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Quality Perceptions and Willingness-to-Pay for Imported Rice in Japan

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Attitudes of Japanese consumers toward domestic and foreign varieties of rice were analyzed on the basis of a survey. We found that the current retail prices for imported rice are higher than the average consumers' willingness-to-pay (WTP), whereas most domestic rice was priced below the average WTP. Unfamiliarity or negative perceptions of the safety and flavor of foreign rice lowered WTP substantially. The WTP for U.S. rice was limited more by negative perceptions of flavor than from concerns about food safety.

Key Words: choice experiment, food safety, Japan, quality perceptions, rice, U.S. export, willingness-to-pay

JEL Classification: Q13

Food safety, which is a growing consumer concern worldwide,[1] is a nontrivial issue in trade negotiations. In Japan, the percentage of caloric intake supplied from domestically produced food has declined from more than 70% during the 1960s to 40% during recent years. A primary argument used by advocates for tougher restrictions on imports and government support for domestic agriculture is securing food safety, because it is widely believed that domestically produced food is safer (e.g., Kawai). Since agricultural trade became liberalized in the 1990s, the Japanese have shown strong resistance to consuming foreign produce. Labeling the country of origin of imported foods became mandatory for all fresh foods, including grains, in July 2000. Recent discoveries of excess pesticide residues on imported vegetables from China have strengthened this sentiment (Nougyou Shimbun). A national survey done in September 2002 revealed that 74% of surveyed housewives were concerned with the safety of imported food items (Mainichi Shimbun).

Rice is a staple in the Japanese diet; a statistic from 2000 showed that an average household spent approximately 4.5% of its food expenditure on rice. The Uruguay Round agreements of the World Trade Organization opened the markets in Japan and South Korea to world rice producers in 1995. U.S. rice sales to Japan increased from $31 million in 1995 to $120 million in 2000 (U.S. Department of Agriculture, Foreign Agricultural Service).

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[1] For example, in a consumer survey by the European Commission in 1999, 68% of respondents identified food safety as their top concern (Bonino). In the United States, the percentage of consumers who are confident in the food supply declined from 83% in 1996 to 74% in 2000 (U.S. Department of Agriculture, Economic Research Service).

Today, Japan is the largest overseas market (by value) for the U.S. rice industry. The U.S. share of Japanese imports has been approximately 50% since trade liberalization. The remainder has consisted of rice mainly from Australia, China, and Thailand. Imports make up 7% of the overall rice consumption in Japan, and most imported rice is processed into food products.

Beyond the trade barriers and food safety concerns, Japanese consumers are known for being unusually discerning. U.S. food scientists have noted that the Japanese possess refined preferences for rice quality that U.S. consumers cannot perceive (Lee). Most fresh produce in Japan is labeled by prefecture (political units similar to states) of origin, and many Japanese differentiate not only across varieties of rice but across a single variety produced in different regions. Thus, a brand of rice consists of a combination of variety and a region of origin.

Because most imported rice is used in processing, the quantity of imported rice that currently appears in the Japanese storefront is limited. U.S. rice is more expensive than other imported rice but is priced 3%–30% below mainstream Japanese brands at retail (Food Agency). Because the quantity of imported rice in the market is limited and regulated, the price does not reflect competitive market conditions. The questions of interest are (1) how the retail price compares with Japanese willingness-to-pay (WTP) for foreign varieties and (2) how much, if at all, Japanese WTP is affected by consumers' preconceived images regarding the safety and flavor of imported rice. If negative images lower WTP, promotional efforts could be effective in gaining market share. Consumers' WTP may improve if they are given opportunities to experience the good.

The present article analyzes attitudes of Japanese consumers toward domestic and foreign varieties of rice based on a survey. Specifically, we estimate the WTP for imported rice and major domestic brands of rice, investigate how consumers' perceptions of imported rice affect WTP, identify socioeconomic and demographic profiles of households with various rice purchasing patterns, and examine regional differences regarding the perception of and WTP for imported rice. A previous study elicited Japanese WTP values on the basis of a blind taste test and found that the WTP for domestic rice was not statistically different from that for imported rice (Ito, Fujii, and Higuchi). However, their subjects were attendees at an academic conference, who are unlikely to be representative of the consumer population.

In the next section, the survey is explained in detail, and the responses collected in the spring of 2002 from three prefectures are summarized. Then, a choice model is specified and applied to survey responses, and the WTP for domestic and imported rice is estimated. Results from an estimated nested logit model identify the role of consumers' perceptions of safety and flavor of imported rice on consumption behavior, as well as the effects of demographic and socioeconomic characteristics of households. We find regional differences in consumers' attitudes toward imported rice. In all regions, however, negative image and unfamiliarity with quality of imports discount the WTP substantially. Regarding U.S. rice, results suggest that Japanese consumers are more concerned with its flavor than with its safety.

The Survey

Consumer preferences can be estimated from stated or revealed choices. We used a stated choice method, in which data are obtained from the hypothetical choices of decision-makers in controlled experiments rather than their actual choices in the market, because imported rice has only been in the Japanese market for a relatively short period and in restricted quantities. Among the stated choice methods, choice experiments have emerged from the marketing literature as an effective method of placing consumers in a realistic resource-allocation decision environment. In a choice experiment, respondents are asked to choose from a set of goods with varying attributes. Previous applications have assessed consumer preferences for various food attributes, including the color of veal (West et al.),

the use of recombinant somatotrophin in milk (Kuperis, Veeman, and Adamowicz), food safety attributes in fresh apples (Baker), and the use of genetically modified organisms (Burton et al.). Quagrainie, Unterschultz, and Veeman used a stated preference questionnaire to examine the preferences of consumers in Western Canada for meat products from various Canadian provinces and the United States and found that fresh beef and pork products from Canada were preferred to products from the United States.

Survey Design

Our survey was designed to elicit values for several domestic and imported brands of rice in different regions. Three prefectures were selected as the study regions for the survey to be administered: Tokyo, Osaka, and Shizuoka. Tokyo is where the nation's capitol is located. Osaka includes the second-largest metropolitan area in the nation, which is characterized by a culture distinct from Tokyo. Shizuoka is located between the two prefectures on the Pacific coast and represents a more rural but not a major rice-producing region. It is a site that is frequently selected by research firms because its demographics and preferences are comparable to those of the national average (Akai and Itaoka). The population densities of three prefectures in 2001 were approximately 5,600, 4,600, and 500 residents per square kilometer in Tokyo, Osaka, and Shizuoka, respectively. The percentages of the population engaged in agriculture were 0.004%, 0.009%, and 7.7%, respectively. This selection of study regions allowed us to examine how, if at all, perceptions toward safety and WTP for imported rice vary across the Japanese population.

Brands in each study region were identified on the basis of contacts with several local rice retailers. In all regions, the three nationally known varieties from their lead producing prefectures were selected as domestic brands: the Koshihikari variety, produced in Niigata prefecture; the Akitakomachi variety, produced in Akita prefecture; and the Hitomebore variety, produced in Miyagi prefecture. In addition, a fourth domestic brand in each region was specified as the Koshihikari variety, produced in a nearby prefecture, to represent rice brands with local familiarity to the survey participants. The three imported brands were specified as the Koshihikari variety from the United States and Australia and the Akitakomachi variety from China.

The first section of the survey inquired about rice consumption patterns of respondents in terms of types of retail outlets, brands of rice usually purchased, and price, among other things. The survey then displayed a photo of a storefront, with imported vegetables labeled with their countries of origin, and asked questions regarding purchases of foreign produce. Another set of questions asked respondents to rank images of the safety and flavor of U.S., Australian, and Chinese rice, relative to domestic rice.

The second section presented choice scenarios. The survey was pretested twice, using small samples of households to ensure statistically reliable estimation from responses to this valuation section.[2] The choice experiment depicted a plausible situation in the future, similar to the current situation with vegetables, where both imported and domestic produce appear on the store shelves with imports sold at a lower price than domestic produce. A sample choice scenario on the survey is depicted in Figure 1. The price for a 5-kg bag of each brand was set at one of five possible price levels. The middle price level for each brand was set on the basis of market prices: 2,680 yen for Niigata Koshihikari, 2,280 yen

[2] The first version, with each choice scenario consisting of five brands and similar price levels across all brands, was mailed to 200 households in Tokyo in January 2002. Of the 75 responses, only 10% selected imported brands, which would result in too few observations in this category to allow for a reliable estimation. Accordingly, we reduced the number of choices in each scenario to three brands and lowered the price levels for imported brands in the second version, which was mailed to 100 households each in Osaka and Shizuoka in February 2002. Only 1 of 38 responses from Osaka and 5 of 50 responses from Shizuoka selected imported rice, which indicates the need to further lower the price levels of imported brands in the final version.

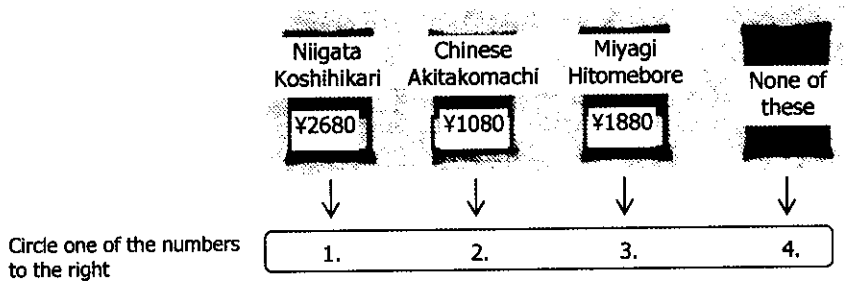

Figure 1. A Sample Choice Scenario (Translated)

for Miyagi Hitomebore and Akita Akitakomachi, and 2,180 yen for a local Koshihikari. Other price levels were set in 200-yen increments. For imported rice, the middle price level was set at 680 yen, under the assumption that tariffs were eliminated or lowered considerably from the current levels.

In the choice experiment method, several choice scenarios are typically presented to each respondent. Designing the choice scenarios so that all alternatives are orthogonal is desirable but not essential.[3] In our case, there were 35 orthogonal brand-price combinations (seven brands with five prices for each). SPSS version 10.0J was used to generate a total of 48 combinations (35 orthogonal and 13 additional combinations). These combinations were grouped into three brands per choice scenario, creating 16 choice scenarios, which were presented in two versions of eight choice scenarios each. Each choice scenario included an option of choosing none of the three (Figure 1).

After the valuation section, respondents were informed that approximately 7% of rice consumed in Japan is currently imported from countries such as Australia, the United States, and China, and they were asked directly whether or not they would purchase imported rice. Then, respondents were informed that the current level of overall self-sufficiency of food is 40%, and they were asked whether they thought it was low or high. The last section of the survey collected demographic information.

Survey Responses

The survey was mailed in March 2002 to 400 households in the Tokyo prefecture and 200 households each in the Osaka and Shizuoka prefectures, all of whom were selected at random from a commercial phone directory database. The survey was mailed from the Policy Research Institute, Ministry of Agriculture, Forestry, and Fisheries, and the cover letter requested that the person who typically purchases rice in the household complete the survey. A reminder was sent two weeks after the mailing. Two hundred fifty-six households in Tokyo, 119 households in Osaka, and 126 households in Shizuoka completed and returned the surveys by mail, which resulted in an overall response rate of 62.6%. When incomplete responses were deleted, 207, 88, and 92 usable surveys remained from Tokyo, Osaka, and Shizuoka, respectively, which was 48.4% of the original mailing. Because some of them did not respond to all eight choice scenarios, there were a total of 3,087 usable observations (1,649 from Tokyo, 702 from Osaka, and 736 from Shizuoka).

Nonresponse bias may exist if nonrespondents differ from respondents in observable characteristics and could be partially corrected with information regarding households who did not respond to our survey (Mitchell and Carson), which is not available. Of the returned surveys, we compared demographic

[3] Lack of complete orthogonality does not affect the results if there are more than 32 profiles (Louviere, Hensher, and Swait).

patterns between those with incomplete responses and those who completed the survey fully and did not find any systematic differences. Moreover, survey respondents appeared to be representative of the consumer population overall. The respondents were approximately 70% female and 30% male in all regions, which suggests that household food purchases continue to be made primarily by women. The sample average household size varied between 3.1 in Tokyo and 3.33 in Shizuoka, which is comparable to the national average household size of 3.22 in Japan in 2001. Average households from Tokyo, Osaka, and Shizuoka samples earned annual incomes of approximately 7.1, 6.3, and 6.1 million yen, respectively, whereas the national average in 2001 was 6.9 million yen ($57,500 at the exchange rate of $1 = 120 yen). As expected, urban households were smaller and earned more, on average, than rural households. The average age of respondents was approximately 57. On the basis of their answers, the households in Tokyo, Osaka, and Shizuoka purchased an average of 125, 144, and 165 kg of rice annually. These numbers are higher than the reported national average of 100 kg per household in 2001, but the regional differences were expected. Rural households consumed more rice at home, likely because of a lower frequency of eating out and being more rooted in a traditional lifestyle.

Responses to selected questions from the survey are summarized in Table 1. Koshihikari and Akitakomachi were the two dominant rice varieties consumed by sample respondents (question 1). Respondents appeared to purchase these varieties in higher proportions compared with the national average, where the two varieties comprised 42% of marketed rice. Tokyo respondents purchased a higher proportion of rice from Niigata and Akita, whereas many Shizuoka respondents consumed local brands (question 2).

Regarding the country of origin for vegetables (question 3), more than half of the respondents indicated that they make an effort to purchase domestic produce. A larger proportion of people had preferences for domestic produce in rural Shizuoka than in more urban areas. On the other hand, more than 25% of the full sample responded that they "did not care at all" or "did not care very much." In contrast to the relatively small group (12%–18% of respondents) answering that they purchased only domestic vegetables in question 3, approximately 38%–44% of the respondents answered that they wished to purchase only domestic rice in question 7. This could partly be attributed to the unfamiliarity of imported rice at storefronts and to the cultural values placed on rice in Japanese traditions. The factor of largest concern when purchasing foreign produce was safety (question 4), which is consistent with results of the national survey cited above (Mainichi Shimbun). Eighty-five percent of all respondents felt that the current 40% of self-sufficiency level of food in Japan is too low (question 8), and respondents, on average, thought 70% to be the ideal level of self sufficiency (not shown).

Perceptions regarding safety and flavor of imported rice were similar across the source countries (questions 5 and 6). Approximately half of the people chose the answer "do not know," indicating a lack of familiarity with the quality of foreign rice, and the majority of those who had any opinion expressed negative opinions. A slightly larger proportion of the sample had a negative preconception regarding flavor of imported rice than its safety. Safety perceptions toward U.S. and Australian rice seemed to more positive than those toward Chinese rice.

Model

Choice modeling is based on random utility theory, which posits that the probability of selecting an alternative increases as its associated utility increases (Louviere, Hensher, and Swait). Consumers in region g are assumed to have an indirect utility function of the form

$$(1) \qquad U_{ij}^{g} = V_{ij}^{g} + \varepsilon_{ij}^{g},$$

where V denotes the deterministic component of the utility function that depends on household and rice characteristics, ε is a random residual component, and i and j stand for

Table 1. Summary of Selected Questions from the Survey

	Full Sample	Tokyo	Osaka	Shizuoka
Number of Respondents	387	207	88	92
Rice variety consumed at home	Percent of Respondents			
Koshihikari	54.7	59.4	55.7	45.7
Akitakomachi	22.8	23.2	19.3	26.1
Hitomebore	4.9	6.3	1.1	5.4
Other	17.6	12.1	26.1	22.8
Prefecture of origin of rice consumed at home				
Niigata	33.8	41.1	31.8	21.7
Akita	20.9	21.7	19.3	21.7
Miyagi	3.6	5.3	1.1	2.2
Local[a]	13.0	4.8	10.2	34.8
Other	28.8	28.5	40.9	19.6
When purchasing vegetables, do you normally care whether produce is of foreign origin?				
Not at all	6.2	6.3	8.0	4.3
Not very much	19.6	21.3	18.2	17.4
Undecided	8.8	9.7	6.8	8.7
Make effort to purchase domestic produce	51.2	51.2	48.9	53.3
Only buy domestic produce	14.2	11.6	18.2	16.3
What is your largest concern when purchasing foreign produce?				
Flavor	9.6	10.6	8.0	9.8
Price	7.6	10.6	3.4	5.4
Safety	65.7	68.6	62.5	67.4
Freshness	13.7	11.1	19.3	15.2
Appearance/Other	3.3	2.4	6.8	2.2
What do you think about safety of rice imported from the following countries relative to domestic rice?				
United States				
Higher/Slightly higher/About the same	11.6	11.6	12.5	10.9
Lower/Slightly lower	38.7	39.5	40.9	34.8
Do not know	49.6	48.8	46.6	54.3
Australia				
Higher/Slightly higher/About the same	16.0	17.4	15.9	13.0
Lower/Slightly lower	31.3	31.4	34.1	28.3
Do not know	52.7	51.2	50.0	58.7
China				
Higher/Slightly higher/About the same	6.5	5.3	5.7	9.8
Lower/Slightly lower	43.0	44.9	45.5	35.9
Do not know	50.5	49.3	48.9	54.3
What do you think about flavor of rice imported from the following countries relative to domestic rice?				
United States				
Better/Slightly better/About the same	12.1	15.9	8.0	7.6
Worse/Slightly worse	44.7	41.5	52.3	44.6
Do not know	43.2	42.5	39.8	47.8

Table 1. (Continued)

	Full Sample	Tokyo	Osaka	Shizuoka
	Percent of Respondents			
Australia				
Better/Slightly better/About the same	9.6	12.1	5.7	7.6
Worse/Slightly worse	40.8	37.7	52.3	37.0
Do not know	49.6	50.2	42.0	55.4
China				
Better/Slightly better/About the same	6.2	6.3	4.5	7.6
Worse/Slightly worse	45.2	45.4	51.1	39.1
Do not know	48.6	48.3	44.3	53.3
Do you wish to purchase rice imported from countries such as Australia, the United States, and China?				
Yes, if cheaper	9.3	15.0	9.1	9.8
Yes, if safe	26.1	36.2	30.7	35.9
Yes, if it tastes good	27.9	40.1	40.9	27.2
I won't buy foreign rice	29.8	37.7	40.9	43.5
Undecided	7.0	9.7	5.7	12.0
What do you think of the current level of self-sufficiency in Japan?				
Low	51.6	46.9	50.0	63.0
Slightly low	33.7	36.2	35.2	26.1
Adequate/Do not know	12.2	13.0	13.6	8.7
Slightly high	1.8	2.9	0.0	1.1
High	0.8	1.0	0.0	1.1

[a] Ibaraki for Tokyo, Fukui for Osaka, and Shizuoka for Shizuoka.

household and rice brand, respectively. The ith household chooses j from its choice set C_i^g when

$$(2) \quad U_{ij}^g \geq U_{ik}^g \quad \forall k \neq j \quad \text{and} \quad \{k, j\} \in C_i^g.$$

Following the literature on discrete choice, V is assumed to be a linear function of household and rice characteristics, and the random component is assumed to follow a Gumbel distribution with scale factor λ_g.[4] A simple conditional logit model specifies the probability of household i choosing the jth alternative as

$$(3) \quad P(y_i^g = j) = \frac{e^{\lambda_g \mathbf{x}_{ij}^{g\prime} \boldsymbol{\beta}_g}}{\sum_{k \in C_i^g} e^{\lambda_g \mathbf{x}_{ik}^{g\prime} \boldsymbol{\beta}_g}},$$

where y_i^g is the choice of the ith household in region g, $\mathbf{x}_{ij}^g$ is a vector of observations, including the ith household's characteristics and the jth alternative's attributes, and $\boldsymbol{\beta}_g$ is a vector of parameters to be estimated.

Two corrections in the error structure may be needed to obtain consistent estimates of the parameters in Equation (3). First, the scale factors (λ_g) cannot be independently estimated because they are confounded with the model parameters. In a standard logit model, this indeterminacy is resolved by normalizing the scale factor to unity. Such an approach would invalidate cross-region comparisons of the parameter estimates $\hat{\boldsymbol{\beta}}_g$, because it imposes the restriction that the variance of the error terms are equal in all regions. Swait and Louviere introduced a method to estimate relative scale factors across data sets, where the scale factor from one data set is normalized to unity (e.g., $\lambda_{\text{Tokyo}} = 1$). For the other data sets, the independent variables ($\mathbf{x}_{ij}^g$) are multiplied by candidate values of scale factors before estimation. A grid search is then conducted on λ_{Osaka} and $\lambda_{\text{Shizuoka}}$ to find the values that maximize the log-likelihood function.

[4] The scale factor is the dispersion parameter of a Gumbel distribution and is inversely proportional to its standard deviation (Louviere, Hensher, and Swait).

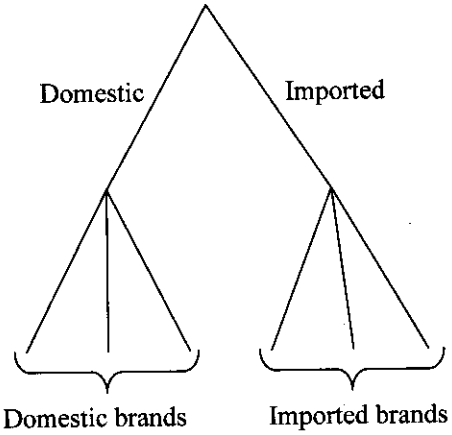

Figure 2. Nesting Structure of Rice Purchasing Decisions

The second complication is the assumption of the independence of irrelevant alternatives (IIA), which implies that the probability ratio of any two choices depends only on those two choices, leading to unrealistic substitution patterns. On the basis of findings of the national survey on consumers' concerns for the safety of imported food (Mainichi Shimbun), along with responses to our pretests and the final survey, we suspected that most households view domestic and foreign rice brands as distinct groups and perceive brands as close substitutes within each group but not between groups. In such cases, error terms among the alternative varieties are correlated, leading to inconsistent parameter estimates from the conditional logit model.

If the IIA assumption is rejected by the data, the model can alternatively be specified as a nested logit model, which maintains the IIA assumption within each group but relaxes it between the groups. The nesting feature of the model illustrated in Figure 2 does not represent a sequential decision-making process but, rather, a hierarchy within the simultaneous choice of the country of origin (domestic or foreign) and brands. The deterministic component of the random utility function, V, is assumed to be additively separable into a component that varies only with the decision to purchase domestic and foreign rice, and components that reflect the utility of purchasing domestic and foreign brands.

The nested logit model separates conditional and marginal probabilities. Let domestic and foreign groups be indexed by $l = 1$ and 2, respectively, and the brands within each group by $j_l = 1, \ldots, J_l$. Also, let $\mathbf{z}_{j|l}$ and $\mathbf{z}_l$ represent attributes that affect the choice among the j_ls in group l and the choice of l, respectively. Formally, the two-level nested logit model specifies the probability of brand j from group l being chosen by a household in location g, P^g_{lj}, because the product of the conditional probability of choosing brand j given group l has been chosen ($P^g_{j|l}$) and the probability of group l being chosen (P^g_l), which can be written as

$$(4) \qquad P^g_{lj} = P^g_{j|l} P^g_l = \frac{e^{\lambda_g \boldsymbol{\beta}'_g \mathbf{z}^g_{j|l}}}{\sum_{j \in J_l} e^{\lambda_g \boldsymbol{\beta}'_g \mathbf{z}^g_{j|l}}} \frac{e^{\lambda_g \boldsymbol{\beta}'_g \mathbf{z}^g_l + \tau^g_l I^g_l}}{\sum_{l \in \{1,2\}} e^{\lambda_g \boldsymbol{\beta}'_g \mathbf{z}^g_l + \tau^g_l I^g_l}},$$

where $I^g_l = \ln \Sigma_{j \in J_l} e^{\lambda_g \boldsymbol{\beta}'_g \mathbf{z}^g_{j|l}}$ ($l = 1, 2$) are the inclusive values, or the expected utility for the choice of alternatives within domestic and imported groups, respectively, and τ_l are the inclusive value parameters. If the inclusive value parameters equal 1, then the model collapses to the nonnested logit model in Equation (3).

The elasticity of the probability that alternative j in group l is chosen with respect to the nth attribute of alternative k, assuming it is a continuous regressor, is

$$(5) \qquad \frac{\partial \ln P^g_{lj}}{\partial \ln z^g_{kn}} = [1 - P^g_{j|l} + \hat{\tau}^g_l P^g_{j|l}(1 - P^g_l)]\lambda_g \hat{\boldsymbol{\beta}}^g_{kn} z^g_{kn},$$

where $\hat{\boldsymbol{\beta}}^g_{kn}$ is the estimated coefficient on the nth attribute of alternative k (Greene). If the attribute is binary, its marginal effect is computed as the difference between the probability of choosing alternative j in group l when the attribute variable assumes the value of one and when it equals zero. Marginal effects of binary variables that represent a category, such as brand, are computed as the difference between the probability when the specific binary variable is one and, when it is zero, holding other binary variables within the category equal to zero. Elasticity and marginal effects of an attribute on the probability that group l is chosen can be computed similarly.

Empirical Model

The choice model was first specified as a simple conditional logit model and was tested for the IIA assumption. The choices in the model consisted of eight rice brands: U.S. and Australian Koshihikari (*US, AU*), Chinese Akitakomachi (*CH*), Niigata Koshihikari (*NG*), Akita Akitakomachi (*AK*), Miyagi Hitomebore (*MY*), a local Koshihikari (*L*), and choosing none of the alternatives. Indirect utility depends on brand- and household-specific factors. The utility of brand choice depends on the price (*P*) and the brand, where brands were represented by binary variables (*US, AU, CH, NG, AK, MY,* and *L*). In addition, images regarding safety and flavor affect utility in choosing one of the imported brands. Specifically, binary variables (*USSAFE, AUSAFE,* and *CHSAFE*) were defined for each foreign brand to assume a value of one if respondents answered that safety is a higher concern for the specific imported brand of rice than for domestic rice or that they were uncertain of its safety (question 5 in Table 1). Similar binary variables were defined for flavor on the basis of the response to question 6 in Table 1, representing whether flavor is a concern (*USTASTE, AUTASTE,* and *CHTASTE*). If consumers have selected a brand of their choice over time, their utility also may be affected by a habit formation factor. Thus, for domestic rice, the utility level was specified to depend on whether it is the brand usually consumed by the respondent. A binary variable *HABIT* was specified to equal one when the respondent usually purchases rice from the same region as the specific domestic brand (question 2 in Table 1).

Household characteristics included household income in 10,000 yen (*INC*), a binary variable that indicates whether the household includes a member under age 18 (*CHILD*), and age (*AGE*) and gender (*GENDER*) of the household member who primarily purchases rice. The gender variable equals one for female and zero for male. To allow for a nonlinear relationship, income was specified with a squared term, *INC2*. In addition, several variables were included to capture the decision-maker's attitude toward food security. The perception of the current level of food self-sufficiency (*SELFSUFF*) was specified numerically as their answers to question 8 (Table 1), one corresponding to the level being low and five corresponding to the level being high. The answer "do not know" was treated as adequacy (the value of 3). Their attitude toward foreign produce (*ATTFOR*) was numerically specified as their answers to question 3 (Table 1) regarding their purchases of imported vegetables, with one as least caring and five as only purchasing domestic produce. A binary variable (*SAFETY*) assumed a value of one if the respondent identified safety as a concern in purchasing food of foreign origin (question 4, Table 1).

According to Hausman and McFadden, the IIA assumption can be tested using a test statistic that follows a χ^2 distribution:

$$(6) \quad q = (\hat{\boldsymbol{\beta}}_r - \hat{\boldsymbol{\beta}}_u)'(\hat{\mathbf{V}}_r - \hat{\mathbf{V}}_u)^{-1}(\hat{\boldsymbol{\beta}}_r - \hat{\boldsymbol{\beta}}_u),$$

where $\hat{\mathbf{V}}$ is estimated covariance matrix of the parameter estimates $\hat{\boldsymbol{\beta}}$, and r and u indicate restricted and unrestricted models. In our case, the restricted model was estimated by eliminating the three imported brands from the choice set. The Hausman and McFadden test rejected the IIA hypothesis at the 5% significance level for all samples.[5]

In the nested structure, the brand choice was specified to depend on brand-specific characteristics, and the country-of-origin choice depended on household characteristics. The binary variables of perceptions were multiplied by the alternative-specific constants to enter the brand-specific utility functions. Hence, the model in region g was defined as follows:

$$(7a) \quad U^g_{US|foreign} = \beta^g_P P + \beta^g_{US} US + \beta^g_{US,1} USSAFE + \beta^g_{US,2} USTASTE + \varepsilon^g_{US},$$

$$U^g_{AU|foreign} = \beta^g_P P + \beta^g_{AU} AU + \beta^g_{AU,1} AUSAFE + \beta^g_{AU,2} AUTASTE + \varepsilon^g_{AU},$$

[5] The computed statistics were 53.80 ($p = 0$), 31.64 ($p = 0$), 11.61 ($p = 0.04$), 12.94 ($p = 0.02$) for the full, Tokyo, Osaka, and Shizuoka samples, respectively.

$$U^g_{CH|foreign} = \beta^g_P P + \beta^g_{CH} CH + \beta^g_{CH,1} CHSAFE + \beta^g_{CH,2} CHTASTE + \varepsilon^g_{CH},$$

$$U^g_{NG|domestic} = \beta^g_P P + \beta^g_{NG} NG + \beta^g_{HAB} HABIT + \varepsilon^g_{NG},$$

$$U^g_{AK|domestic} = \beta^g_P P + \beta^g_{AK} AK + \beta^g_{HAB} HABIT + \varepsilon^g_{AK},$$

$$U^g_{IB|domestic} = \beta^g_P P + \beta^g_{IB} IB + \beta^g_{HAB} HABIT + \varepsilon^g_{IB},$$

$$U^g_{L|domestic} = \beta^g_P P + \beta^g_L L + \beta^g_{HAB} HABIT + \varepsilon^g_L,$$

and

$$(7b)\quad U^g_l = \alpha^g_{l0} + \alpha^g_{l1} INC + \alpha^g_{l2} INC2 + \alpha^g_{l3} CHILD + \alpha^g_{l4} GENDER + \alpha^g_{l5} AGE + \alpha^g_{l6} SELFSUFF + \alpha^g_{l7} ATTFOR + \alpha^g_{l8} SAFETY + \varepsilon^g_l$$

for l = {domestic, foreign}, g = {Tokyo, Osaka, Shizuoka}, and parameters $\boldsymbol{\alpha}^g$ and $\boldsymbol{\beta}^g$. The error terms ε^g_{US}, ε^g_{AU}, and ε^g_{CH} are correlated for all g; ε^g_{NG}, ε^g_{AK}, ε^g_{IB}, and ε^g_L are correlated for all g; there is no correlation between the two sets of error terms; and ε^g_l are independent for all g. The standard deviations of the error terms from different locations are proportionally related to the ratio of respective scale parameters.

Results

Regional Differences

The full information maximum likelihood results were computed using the NLOGIT module of LIMDEP, version 8.0. Using the method of Swait and Louviere, estimates of the scale parameters were obtained by performing a two-dimensional search of λ_{Osaka} and $\lambda_{Shizuoka}$, with λ_{Tokyo} fixed at 1. The model solution that maximized the value of the log-likelihood function was $\lambda_{Osaka} = 1.06$ and $\lambda_{Shizuoka} = 1.07$.

To test whether regional differences in consumer attitudes exist, the same model was fitted to scaled observations from three locations separately. The likelihood-ratio test for the null that the model parameters from all locations are proportional by the relative scale parameters was strongly rejected with a test statistic of 170.77 (the corresponding χ^2 value at the 5% significance level was 51.74). Pairwise likelihood ratios were computed to test similarities between two of the three locations, but all were rejected; the computed test statistics were 112.17 for the null of Tokyo differing proportionally to Osaka, 64.27 for the null of Tokyo differing proportionally to Shizuoka, and 77.24 for the null of Osaka differing proportionally to Shizuoka (the 5% χ^2 value was 22.47). Thus, the results suggest distinct regional preferences toward domestic and imported rice. The estimation results are presented in Table 2, with the scaled full sample results in the first column and the second through fourth columns corresponding to the estimation results for individual locations. Because the proportional equivalence was rejected, only the location-specific results are presented below.

In appropriate nesting structures, inclusive value parameters are between 0 and 1. The two inclusive value parameters for Tokyo and Osaka and the inclusive value parameter for foreign brands for Shizuoka were significantly different from zero, as based on a two-tailed t-test at the 95% confidence level. The null hypothesis of the inclusive value parameters equaling one was tested using a one-tailed χ^2 likelihood ratio test in which the model was fitted with and without the restriction, and the statistic was computed as twice the difference in the log-likelihood functions (Greene). For Tokyo, Osaka, and Shizuoka, the test statistics were 10.59, 1.10, and 10.14. The critical χ^2 value at the 5% significance level with two degrees of freedom was 5.99, rejecting the null hypothesis that the inclusive value parameters were one for the Tokyo and Shizuoka samples. Although these latter results suggest that the nested model is not statistically superior to a simple conditional logit model for the Osaka sample, the nested structure seems to be appropriate for all samples given the overall results, including those of the Hausman-McFadden test.

The model predicted the brand choices accurately 41.6%, 45.7%, and 45.1% of the time in the Tokyo, Osaka, and Shizuoka samples,

respectively. To help with the interpretation of the coefficients, computed elasticities or marginal effects are reported in Tables 3–7, which are discussed in turn.

WTP and Price Elasticity

The brand-specific binary variables were all statistically significant (Table 2) and had positive marginal effects on the probability of purchase, except for Chinese rice in the Shizuoka sample (Table 3). Marginal effects for domestic rice were uniformly larger than those for imported rice. In Tokyo, for example, the knowledge that the rice was of a U.S. brand increased the probability of its purchase by 0.10, whereas a similar knowledge that it was Niigata Koshihikari increased the probability of its purchase by 0.56. If the largest marginal effects of imported brands were divided by the smallest marginal effects of domestic brands (e.g., 0.113/0.494 for the Tokyo sample), the ratios of imported and domestic marginal effects were, at most, 0.23, 0.10, and 0.00001 in Tokyo, Osaka, and Shizuoka, respectively. Thus, holding everything else constant, domestic brands were at least 4, 10, and 100,000 times more likely to be purchased than foreign brands in these locations, respectively.

Using the estimated parameters, WTP for a brand was calculated as the negative of the coefficient of the specific brand divided by the coefficient on price. Table 4 reports the computed WTP estimates, along with the average retail prices in 2000 for comparison. An average respondent in Osaka is willing to pay more than the average retail price for all domestic varieties, which supports our pretest findings of strong preferences toward domestic rice. In Tokyo and Shizuoka, however, the WTP for some of the domestic varieties was slightly below the average retail price. On average, respondents in all locations were willing to pay the most for Niigata Koshihikari, which is generally regarded to be the most prized rice in Japan. On the basis of a national survey by the Food Agency in 2000, 57% answered that the price of rice was appropriate, 21% thought that it was cheap, and 14% indicated that the rice price was high (Food Agency, p. 207). Hence, our WTP estimates are consistent with previous survey results.

The average WTP estimates for all imported varieties, except for Chinese rice sold in Tokyo, were lower than the corresponding retail prices. An average respondent in Tokyo was willing to pay more for Chinese rice than the other foreign varieties, whereas respondents in Shizuoka were not willing to consume Chinese rice for any positive price. The estimated WTP for U.S. rice ranged from 1,572 yen in Tokyo to 1,082 yen in Shizuoka, 417–907 yen below the national average retail price (a 21%–46% difference). It commanded the lowest WTP among foreign varieties in Tokyo but the highest in Osaka and Shizuoka.

In addition, there is evidence of a positive habit formation. Consumers were willing to pay 25%–66% more for rice of the same regional origin as what they regularly purchase. Osaka respondents showed the strongest habit formation across all varieties.

Elasticities of the probability of a brand being chosen with respect to changes in price, computed at 2000 retail prices, are reported in Table 5. The probability was elastic with respect to changes in price; for example, if the price of U.S. rice increased in Tokyo by 1%, the probability of a household choosing it decreased by 1.86%. The results indicate that consumers are sensitive to price changes. The elasticities for imported brands were slightly lower in magnitude at the current retail prices than domestic brands in Tokyo, which suggests that the people who are consuming an imported brand are less likely to switch to another brand given a small price change than those consuming a domestic brand.

Probability elasticities with respect to price with habit are computed by setting the variable *HABIT* equal to 1 for various domestic brands in Equation (5). Habitually purchasing a given brand reduces the own-price elasticity of that brand. For example, consider a household in Tokyo that habitually purchases Niigata rice. If this household has average attributes in oth-

Table 2. Full Information Maximum-Likelihood Estimates of the Nested Logit Model[a]

	Full Sample	Tokyo	Osaka	Shizuoka
Dependent Variable	Probability of a Rice Brand Being Chosen			
Number of Observations	3,087	1,649	702	736
Relative Scale Parameters[b]		1	1.06	1.07
Variables[c]				
Brand Attributes				
P	−0.001244*	−0.001124*	−0.001202*	−0.001415*
	(0.000111)	(0.000154)	(0.000229)	(0.000227)
US	1.3655*	1.7674*	1.6543	1.5307
	(0.4452)	(0.5799)	(1.1185)	(0.8898)
AU	1.5292*	1.9766*	1.0229	0.6414
	(0.3814)	(0.4938)	(1.2730)	(0.7140)
CH	0.7427	2.1989*	1.3469	−1.9748
	(0.4810)	(0.6849)	(1.1417)	(1.2276)
NG	4.0051*	3.5905*	3.9627*	4.4624*
	(0.3201)	(0.4425)	(0.6623)	(0.6502)
AK	3.4725*	3.0929*	3.5560*	3.8776*
	(0.2719)	(0.3755)	(0.5635)	(0.5538)
MY	3.3076*	2.9812*	3.2577*	3.7813*
	(0.2685)	(0.3722)	(0.5475)	(0.5475)
L	3.1428*	2.8382*	3.4762*	3.2068*
	(0.2469)	(0.3423)	(0.5067)	(0.5076)
USSAFE	−0.8966*	−0.8999*	−0.2811	−1.3755
	(0.3724)	(0.4591)	(0.9899)	(0.7322)
USTASTE	−2.7352*	−2.6078*	−3.1325*	−2.9372*
	(0.4144)	(0.4852)	(1.2877)	(0.9029)
AUSAFE	−1.7769*	−2.1156*	−1.7208	−0.2424
	(0.3396)	(0.4174)	(0.9143)	(0.8289)
AUTASTE	−1.8150*	−1.4345*	−1.0074	−2.5307*
	(0.3485)	(0.4196)	(1.1793)	(0.7232)
CHSAFE	−1.1455*	−1.8864*	−1.2072	0.7820
	(0.4705)	(0.5987)	(1.0895)	(1.1367)
CHTASTE	−1.9452*	−2.2462*	−2.0547	−0.8871
	(0.4475)	(0.5439)	(1.3362)	(0.8825)
HABIT	1.1279*	1.1964*	1.3045*	1.0560*
	(0.0839)	(0.1188)	(0.2079)	(0.1585)
Household Characteristics				
$\text{Constant}_{foreign}$	2.5924*	3.3104*	−1.4904	2.6771
	(0.7731)	(1.1538)	(2.1407)	(1.8486)
$INC_{foreign}$	0.0002025	0.0002028	−0.0007063	−0.0005224
	(0.00078)	(0.00115)	(0.00189)	(0.00193)
$INC2_{foreign}$	−0.00000023	−0.00000041	0.00000062	0.00000010
	(0.00000041)	(0.00000062)	(0.00000093)	(0.00000111)
$CHILD_{foreign}$	−0.7911*	−0.5787	−0.4636	−0.5908
	(0.2473)	(0.3408)	(0.6068)	(0.6530)
$GENDER_{foreign}$	−0.3381	−1.0078*	2.5161*	0.6025
	(0.2008)	(0.2772)	(0.7887)	(0.4662)
$AGE_{foreign}$	−0.004776	−0.015878	0.088034*	−0.000171
	(0.0082)	(0.0123)	(0.0265)	(0.0178)
$SELFSUFF_{foreign}$	−0.02836	0.06700	−0.99408*	−0.27491
	(0.1138)	(0.1479)	(0.4092)	(0.3089)

Table 2. (Continued)

	Full Sample	Tokyo	Osaka	Shizuoka
$ATTFOR_{foreign}$	−0.5741*	−0.5005*	−1.3493*	−0.6919*
	(0.0860)	(0.1268)	(0.2809)	(0.2056)
$SAFETY_{foreign}$	−0.1244	−0.4323	0.0390	0.3421
	(0.2114)	(0.2964)	(0.5269)	(0.5116)
$Constant_{domestic}$	−2.1580	−0.3047	−1.5434	−2.2437
	(1.1047)	(1.7222)	(3.0446)	(2.4579)
$INC_{domestic}$	−0.001135	−0.001445	−0.000576	−0.003275
	(0.001213)	(0.001682)	(0.004052)	(0.003678)
$INC2_{domestic}$	0.00000056	0.00000036	0.00000104	0.00000171
	(0.00000067)	(0.00000083)	(0.00000294)	(0.00000239)
$CHILD_{domestic}$	0.9201*	0.4975	−0.1380	27.6741
	(0.3844)	(0.5095)	(0.9296)	(347822.8600)
$GENDER_{domestic}$	0.5455	0.9695*	−1.8445	0.6858
	(0.2917)	(0.4267)	(1.2319)	(0.6801)
$AGE_{domestic}$	0.006258	0.003858	−0.068538	0.002535
	(0.0119)	(0.0186)	(0.0397)	(0.0251)
$SELFSUFF_{domestic}$	0.2681	−0.0722	1.1772	0.4950
	(0.1674)	(0.2132)	(0.6386)	(0.4125)
$ATTFOR_{domestic}$	0.3627*	0.2309	1.3540*	0.4611
	(0.1287)	(0.2025)	(0.4851)	(0.2735)
$SAFETY_{domestic}$	0.1707	−0.2520	1.1356	0.2915
	(0.3103)	(0.4808)	(0.7663)	(0.7439)
Inclusive Value Parameters				
FOREIGN	0.7219*	0.8247*	0.7172*	0.9462*
	(0.0917)	(0.1252)	(0.3027)	(0.2640)
DOMESTIC	0.3658*	0.4517*	0.8656*	−0.0818
	(0.1405)	(0.1974)	(0.3430)	(0.3427)
Log-Likelihood	−3,208.351	−1,732.052	−672.995	−717.921
Chi-Squared Statistic[d]	7,437.795	3,900.972	1,820.433	1,887.157

[a] The numbers in parentheses are standard errors. * denotes significance at the 5% level.

[b] The parameters were obtained from a two-dimensional search (Swait and Louviere). The estimates are based on the solution that maximized the log-likelihood value. The Full Sample was estimated with observations from each location, scaled by respective scale parameters.

[c] *P* is price; *US, AU, CH, NG, AK, MY,* and *L* equal 1 for U.S. Koshihikari, Australian Koshihikari, Chinese Akitakomachi, Niigata Koshihikari, Akita Akitakomachi, Miyagi Hitomebore, and local Koshihikari, respectively, and 0 otherwise; *USSAFE, USTASTE, AUSAFE, AUTASTE, CHSAFE,* and *CHTASTE* equal 1 for U.S., Australian, and Chinese rice when the respondent has indicated a negative image toward its taste or safety, respectively, and 0 otherwise, multiplied by respective alternative-specific constants; *HABIT* equals 1 for domestic rice if the respondent typically purchases rice from the same region and 0 otherwise; *INC* is household income in 10,000 yen; *INC2* is its squared term; *CHILD* equals 1 if the household has a member under age 18 and 0 otherwise; *GENDER* equals 1 if the decision-maker is female and 0 if male; *AGE* is the age of the decision-maker; *SELFSUFF* is the respondent answer to question 8 (Table 1); *ATTFOR* is the respondent answer to question 3 (Table 1); and *SAFETY* is the respondent answer to question 4 (Table 1).

[d] The null hypothesis is all coefficients (not including the constants) jointly equalling 0.

er respects, its price elasticity for Niigata rice is −1.81 instead of −2.51 (Table 5). Although only own-price elasticities of habitual households are reported in Table 5, to conserve space (full results are available from the authors on request), those households had higher price elasticities for the brands they do not typically purchase. For example, the same household in Tokyo that habitually purchases Niigata rice has a price elasticity for Akita rice of −2.28 (not reported) instead of −2.08 (Table 5).

Table 3. Brand-Specific Marginal Effects[a]

Type of Rice	Tokyo	Osaka	Shizuoka
U.S. Koshihikari	0.100	0.065	0.0000051
Australian Koshihikari	0.113	0.049	0.0000049
Chinese Koshihikari	0.069	0.046	−0.0000665
Niigata Koshihikari	0.557	0.755	0.811
Akita Akitakomachi	0.552	0.666	0.678
Miyagi Hitomebore	0.494	0.684	0.736
Local Koshihikari[b]	0.503	0.663	0.572

[a] Computed holding all variables at their sample means.
[b] Ibaraki for Tokyo, Fukui for Osaka, and Shizuoka for Shizuoka.

The Role of Perception on Choice Probability and WTP

Negative perceptions of safety and flavor of imported rice decrease the probability of the imported varieties being chosen (Table 6). For example, if a Tokyo consumer has a negative perception or is uncertain about how safe U.S. rice is, the probability of her choosing U.S. rice decreases by 0.118, holding everything else constant. For U.S. rice, the effect is greater for perceptions of flavor relative to safety in all locations, which implies that Japanese consumers have a larger concern about the flavor of U.S. produce than health risks. Indeed, the coefficient on *USSAFE* is not statistically different from zero in Osaka and Shizuoka (Table 2). Regarding Australian rice, the concern is greater about its safety than flavor in Tokyo. The effects of negative perceptions are much greater in magnitude in Tokyo than in the other locations. Although the results thus far suggest that Tokyo consumers are more willing to consume imported rice (e.g., higher WTP, lower price elasticity), Tokyo respondents with negative images may behave similarly to respondents in Osaka and Shizuoka, who on average have stronger preferences against imported rice.

If the respondent has a negative or unknown image about safety or flavor, WTP decreases by at least half (compare Tables 6 and 4). WTP becomes negative for some of the imported varieties, which reflects consumers' strong aversion toward consuming produce of foreign origin. For U.S. and Chinese rice, WTP estimates were more heavily influenced by negative perceptions about flavor than

Table 4. Willingness-to-Pay Estimates for Rice Varieties (Yen per 5 kg)

Type of Rice	Tokyo	Osaka	Shizuoka	Retail Price[a]
U.S. Koshihikari	1,571.96	1,376.21	1,081.73	1,988.5
Australian Koshihikari	1,758.07	850.96	453.26	1,927.5
Chinese Koshihikari	1,955.81	1,120.44	−1,395.54	1,650.5
Niigata Koshihikari	3,193.53	3,296.52	3,153.53	2,789.0
Akita Akitakomachi	2,750.94	2,958.16	2,740.28	2,789.0
Miyagi Hitomebore	2,651.59	2,710.01	2,672.22	2,343.5
Local Koshihikari[b]	2,524.38	2,891.74	2,266.18	2,396.5
When the brand is from the same region as the rice consumed at home				
Niigata Koshihikari	4,257.65	4,381.71	3,899.80	
Akita Akitakomachi	3,815.06	4,043.35	3,486.54	
Miyagi Hitomebore	3,715.71	3,795.20	3,418.48	
Local Koshihikari[b]	3,588.50	3,976.93	3,012.45	

[a] National average retail price in 2000 reported for 10-kg packages by Food Agency, Japan, divided by 2.
[b] Ibaraki for Tokyo, Fukui for Osaka, and Shizuoka for Shizuoka.

Table 5. Price Elasticity of the Probability of the Brand Being Chosen[a]

Type of Rice	Tokyo	Osaka	Shizuoka
U.S. Koshihikari	−1.863	−2.022	−2.704
Australian Koshihikari	−1.749	−2.148	−2.687
Chinese Koshihikari	−1.366	−1.757	−2.333
Niigata Koshihikari	−2.510	−2.629	−2.839
Akita Akitakomachi	−2.083	−2.060	−2.306
Miyagi Hitomebore	−2.237	−2.376	−2.565
Local Koshihikari[b]	−2.140	−2.027	−2.708
When the brand is from the same region as the rice consumed at home			
Niigata Koshihikari	−1.807	−1.599	−1.779
Akita Akitakomachi	−1.485	−1.150	−1.393
Miyagi Hitomebore	−1.665	−1.554	−1.702
Local Koshihikari[b]	−1.582	−1.129	−2.019

[a] Evaluated at the retail price levels in Table 4.
[b] Ibaraki for Tokyo, Fukui for Osaka, and Shizuoka for Shizuoka.

about safety, providing additional evidence that flavor appears to be a larger concern. In all samples, respondents with unfavorable perceptions toward taste of U.S. or Chinese rice were not willing to purchase those brands at any positive price. To the contrary, WTP estimates for Australian rice were lower for those with a negative image about safety compared with those with a similar view about flavor, which suggests a more negative perception toward its safety than its flavor. Unfavorable perceptions regarding safety of Australian rice made an average respondent in Tokyo and Osaka unwilling to purchase it at any positive price.

Socioeconomic and Demographic Characteristics and Attitudes Towards Food Safety

Table 7 reports the marginal effects and elasticities of various household characteristics on the probability of choosing different rice brands. Income of the household was not statistically significant in any of the samples (Table 2). One would expect rice to be a normal good, although in recent decades, per capita rice consumption has declined while per capita income continued to increase in Japan (Food Agency). It is possible that, with higher income, people have substituted at-home consumption of rice for eating out and consuming other forms of carbohydrates, such as pasta and bread.

The effect of children in the household was statistically significant in the full sample (Table 2) and was consistent across all samples (Table 7). In particular, the existence of a child in the household positively affected the probability of choosing domestic over imported rice. If there was a child in the household, the probability of the household purchasing foreign variety decreased—for example, by 0.163 in Shizuoka—whereas the probability of purchasing domestic variety increased symmetrically.

Gender and age of the household's grocery shopper affected the choices of rice brands as well, but these effects differed by region. If an average person in Tokyo making rice purchases was female, the probability that the household purchases imported rice declined by 0.18, whereas the probability that she purchased domestic rice increased (Table 7). The opposite was suggested in Osaka, but with a smaller magnitude. The gender effects are statistically significant in the Tokyo and Osaka samples (Table 2). Age was a statistically significant factor in Osaka (Table 2), where age increased the probability that the household purchased imported rice and decreased the probability of choosing domestic rice (Table 7). The age effect was the reverse in the Tokyo and Shizuoka samples, although this was not statistically

Table 6. Effects of Perception on Choice of Imported Rice

Effect	Tokyo	Osaka	Shizuoka
Brand-Specific Marginal[a]			
With Negative or Uncertain Images of Safety			
U.S.	−0.118	−0.008	−0.000410
Australian	−0.221	−0.017	−0.000045
Chinese	−0.243	−0.020	0.000020
With Negative or Uncertain Images of Taste			
U.S.	−0.221	−0.036	−0.000517
Australian	−0.177	−0.013	−0.000190
Chinese	−0.266	−0.026	−0.000009
Willingness-to-Pay (Yen per 5 Kilograms)			
With Negative or Uncertain Images of Safety			
U.S.	771.52	1,142.38	109.67
Australian	−123.66	−580.54	281.99
Chinese	278.01	116.21	−842.92
With Negative or Uncertain Images of Taste			
U.S.	−747.54	−1,229.64	−993.93
Australian	482.18	12.93	−1,335.18
Chinese	−42.06	−588.80	−2,022.46

[a] Evaluated at sample means.

significant. The differences in the Osaka results may be attributed to the unique culture of the region; the results of a recent poll have suggested that people in that area are less concerned about health than those in the Tokyo area (Johnson).

Regarding attitudes toward food security, the variable measuring the attitude of the decision-maker toward foreign produce was statistically significant (Table 2), with consistent results across all samples (Table 7). Households with additional aversion toward foreign produce, as measured by the survey question, were less likely to purchase foreign rice. For example, a unit increase in a Tokyo respondent's response to question 3 (Table 1), on average, would decrease the probability of purchasing imported rice by 0.03 and would increase the probability of purchasing domestic rice by 0.014. The effect of other perceptions toward food security and safety on the probability of choices between domestic and imported rice were smaller in magnitude and were mostly statistically insignificant, which suggests varying opinions among the population. The opinion toward the current self-sufficiency level was statistically significant in the Osaka sample (Table 2). An average respondent in Osaka purchased imported rice with less probability if she thought the current self-sufficiency level is low (Table 7).

Summary and Implications

Japanese rice purchase decisions were analyzed in a nested logit model in which consumers were assumed to simultaneously choose among rice brands and whether they were produced domestically or imported. On the basis of a survey designed to elicit Japanese consumers' WTP for imported rice, we found that the current retail prices for imported varieties of rice were mostly higher than the average consumers' WTP. This suggests that the sales of imported rice varieties could increase by lowering the price. If consumers have negative preconceived opinions of or are uncertain about the safety or flavor of imported rice, their WTP is heavily discounted, sometimes to zero or less. For U.S. rice, the results suggested that Japanese consumers are more concerned about flavor than safety. The

Table 7. Effects of Household Characteristics on Probability of Foreign and Japanese Rice is Chosen[a]

Effect	Tokyo	Osaka	Shizuoka
Income Elasticity			
Foreign	−0.251	0.089	−0.254005
Domestic	−0.043	0.005	−0.000026
Marginal Effects with Respect to the Household Including a Child			
Foreign	−0.053	−0.0026	−0.163
Domestic	0.053	0.0026	0.163
Marginal Effects with Respect to the Decision-Maker Being Female			
Foreign	−0.182	0.024	−0.0000034
Domestic	0.182	−0.024	0.0000034
Marginal Effects with Respect to Age of the Decision-Maker			
Foreign	−0.00097	0.00071	−0.000000006
Domestic	0.00023	−0.00056	0.000000096
Marginal Effects with Respect to Opinion of the Current Self-Sufficiency Level			
Foreign	0.0041	−0.0081	−0.000010
Domestic	−0.0044	0.0095	0.000019
Marginal Effects with Respect to Attitude Toward Foreign Produce			
Foreign	−0.030	−0.0109	−0.000026
Domestic	0.014	0.0110	0.000017
Marginal Effects with Respect to Safety Being the Major Concern			
Foreign	−0.0113	−0.0114	0.0000020
Domestic	0.0113	0.0114	−0.0000020

[a] Evaluated at sample means.

probability of the purchase of a specific brand was responsive to these negative and uncertain images as well, which suggests opportunities for promotional activities. On the basis of demographics, households with children were more averse to imported varieties, as were those who currently discriminate against foreign produce in favor of domestic produce.

The sample of the current study was collected from residents in three prefectures varying in culture and along the urban-rural spectrum, and we found distinct preferences across the regions. The survey responses confirmed that resistance toward foreign brands is stronger outside Tokyo. Yet the results suggest that Tokyo residents with negative perceptions about the quality of imported rice have averse preferences toward imported rice similar to those who live in other parts of the country. Moreover, attitudes of the same demographic groups in different regions varied. Female decision-makers in Tokyo were more averse to imported rice, whereas those in Osaka were not. Income and age effects were mostly not statistically significant and were not consistent across regions either, which suggests that more refined analysis is necessary to identify target demographic groups in regional markets.

If imported rice is to increase its market share in Japan, it is critical to overcome negative preconceived images held by the majority of consumers. Promotional efforts should be designed to inform consumers regarding its safety and to provide them with opportunities to actually taste it. The promotion of safety is particularly relevant for Australian rice, and tasting opportunities are particularly important for U.S. rice. Although our results suggest that lower prices would increase sales revenue, price may also serve as a quality signal. Thus, future examination of the interaction between price and brand image is warranted.

An interesting finding was that resistance to foreign produce was smaller for fresh vegetables than for rice. Vegetable imports appear prominently in the Japanese storefront today. To the contrary, the average Japanese consumer has not directly viewed imported rice in stores, much less had an opportunity to taste it, because the majority of imported rice continues to be routed for processing. Hence, the results reflect the consumers' preconceived perception of foreign rice in a hypothetical setting. Although the current results provide realistic WTP estimates, future experimental work with taste tests could reveal the direction of any hypotheticality bias. Such experiments would also provide further insight on the relative importance of physical quality and brand perception components of consumers' WTP.

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