Japanese Consumer Preferences toward GM Foods after the Great East Japan Earthquake

Kayode Ajewole
Department of Agricultural Economics
Kansas State University
kajewole@ksu.edu

Hikaru Hanawa Peterson
Department of Agricultural Economics
Kansas State University

Koichi Yamaura
Department of International Environmental and Agricultural Science
Tokyo University of Agriculture and Technology

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Introduction

Genetically modified (GM) crops and foods are prevalent in the world. Large agricultural producing countries such as the United States, Brazil, and Argentina have expanded production of GM crops, while consumers in many large importing countries including the European Union and Japan have been apprehensive about their consumption. An ethical objection to GM foods is based on a belief that genetic engineering is unnatural and may have unforeseen consequences to the environment (Hobbs, 2000). Other concerns are health-related. Some are specific to potential allergenic responses to GM foods, while others pertain to unknown impacts on health in the long run.

The food scape in Japan was largely affected in March 2011 when a massive earthquake and its tsunami brought about a widespread radioactive contamination near and beyond the Fukushima nuclear plant located in the northern part of the country. Trace amounts of radiation on agricultural products were reported, not only on those produced in the northern region but also in prefectures close to the Tokyo metropolitan area, naturally raising food safety concerns nationwide. The government responded by establishing a regulatory protocol to test for radionuclide levels in various agricultural products before they entered the food system. Officially to aid the economic recovery of disaster-affected regions, the government also

launched national campaigns to encourage consumption of farm products from these affected regions.

Consumers perceive risks on food they purchase in different ways. Risk attitude can be described as how willing a person is to accept risk, while risk perception can be described as a person's view about risk inherent in a particular situation (Schroeder, Tonsor, & Mintert, 2007). Agricultural and livestock products contamination by radioactive material after the Daiichi Nuclear plant accident has made the consumer aversion against purchasing food products form the affected a major social problem in Japan (Sawada, Aizaki, & Sato, 2014). Long-run health impacts of consuming GM foods or foods with traces of radioactive substances represent ambiguity (Antl 1996; Melkonyan and Schubert 2009; Kivi and Shogren 2010). Ambiguity, where the probability distribution over outcomes of a random occurrence is unknown, is distinguished from risk where the probabilities are known. Studies have found both ambiguity and risk aversions to affect decisions in various contexts, including food safety (e.g., Einhorn and Hogarth 1986, Dow and Werlang 1992; Engle-Warnick, Escobal, and Laszlo 2006; Kivi and Shogren 2010).

Japanese consumers have held strong preferences for food produced domestically where no GM crops are planted (Peterson et al. 2013; ISAAA 2011). Thus, their preference for domestic foods has been in line with their aversion for GM foods. The occurrence of the nuclear

disaster put many Japanese consumers in the position of choosing between possibly contaminated, locally produced food and likely GM, imported food products. This study examines how Japanese consumers are making choices among food attributes that are now in conflict with each other in the context of two different sources of ambiguity. Specifically, the study investigates the degree Japanese consumers distinguish and value the product origin in terms of both country and region within Japan, which will reveal the net effect of food safety concerns and the government support campaign, and their preferences toward GM food in light of the nuclear disaster. Impacts of consumer aversions to risk and ambiguity on their preferences toward origin and food safety attributes will also be explored.

Choice experiment responses were analyzed using a latent class model. Consumer valuations for GM and non-GM foods and various food origins were calculated for each estimated class of sample respondents. The selected latent class model consisted of three classes based on preferences towards GM and country of origin of the food products: the "Indifferent-to-GMO consumers", the "bargain seekers", and the "Domestic food seekers". All three classes had clear preferences towards foods produced in Japan. The "Domestic food seekers", consisting of 46.9% of the sample, were the only group willing to pay premium (138.44 yen/300gm) for tofu with Non-GM attribute. The "Indifferent-to-GMO consumers", 39.5% of the sample, was the only group with a positive attitude towards food products from

United States (US), and was willing to pay premium for US products. Generally, the three classes did not prefer food products from China.

Related Literature

The use of genetically modified organisms in agriculture has become an intense public and political debate (M. Loureiro & Hine, 2004). Since the commercialization of GM foods, many researchers have worked on the consumer perception towards GM. From previous studies, generally consumers prefer GM-free food if prices were equal (Costa-Font, Gil, & Traill, 2008). Consumers appear poorly informed about genetic engineering and base final product acceptability on risks and benefits to themselves or the environment as well as social and ethical concerns (Brown & Yanchao Ping,2003). According to Costa-Font et al. (2008), consumer attitudes towards GM foods are driven by three factors: risks and benefit perceptions associated with GM food, individual values and attributes, and the knowledge of the decision maker on GM foods. Rodríguez Entrena & Sayadi (2013) found in the context of GM functional cornflakes that while consumers prefer GM-free food, there is a potential market niche for GM foods in Spain.

Awareness and acceptance of GM food is different from country to country, and Japanese consumers have had lower acceptance for GM food relative to other places.[1] In a

[1] Examples of studies on consumer preferences toward GM food in other countries include Burton et al. (2001) in UK, Huang et al. (2006) in China, and Christoph, Bruhn, & Roosen (2008) in Germany.

comparative study of consumer willingness to pay for selected GM foods in Japan, Norway, Taiwan, and the US., only 17 percent of Japanese students in their study were willing to consume GM foods, compared to 80 percent of US students (Chern et al. 2002). A survey of Japanese members of a consumer cooperative showed that discount needed for these coop consumers to purchase GM food products was positively affected by higher levels of self-reported risk perceptions toward GM food, higher level of concern about food safety and the environment, as well as knowledge about technology, educational levels, and income levels (McCluskey, Grimsrud, Ouchi, & Wahl, 2003). According to Matsumoto (2006), most Japanese consumers pay non-negligible premiums for products produced under strict GMO-segregation program.

Food safety crises increase public concerns about and distrust towards the agro-food sector, making consumers wary of genetically modified (GM) foods (Rodríguez Entrena & Sayadi 2013). When consumers are making decision on what to consume, his/her perception toward risk may play a significant role. For example, a study found consumers to perceive relatively high risks associated with the consumption and production of conventionally grown produce relative to organic produce, compared with other public health hazards (Williams & Hammitt 2001). Many food safety concerns have been documented, but little has been done to enlightened consumers on the range of food safety hazards (Williams & Hammitt 2001). Trust in food safety play important role in food hazard appearance. When there is lack of trust in food safety, consumers will start

feeling unsafe, this will lead to distrust in the food producers and the food safety regulators (de Jonge, van Trijp, Renes, Frewer, & Jan Renes, 2007; Kher et al., 2013; Niewczas, 2014; Wilcock *et. al.*, 2004). Japanese consumers trust strongly the Japanese government handling and food risk regulations, and have constant Japanese domestic food preferences (Peterson & Yamaura, 2014).

Consumers in different countries respond differently to food safety events. For example, Schroeder et al. (2007) compared how food safety risk perceptions and attitudes of US, Canadian, Japanese, and Mexican consumers impact their beef consumption, and found that Japanese and Mexicans were more risk averse towards beef food safety than US and Canadian consumers. Further, Tonsor & Schroeder (2009) showed that consumer demographics, country-of-residence, and alternative food safety information sources affected risk perceptions of consumers in Canada, Japan, and the US, concluding that personal and indirect food safety experiences substantially affected risk perceptions. Food safety perception and importance placed on country of origin of food products also varied across consumers of different countries McKendree *et al.* (2013).

Labels of country of origin of food products allow consumer to be trace where their food products originated from. Traceability was considered as a very useful tool to improve consumer confidence in food safety. Advantage of domestic food product over imported food product can be partly explained by consumers' risk handling behavior (Lim *et al.* 2014). It was noted that consumers sometimes prefer to pay for products from a reliable source; they will be willing to pay

more in order to avoid unknown risk. Muthukrishnan *et al.,* (2009) proposed that ambiguity aversion drives the preference for established brands in multi-attributes choices among branded alternatives. In the case of Finnish consumers, they held strong positive perceptions of domestically produced broiler products and little concern towards the genetic engineering used in the domestic food production, although GMO in general was found to be a significant concern (Pouta *et al.* 2010).

Risk aversion also determines consumer willingness to pay for imported products, and the country of origin of the imported products will also be a strong determining factor. Lim et al. (2014) in their study of US consumers' preferences for imported and domestic beef, found that consumers' perceptions in regard to food-safety risks associated with beef consumption and consumers' aversion towards risk from beef consumption are likely to shape consumers' likelihood to purchase imported beef and willingness to pay for imported beef.

In this paper, we analyze Japanese consumer attitudes towards GM foods and food origin post the nuclear disaster accounting for the factors recognized in the past studies. Specifically, the analysis considers individual's ambiguity and loss aversion, knowledge about GM technology, and other demographic variables.

Survey Design

The survey was designed with a choice experiment and a series of questions eliciting degrees of loss and ambiguity aversion, along with screening questions, demographic questions, and other general questions. The general equations included a series of questions on the frequency of their purchase of selected domestic and imported perishable food products and other food shopping habits, such as the frequency at which they checked food labels when making purchases.

The choice experiment was designed using Tofu products. Tofu is made from soybeans and perishable. Tofu products in our choice experiment varied in three different attributes. The first attribute was price with three levels (68 yen, 89 yen, and 128 yen per 300 gram, a common unit that Tofu is sold). The second set of attributes was origin of soybeans. In addition to three countries (domestic, United States, and China), three regions of Japan were considered to examine whether sentiment to support the disaster affected region of Tohoku existed or whether the safety concerns and preferences toward sources further away from the nuclear plants prevailed (Tohoku, Chubu, and Kyushu). The third attribute was the GMO identification (GMO, non-GMO, and no label). From the 54 profiles from the full factorial design, 18 product profiles were chosen and combined into six choice scenarios, each with three Tofu products and an option of choosing none. The D-efficiency score was 94.8.

The questionnaire was designed in a way that their level of Loss aversion and ambiguity

aversion can be measured. Following Engle-Warnick, Escobal, and Laszlo (2006), series of four and five questions were written to measure the degrees of loss aversion and ambiguity aversion (see Appendix). For loss aversion, the respondent was asked to choose between 50-50 odds lotteries that were increasing in expected payoff and stake, starting with 10,000 yen (roughly US$100). For ambiguity aversion, the respondent was presented with binary lotteries with identical stakes, but in one lottery, the probabilities of the outcomes were specified as 50-50, while in the other, they were left vague. Unlike the field experiments with real payoffs, these elicitations occur in hypothetical settings. To minimize the chances that respondents may dismiss the stakes as trivial, a statement was included at the beginning of these series of question that if the national average number of hours worked by a part-time employee (25.6 hours/week) and hourly pay of 1,000 yen are assumed, people can earn 25,600 yen in a week.

Survey was conducted online in February 2014 to a stratified random sample of consumers across Japan to represent gender, age, and regional distributions of the population. A total of 1,213 responses were recorded for this study. Table 1 shows the descriptive statistics of the individual characteristic variables used in this study. The average respondent was 47 years of age, which is younger than the Japanese average age of 52.9 years of people older than 20 years of age in 2013. This is due to the fact that the online panel the research company is able to draw has relatively limited number of older subjects. The education dummy variable (*EDU*) was defined to

equal one for consumers with a bachelor degree, and zero for those without. More than half (59%) of our respondents had attained a bachelor degree, which is higher than Japanese 45% of the persons with tertiary education[2]. The annual gross household income (*HINC*) was measured in 10,000 Japanese Yen; the sample average income of respondents is 5.96 million yen was comparable to the Japanese average household income of 5.39 million in 2014.[3] Gender is represented by dummy variable, one for male and zero for female, with 51 percent of respondents are male.

Another important variable was about their familiarity with GM foods (*FAMGM*). The familiarity was the respondent self-reported knowledge about GM technology in crop production in a 5-point scale, with one corresponding to no knowledge while five meant that the individual was very knowledgeable. The average score was 2.31, suggesting that average respondents did not feel very informed about GM technology. Loss aversion of respondents (*LOSSAV*) was measured in a scale of 1 to 5, corresponding to the number of lotteries they progressed in the series of questions, with lower values correspond to higher degrees of loss aversion. Similarly, ambiguity aversion (*AMBAV*) was measured in scale of 0 to 5, with greater values corresponding to lower degrees of ambiguity aversion. There were many respondents who scored 1 for LOSSAV, thus, the

[2] http://www.oecd.org/unitedstates/CN%20-%20United%20States.pdf

[3] Calculated from data obtained from the Japanese Statistics Bureau site (http://www.stat.go.jp/english/data/kakei/156.htm).

mean score of 1.4. In contrast, there was much more variability in AMBAV, with the mean score of 2.23 and almost twice the standard deviation.

Latent Class Model

A latent class model posits that individual behavior depends on observable attributes and on latent heterogeneity that varies with factors that are observed by the analyst (Greene & Hensher, 2003). The latent class model is based on random utility:

$$U_{njt} = \beta_n' X_{njt} + \epsilon_{\mathrm{njt}}$$

where U_{njt} is the utility of consumer *n* (*n*=1,2,….,*N*) choosing *j* (*j*=1,2,……..,*M*) from a set of *M* alternatives in choice scenario *t* (*t*=1,2,…..,*T*).

The latent class model sorts consumers into a number of latent classes based on their choice of preferred attributes combinations. Consumers within the same class have similar preferences, and their preferences vary across classes. The probability that individual *n* from class *c* chooses alternatives *j* from set of scenario *t* can be represented as

$$\Pr(njt|c) = \Pi_{t=1}^{T} \frac{e^{\beta_c x_{njt}}}{\sum_j^M e^{\beta_c x_{njt}}}$$

where x_{njt} represents a vector of observed attributes associated with alternative *j*, and β_c is a vector of class-specific utility parameters that measure heterogeneity in preferences across classes (Chengyan et al. 2015; Ouma, Abdulai, & Drucker 2007). In latent class model, each member of the class is not observed directly, and the identification of the class is unknown. The weight of

latent class *c* is the population share of the class. Probabilities of an individual belonging to a particular class can be specified as:

$$\pi_{cn}(C) = \frac{e^{\alpha_c' m_t}}{1 + \sum_{c=1}^{C-1} e^{\alpha_c' m_t}}$$

where m_t is a set of individual-specific characteristics, and α_c is a vector for class-specific utility parameters.

For this study, utility equation can be represented as:

$$u_{njt} = \beta_{0j} + \beta_1 Price_{jt} + \beta_2 Japan_{jt} + \beta_3 Kyushu_{jt} + \beta_4 Tohoku_{jt} + \beta_5 US_{jt} + \beta_6 CN_{jt} + \beta_7 GM + \beta_8 NONGM_{jt}$$

The *Chubu* region was specified as the base origin. The *Price* represents the price level for each alternative, *Japan, Kyushu, and Tohoku, US (United States), CN (China)* are the origin attributes, and *GM* and *NONGM* represent the GM identification attributes in the alternatives.

For the individual characteristic variables used to sort individuals into different classes, *GENDER* equaled 1 for male, 0 for female; *AGE* was the number of years in age; *EDU* was a dummy variable representing the acquisition of bachelor degree or not, and *HINC* was the annual gross household income in 10,000 yen. In addition, *FAMGM* represented the respondents' self-reported familiarity with GM technology in crop production measured in a 5-point scale with 1 corresponding to no knowledge, and 5 to very high knowledge. Lastly, *LOSSAV* and *AMBAV* represent degrees of loss and ambiguity aversion explained earlier, respectively.

Willingness to Pay

The willingness to pay (WTP) for an attribute is the marginal utility of the attribute divided by the marginal utility of its cost (Zito, 2012). WTP can also be defined as the price premium that consumers are willing to pay for obtaining a desired attribute level (Nguyen et al. 2015). The estimated model parameters can be used to calculate the WTP. The WTP for attribute *j* in latent class *c* is calculated as:

$$WTP_j^c = \frac{-\hat{\beta}_{cj}}{\hat{\beta}_{cp}}$$

$\hat{\beta}_{cj}$ and $\hat{\beta}_{cp}$ are the parameter estimates of attributes (*j = Japan, Kyushu, Tohoku, US, CN, GM,* and *NONGM*) and price, respectively. The overall WTP for the sample is weighted averages of the class WTPs, the weight equals the probabilities (Pr_c) of class membership (Nguyen et al., 2015).

$$WTP_{sample} = \sum_{c=1}^{C} Pr_c WTP_{ij}^c$$

To determine the statistical significant of WTP, 95% confidence interval was calculated by Delta method using NLOGIT 5.0.

Results and discussion

The model with three classes was supported by the data over models with different numbers of classes. The estimated result of the latent class model is presented in Table 2; the willingness to pay for each class is presented in Table 3. Based on the coefficients of the attributes in each class,

we named the three classes ‘Indifferent-to-GMO consumers’, ‘Bargain seekers’, and ‘Domestic food seekers’, respectively. The largest class was the ‘Domestic food seekers’ accounting for 46.9% of the sample. ‘Indifferent-to-GMO consumers’ accounted for 39.5% of the sample, and ‘Bargain seekers’ accounted for 13.6%. Each class is discussed in turn.

In the first class, all coefficients were statistically significant except for those on *GM* and *NONGM*. They were not as sensitive to price as the second class. Relative to the base Chubu region, they preferred product labeled as “domestic” the most, followed by the regional origins of Kyushu and then Tohoku. They gained more utility from products from US than the Chubu region, but did not care for products from China similar to the third class. This class appears to be sensitive to origin of their product but not as the third class. The distinct feature of this class is their indifference to the presence or absence of GM attribute, and thus, the class was named “Indifferent-to-GMO consumers.” The estimated membership coefficients suggest the class is the youngest among the classes, with lower educational attainment and less household income than the third class. The class was also distinct in terms of being less loss averse than the other classes. They were also less ambiguity averse than the third class.

The second group was distinct from the other classes by the most negative price coefficient, thus named the “Bargain seekers.” This group preferred no information about GM content than products with GM or GM-free labels. They preferred domestic products, and

regionally preferred food products from Kyushu, followed by Chubu and Tohoku. Their low valuation of the Tohoku region could be due to their concern toward the nuclear effect. They did not have statistically significant preferences against imported products. Demographically, this group earned less and less educated than the third class. This group has the least degree of loss aversion than the other groups, which makes sense if all they cared were buying food items in the most affordable way.

Third group includes close to half of the sample and consists of the highest income earning and most educationally attained individuals. The group also consisted of averagely oldest respondents. Their demographic characteristics match their marked preference for domestic food products over imported products and negative attitude toward GM products. Their disutility from US products was much smaller than their disutility toward Chinese products, suggesting Japanese attitudes toward imported products varied across countries of origin.

Willingness to Pay

The calculated mean willingness to pay (WTP) estimates for the classes are presented in Table 3. All three classes were willing to pay premium for Japanese food products, even the Bargain Seekers, but the WTP for class 3 was not statistically significant at the 5% level. Figure 1 shows the conditional distribution of WTP related to Japanese products[4].

[4] Positive price coefficient instead of negative price coefficient used in NLOGIT 5.0 to plot the distribution.

Both classes 1 and 2 were willing to pay a premium for Kyushu products, compared to the Chubu products. Consumers in Class 1 were willing to pay a premium for Tohoku products, but class 2 discounted Tohoku products relative to Chubu products. None of the WTP for class 3 are statistically significant. Class 1 was willing to pay a premium for US products, but WTP for Chinese products for all classes were not statistically significant, suggesting wide heterogeneity in preferences among each estimated class.

Regarding GM attribute, WTP for Bargain Seekers was the only statistically significant and negative. Bargain Seekers discounted products with GM-related labels, but preferred non-GM content over GM content. Figure 2 shows the conditional kernel distribution of the WTP[5] for GMO across the sample; we saw that only consumers are willing to pay premium for NONGM attribute. The Domestic food seekers (group 3) are willing to pay on average 138.44 yen/300gm premium for NONGM tofu, but there was too much heterogeneity in preferences for the group WTP to be statistically significant.

Conclusion

The aim of this study is to examine the degree to which Japanese consumers distinguish product origin and their preferences towards GM food after the nuclear disaster. For this purpose, a stated

[5] Note: Positive price coefficient instead of negative price coefficient used in NLOGIT 5.0 to plot the distribution, the signs on the WTP should be opposite of what it is on the graph. For example, a point on with WTP_I of (-5000) should be 5000.

preference survey was conducted in order to gauge the preferences of Japanese consumer relating to food product information about GM and the products origin. A latent class model (LCM) was applied to account for consumer heterogeneity. The sample was best sorted into three classes: 'Indifferent-to-GMO consumers', 'Bargain seekers' and 'Domestic food seekers'. We named the three classes based on their valuation toward these attributes. Our results showed that the three classes have high preferences for food produce in Japan and the coefficients are statistically significant (1% level) for the three classes. The result also showed that the three classes are sensitive to price, but the price attributes is only statistically significant for the 'Indifferent-to-GMO consumers' and 'Bargain seekers'.

In relation to our study objectives, over 60 percent of the respondents discounted GM product, suggesting that many Japanese consumers are still sensitive to GM products,. At once, 40% of the population identified as the 'Indifferent-to-GMO consumers' segment is much larger than suggested from the levels of GM avoidance found among Japanese consumers found by pre-disaster studies. Thus, the concern for radioactive contamination may have dampened the concern toward GM. Educational attainment, household income, and familiarity with GM technology played a role in consumer preferences towards GM food. Also, individuals with greater loss aversion tended to be in groups discounting GM foods. The 'Domestic food seekers' was the only group willing to pay premium for non-GM foods, because they are the highest income earner

among the three groups, they have high degrees of both ambiguity aversion and loss aversion, and they are also the oldest.

On the Japanese consumers' attitude towards products origin, we found out that all three groups of consumers are willing to pay high premium for Japanese domestically produce product. Of the regions included, all groups preferred Kyushu products over the Chubu products. "Indifferent-to-GMO" consumers were willing to pay a premium for Tohoku products over Chubu products, but the "Bargain seekers" discounted Tohoku products over Chubu products. Only 'Indifferent-to-GMO consumers' were willing to pay premium for United States food products. None of the groups preferred Chinese products, but preferences varied widely.

From policy perspective, this study results showed that the younger generations (indifferent-to-GMO consumers) in Japan are less sensitive to GM foods, and would be willing to purchase products from other countries they trust. This younger group consisted of about 40% of the adult consumers. In the nearest future, larger population will be willing to consume GM foods. For a common food product such as Tofu, Japanese consumers preferred the assurance of domestic production, instead of any regional denomination. There was not a consistent support for Tohoku region, which was the target of the government campaign. For regionally focused origin labeling to be effective, it most likely needs to be a more specialized product.

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Table 1: Demographic variables definition and Summary Statistics

Variable	Explanation	Mean	Std. Dev.
GENDER	Gender (1=male; 0=female)	0.51	0.50
AGE	Years	47.29	13.09
EDU	Dummy variable (1=Bachelor degree and above; 0=below bachelor degree)	0.59	0.49
HINC	Annual gross household income, measured in 10,000 yen/year.	596.13	327.36
FAMGM	Familiarity with GM technology (1 = no knowledge, …, 5 = very much knowledge)	2.31	0.95
LOSSAV	Degree of loss aversion; lower values correspond to greater aversion	1.40	1.06
AMBAV	Degree of ambiguity aversion; lower values correspond to greater aversion	2.23	1.81

Table 2. Latent Class Model and membership function

	CLASS 1 "Indifferent-to-GMO"		CLASS 2 "Bargain seekers"		CLASS 3 "Domestic food seekers"	
Variable	Coeff.	Std. Err	Coeff.	Std. Err	Coeff.	Std. Err
PRICE	-0.0020 **	0.0009	-0.0142 ***	0.0026	-0.0005	0.0007
JAPAN	2.2540 ***	0.1137	1.0486 ***	0.2956	2.8967 ***	0.1780
KYUSHU	2.1433 ***	0.1303	0.7258 **	0.3580	2.5628 ***	0.1927
TOHOKU	1.6576 ***	0.1187	-1.5703 **	0.7697	2.4405 ***	0.1683
US	0.7264 ***	0.1331	-0.6958	0.4308	-0.3232 ***	0.0889
CN	-0.5850 ***	0.1702	-25.5937	.125D+9	-3.3655 ***	0.4158
GMO	0.0461	0.0896	-2.3369 ***	0.2736	-4.3130 ***	0.2187
NONGM	-0.0915	0.0605	-1.3466 ***	0.2644	0.0649	0.0433
Membership coefficient						
GENDER	0.2369	0.1555	0.1192	0.2103	0	
AGE	-0.0291 ***	0.0059	-0.0080	0.0078	0	
EDU	-0.4194 ***	0.1523	-0.5084 **	0.2117	0	
HINC	-0.0006 ***	0.0002	-0.0007 **	0.0003	0	
FAMGM	-0.3795	0.2428	-0.3172	0.3402	0	
LOSSAV	0.1846 ***	0.0704	-0.0638	0.1154	0	
AMBAV	0.0675 *	0.0410	0.1710 ***	0.0556	0	
Share	39.5%		13.6%		46.9%	
Log likelihood function			-7569.66			

Note: ***, **, * denotes Significance at 1%, 5%, 10% level.

LCM model with panel has 1,213 groups.

Fixed number of obsrvs./group= 6

Table 3. Willingness-to-Pay Estimates

	Class1 "Indifferent-to-GM"	Class2 "Bargain Seekers"	Class3 "Domestic food seekers"
Atttributes			
JAPAN	1134.50**	73.86***	6174.66
	(166.26, 2102.73)	(49.22, 98.50)	(-10370.24, 22719.56)
KYUSHU	1078.78**	51.12***	5463.06
	(158.75, 1998.82)	(15.77, 86.46)	(-9149.03, 20075.16)
TOHOKU	834.30**	-110.60*	5202.2
	(140.01, 1528.59)	(-237.66, 16.46)	(-8734.61, 19139.02)
US	365.61**	-49.01	-688.88
	(61.46, 669.75)	(-123.18, 25.16)	(-2800.67, 1422.90)
CN	-294.45	-1802.61	-7174.05
	(-650.74, 61.85)		(-26919.23, 12571.14)
GMO	23.18	-164.59***	-9193.92
	(-74.08, 120.44)	(-232.46, -96.72)	(-34164.9, 15777.07)
NONGM	-46.04	-94.85***	138.44
	(-124.78. 32.70)	(-149.45, -40.25)	(-221.13, 498.00)

Note: ***, **, * implies Significance at 1%, 5%, 10% level.
The values in parentheses are the 95% confidence interval.

Figure 1. Conditional expectation kernel distribution of WTP for product from Japan

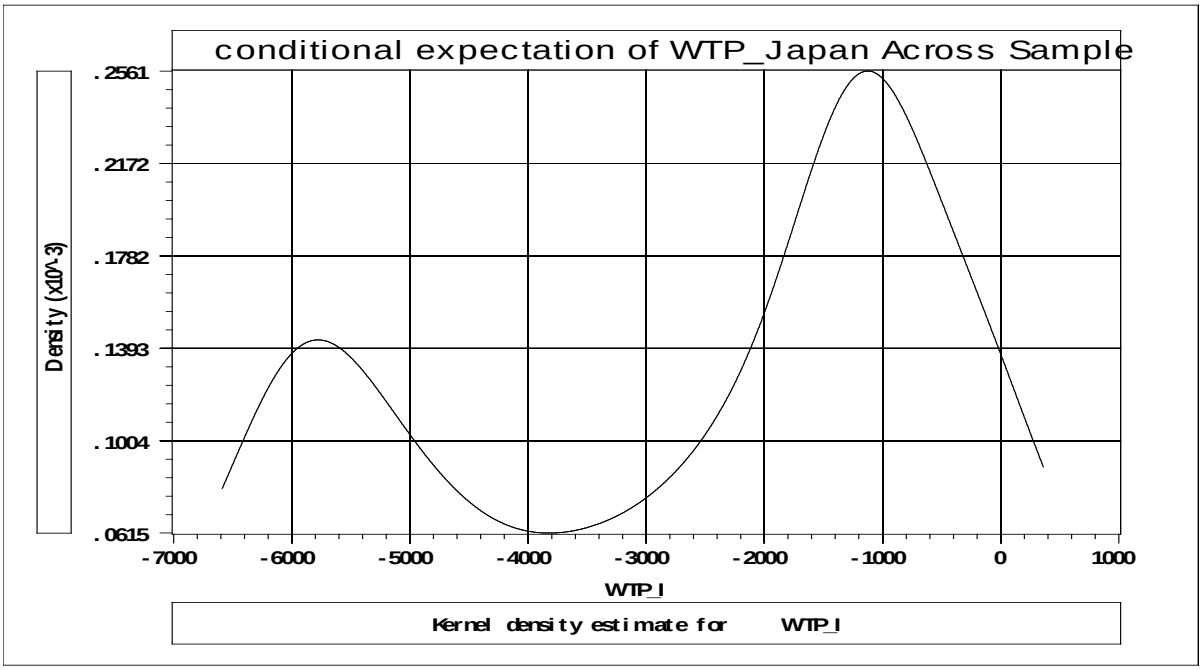
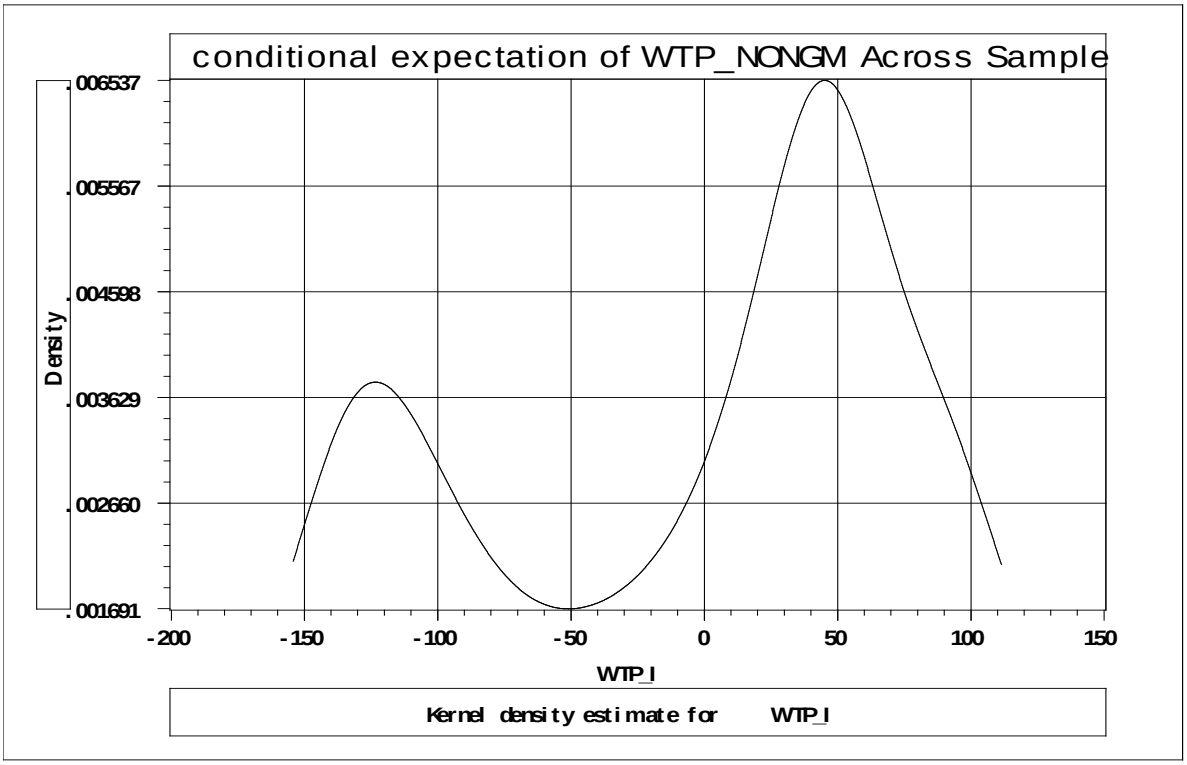


Figure 2. Conditional Expectation Kernel Distribution of WTP for NONGM attribute



Appendix: Questions Used to Elicit Loss and Ambiguity Aversion

The following series of questions concern your preferences toward uncertainty. For reference, the weekly average hours of a part-time worker is 25.6 hours, and if we assume the average hourly pay to be 1,000 yen, the worker earns 25,600 yen in a week.

Q1. Suppose there is a lottery that you can participate with 10,000 yen. If you pay 10,000 yen, then with 50% chance you can earn 13,375 yen, and with 50% chance you can earn 7,750 yen. What would you do?

(a) Keep the 10,000 yen.

(b) Pay 10,000 yen to participate in the lottery (50% chance of winning 13,375 yen; 50% change of winning 7,750 yen).

If respondents chose (a), skip to Q5. If respondents chose (b),

Q2. The lottery you selected is the lottery that you can participate by paying 10,000 yen and can earn 13,375 yen with 50% chance and 7,750 yen with 50% chance. Suppose there is an alternative lottery where you can earn 16,750 yen with 50% chance and 5,500 yen with 50% chance. What would you do?

(a) Choose to participate in the original lottery (50% chance of winning 13,375 yen; 50% change of winning 7,750 yen).

(b) Participate in the alternative lottery (50% chance of winning 16,750 yen; 50% change of winning 5,500 yen).

If respondents chose (a), skip to Q5. If respondents chose (b),

Q3. … Suppose there is an alternative lottery where you can earn 20,125 yen with 50% chance and 3,250 yen with 50% chance….

If respondents chose (a), skip to Q5. If respondents chose (b),

Q4. … Suppose there is an alternative lottery where you can earn 23,500 yen with 50% chance and 1,000 yen with 50% chance….

In the following 5 questions, you are asked to choose from two lotteries as before. In the first lottery, the chances of the amounts you earn are unknown. In the second lottery, those chances are known.

Q5. If you can participate in one of the two lotteries, which would you choose?

a. You pay 10,000 yen to participate and can earn 10,000 yen with some probability and 10,000 yen with the remaining probability.

b. You pay 10,000 yen to participate and can earn 9,800 yen with 50% chance and 9,800 yen with 50% chance.

Q6. If you can participate in one of the two lotteries, which would you choose?

a. …can earn 7,750 yen with some probability and 13,375 yen with the remaining probability.
b. .. can earn 7,550 yen with 50% chance and 13,175 yen with 50% chance.

Q7. If you can participate in one of the two lotteries, which would you choose?

a. …can earn 5,500 yen with some probability and 16,750 yen with the remaining probability.
b. .. can earn 5,300 yen with 50% chance and 16,550 yen with 50% chance.

Q8. If you can participate in one of the two lotteries, which would you choose?

a. …can earn 3,250 yen with some probability and 20,125 yen with the remaining probability.
b. .. can earn 3,050 yen with 50% chance and 19,925 yen with 50% chance.

Q9. If you can participate in one of the two lotteries, which would you choose?

a. …can earn 1,000 yen with some probability and 23,500 yen with the remaining probability.
b. .. can earn 800 yen with 50% chance and 23,300 yen with 50% chance.