)	-0.363*** (0.137)
Faminumb	-1.868 (1.368)	-1.356 (1.430)	-1.239 (1.437)
House	2.313 (3.575)	1.817 (3.728)	2.171 (3.765)
Univ	-2.098 (3.425)	-4.421 (3.502)	-4.693 (3.473)
Income	-0.011* (0.006)	-0.002 (0.006)	-0.002 (0.006)

[continued on the next page]

Variables	Model 1	Model 2	Model 3
$Patpl50$	21.608***	17.180***	17.158***
	(4.095)	(4.235)	(4.216)
$Patmn50$	-12.844 ***	-15.045***	-15.557***
	(3.818)	(3.960)	(3.939)
$Up300$		-1.551	-1.927
		(3.931)	(3.977)
$Up500$		-6.365	-6.733
		(4.861)	(4.872)
$Up700$		-27.273***	-27.787***
		(7.635)	(7.608)
$Up900$		-31.514***	-31.429***
		(7.398)	(7.432)
Area	No	No	Yes
N	2,214	1,908	1,908
AIC	4.996	4.916	4.918
McKelvey & Zavoina's R^2	0.117	0.136	0.142

***=Significant at 1%. **=Significant at 5%. *=Significant at 10%.

Numbers in parentheses are robust standard errors.

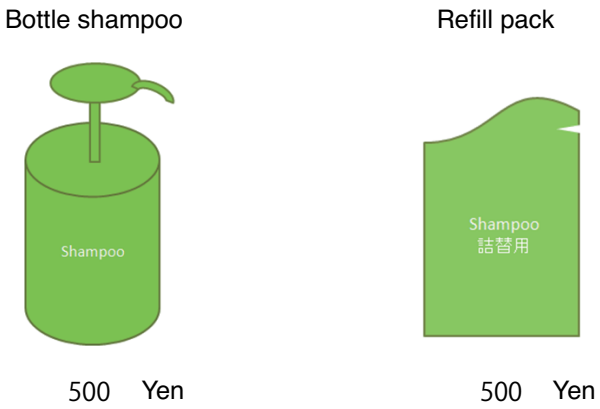
McKelvey & Zavoina's R^2 are computed by using SPost (Long and Freese 2005).

Figure 1: An example of a CV question

Please imagine that you are now going to buy a shampoo and answer the following questions.

Q6. There are two shampoos, as shown in Figure 1. The quality and quantity of both shampoos are the same, and only the packaging of the containers is different. One is “bottle shampoo,” which is packaged in a plastic bottle. The other is a “refill pack,” which is packaged in a plastic film. Which product will you buy if the prices of the products are as indicated below?

Figure 1



1. Bottle shampoo (Go to Q7)
2. Refill pack (Go to Q8)

Table 4: Estimated results of purchase behavior models (N=1,908)

Variables	Logit	Probit
Constant	3.621***	1.906***
	(0.832)	(0.451)
Cprice	-0.090	-0.047
	(0.106)	(0.061)
Cquality	0.252**	0.152**
	(0.124)	(0.071)
Cbrand	-0.104	-0.082
	(0.100)	(0.057)
Cenv	0.065	0.045
	(0.100)	(0.057)
*Up*300	-1.654***	-0.783***
	(0.404)	(0.177)
*Up*500	-2.714***	-1.372***
	(0.405)	(0.180)
*Up*700	-3.295***	-1.718***
	(0.427)	(0.198)
*Up*900	-4.447***	-2.422***
	(0.418)	(0.190)
*Percep*1	0.299***	0.175***
	(0.088)	(0.050)
*Percep*2	-0.072	-0.038
	(0.107)	(0.061)
*Percep*3	-0.214**	-0.113**
	(0.091)	(0.051)
*Percep*4	-0.177**	-0.099**
	(0.084)	(0.047)
*Percep*5	0.133	0.074
	(0.092)	(0.052)
Paypbag	-0.009	0.014
	(0.284)	(0.161)
Plastic	-0.352	-0.196
	(0.230)	(0.131)
Paypla	0.089	0.014
	(0.315)	(0.179)
Gender	-0.501***	-0.280***
	(0.141)	(0.080)
Age	-0.010*	-0.006**
	(0.005)	(0.003)
Faminumb	0.076	0.037
	(0.057)	(0.032)
House	0.000	-0.005
	(0.146)	(0.083)
Univ	0.203	0.120
	(0.136)	(0.078)
Income (*1000)	0.243	0.150
	(0.259)	(0.148)
Area	Yes	Yes
Pseudo R^2	0.214	0.214

***=Significant at 1%. **=Significant at 5%. *=Significant at 10%.

Numbers in parentheses are robust standard errors.

Figure 2: Bidding scheme of the survey

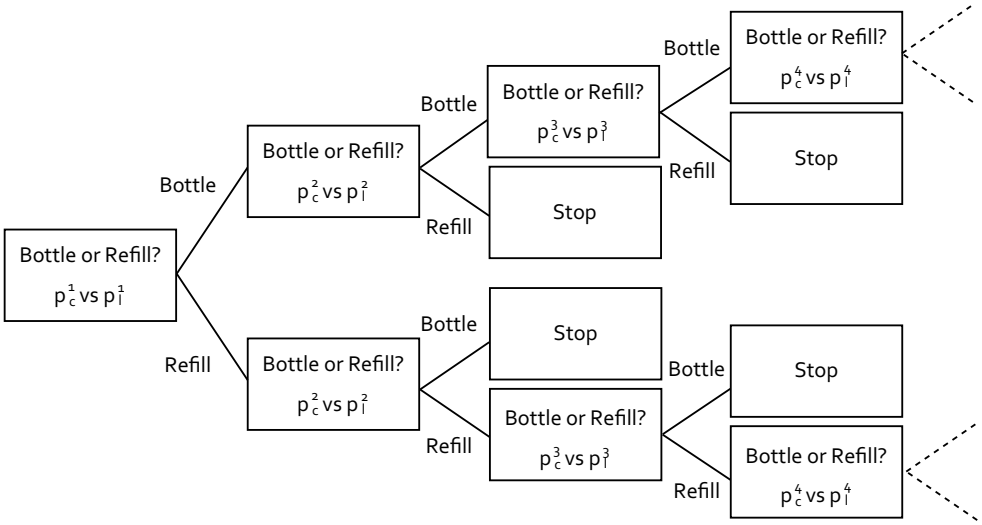
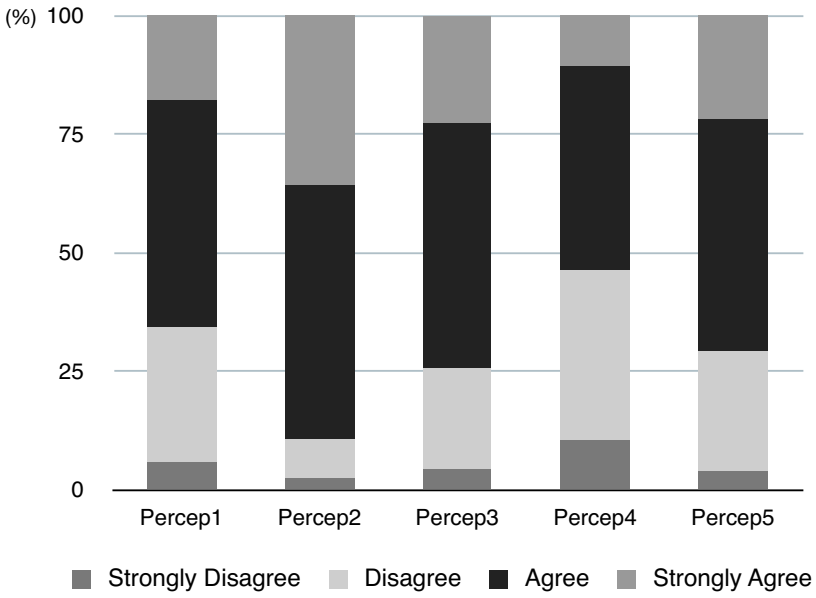


Figure 3: Perceptions regarding refill-pack shampoo (%)



Note: Percep1 = It is compact; Percep2 = It is environmentally friendly; Percep3 = Container looks unsightly when it gets old; Percep4 = Refilling is troublesome; Percep5 = Waste separation is easy.