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Assessing Korean Consumers' Valuation for BSE Tested and Country of Origin Labeled Beef Products

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Abstract

The objective of this study is to estimate Korean consumers' willingness to pay (WTP) for beef products with BSE testing and country of origin labeling. We use a choice experiment to examine consumers' valuation for beef products with these labels. In addition to analysis using the pooled sample, we also conduct sub-sample analyses based on consumers' level of risk perception about beef consumption and selected socio-demographic characteristics. Results suggest that Korean consumers value BSE tested beef. They also have a preference for domestic beef vis-à-vis imported beef. When we conducted separate analysis between respondents who have low vs high risk perception about beef consumption, results suggest that those with high risk perception tend to value BSE testing more than country of origin labeling while those with low risk perception value country of origin labeling more than BSE testing. Moreover, results from separate analysis between respondents who have higher education vs lower education and between older vs younger respondents suggest that young or high educated respondents tend to value BSE testing and imported beef from countries which have not experienced BSE outbreaks more than do older or lower educated respondents.

Keywords

Willingness-to-Pay, BSE test label, Risk Perception, Country of Origin, Choice Experiment

Introduction

Since Korea opened its beef import market in 1988, beef had been imported through a quota system. However, as a result of the Uruguay round of the GATT negotiations, the Korean beef market was fully liberalized with beef import quotas being replaced by an import tariff system in 2001. This has caused beef imports in Korea to significantly increase since 2001, with the market share of imported beef reaching over 50 percent of the total beef consumption in the country. Major exporting countries were the US, Australia, and Canada. However, after outbreaks of the mad cow disease (BSE) in the US and Canada, Korea temporarily stopped the importation of beef from those countries in 2004. Korea did not reopen its beef market to the US and Canada until 2007 and 2012, respectively.

Korean consumers have become more concerned about the safety of imported beef after the occurrence of BSE in major exporting countries. Consequently, consumers have asked for more information on imported beef such as safety and country of origin. The Korean government then enhanced the testing standards for imported beef during the quarantine process. This initiative, however, only examines specified risk materials (SRM)¹ suspected beef products, but does not require BSE testing in beef products. In addition, even though there is a possibility that BSE could affect domestic cattle, the Korean government has not implemented any mandatory BSE testing on domestic cattle. Given this backdrop, Korean consumers highly demanded that the government should improve beef safety standards on domestic and imported beef by requiring BSE testing and country of origin labeling (COOL) in beef products.

¹ Specified risk materials : The brain, skull, eyes, trigeminal ganglia, spinal cord, vertebral column (excluding the vertebrae of the tail, the transverse processes of the thoracic and lumbar vertebrae, and the wings of the sacrum), and dorsal root ganglia from cattle 30 months of age and older and the distal ileum of the small intestine and the tonsils from all cattle [Section 309.1(b) of the Federal meat inspection regulations, USDA/FSIS (http://edocket.access.gpo.gov/cfr_2009/janqtr/pdf/9cfr309.2.pdf)]

No other study, however, has examined Korean consumers' valuation for BSE testing and country of origin labeling in the beef market. This information is needed by policy makers and marketers when deciding whether or not to implement BSE testing or country of origin labeling in beef products in Korea. We attempt to fill this void by investigating consumers' willingness to pay (WTP) for beef labeled as being BSE tested and beef labeled with country of origin using a choice experiment design.

Given that consumers' risk perception about food safety can influence purchasing behaviors (Lusk and Coble 2005; Angulo *et al.* 2005; Angulo and Gil 2007; McCluskey *et al.* 2005), we examined the effect of consumers' level of risk perception about beef consumption on WTP for BSE testing and country of origin labeling by dividing our sample into two groups: low risk perception group (i.e., those who perceived a low risk from consuming beef) and high risk perception group (i.e., those who perceived a high risk from consuming beef).

Moreover, we also examined possible heterogeneity in WTP with respect to respondents' demographic characteristics. Specifically, we analyzed the effect of consumers' age and the level of education on WTP for BSE testing and country of origin labeling by dividing our sample into by education and age levels (i.e., high education group and low education group; older respondents and younger respondents).

Beef safety valuation

A number of studies have attempted to examine consumers' attitudes toward beef safety and investigate their valuations for safer beef products. For example, McCluskey *et al.* (2005) identified the factors that affect Japanese consumers' valuations for BSE tested-beef using the dichotomous choice contingent valuation method. Their results indicated that 86 percent of

respondents reported to have consumed less domestic beef after the BSE outbreak in Japan, and they were willing to pay over 50 percent premium for BSE tested beef. Yang and Goddard (2011) clustered household panel data by survey participants' risk attitude and perception toward beef, and examined the change in household beef purchasing-behavior according to beef risk attitude and perception. They concluded that households with lower willingness to accept the risk on beef consumption have more elastic beef demand than those with higher willingness to accept the risk on beef consumption.

Cranfield (2011) investigated Canadian consumers' willingness to pay for beef from beef that have been tested for BSE using a contingent valuation survey. The results indicated that respondents are willing to pay a premium of 43 percent for beef with BSE testing. Moreover, this premium increased with purchase intention. Lee *et al.* (2011) estimated Korean consumers' willingness to pay for imported beef with traceability using non-hypothetical experimental auction. They also analyzed the effects of different types of information about the traceability of imported beef on consumers' valuations. Their results indicated that consumers are willing to pay an average of 39 percent premium for imported beef that are "traceable" (i.e., with traceability system).

Lim *et al.* (2012) investigated US consumers' valuations for imported beef compared to domestic beef. They also investigated the premium for BSE tested and traceable beef. The results showed that for consumers to switch from domestic beef to Canadian beef, the price discount for Canadian beef must be in the range of \$1.09 to \$35.12 per pound. They also concluded that consumers show \$5.7 and \$5.9 premium for BSE tested and traceable beef, respectively. Chung *et al.* (2009) conducted a conjoint analysis to compare Korean consumers' willingness to pay for domestic and imported beef. Moreover, they calculated consumers' valuations for beef quality attributes such as genetically modified organism (GMO) free feed

and antibiotic free. The results indicated that consumers are willing to pay \$14 per pound more for domestic beef compared to imported beef and that country of origin is the most critical factor contributing to the price differential between domestic and imported beef. Their result also showed that consumers are willing to pay a premium for GMO free and antibiotic free beef.

In summary, many previous studies concluded that consumers' food safety concerns have escalated after outbreaks of BSE and these concerns have changed consumers' beef purchasing behaviors. Consumers tend to be giving more weight on beef safety related attributes such as BSE testing, traceability, and antibiotic free compared to other quality attributes such as marbling and freshness, when purchasing beef in the market.

The occurrence of BSE in major beef exporting countries is a very sensitive issue in Korea relative to other food safety issues since Korea imports 60 percent of its total beef consumption. However, Korean consumers' willingness to pay for a BSE testing and country of origin labeling has not been examined in the past. No other study has also examined possible heterogeneity in WTP with respect to Korean consumers' level of risk perceptions on beef consumption and socio-demographic characteristics.

Experimental design

We conducted a nationwide survey in October, 2012 in South Korea. Since housewives are by far the primary shoppers of beef in Korea, many studies on Korean beef consumption have selected only housewives (Rhee *et al.* 2001, Jeong *et al.* 2002, Song *et al.* 2002, MIFAFF 2010, MIFAFF and aT 2011). Therefore, a total of 500 randomly chosen housewives participated in our choice experiment through an on-line survey. We divided the survey into

three parts; the first part included participants' demographic information; the second part included the choice experiment to estimate participants' valuations for BSE testing and country of origin; the last part included consumers' risk perception on consuming beef.

Each participant was asked which type of beef they would buy among three alternatives in each choice set including a "no buy" option. Each respondent was presented with 8 choice sets. To construct the choice sets, we used a full factorial design since this design method efficiently works in estimating participants' choice behavior (Lusk and Norwood, 2005). D-optimality criterion for the fractional factorial design was then used to generate the choice sets in our choice experiment. We also provided a cheap talk script to participants (Lusk 2003; Carlsson *et al*, 2005; Silva *et al*, 2012) (see Appendix 1), prior to the presentation of the choice sets, to reduce potential hypothetical bias in the choice experiment.

The attributes and levels of each attribute used in the choice experiment are presented in Table 1. We chose 1 kg of beef for "Bulgogi use" as the representative product since it is one of the most famous dishes in the country. Previous studies have identified that Korean consumers are usually concerned about food safety, country of origin, and price when they buy beef products (Lee *et al*, 2011; Chung *et al*, 2012). Therefore, the choice profiles are composed of three attributes: price, BSE testing, and country of origin. Price as an attribute has four levels ranging from 12,000 KW (US \$10.9) to 30,000 KW (\$US 27.3) per kg.² These price levels represent market prices for three imported beef and domestic beef in Korea, respectively. Four types of country of origin were considered in the experiment. We included two countries (i.e. domestic and Australia) which have not experienced BSE outbreaks, and other two countries (i.e. US and Canada) which have experienced a BSE outbreak. Moreover, we considered two levels of BSE testing (i.e. BSE tested or not) as an attribute.

² The won-dollar exchange was 1100 won per US dollar in October 2012.

Table 1. Attributes and Levels in Choice Experiment

Attributes	Levels
Price (Korean won/kg)	12,000, 18,000, 24,000, 30,000
BSE testing	Yes, No
Country of Origin	Canada, United States, Australia, Korea

Summary statistics and Methods

Summary statistics of the demographic characteristics of survey participants are presented in Table 2. The age distributions of survey participants are: 36 percent in their 40s; 31 percent in their 30s, and 25 percent in their 50s. Fifty-seven percent of respondents graduated from a university, and thirty-four percent graduated from high school. For the monthly household income, the largest group is in the range of from 3 million to 4 million won.

In addition, the average household size of the subjects is approximately 3 persons, and they buy beef about 3 times per month. Average quantity of beef per purchase is about 0.867 kg and participants eat beef at home or away from home about 3.5 times per month on average. Survey participants prefer domestic beef mostly and Australian beef next. Moreover, participants indicated that they are first concerned with country of origin when they buy beef, and then, with food safety and then price. This implies that price is not the main determinant of Korean consumers' beef purchase.

Table 2. Summary statistics of participants' socio-demographic variables

Variables	Categories	Value	
		Mean	Std.Dev
Household size		2.98	1.10
Number of purchase ¹		2.80	2.15
Quantity of purchase ²		866.78	490.99
Frequency of eating ³		3.53	2.76
Age	Twenties(20~29)		6%
	Thirties(30~39)		30.8%
	Forties(40~49)		35.6%
	Fifties(50~59)		25.4%
	Sixties(60~69)		2.2%
Education	Elementary school		0.6%
	Middle school		1.2%
	High school		33.8%
	University		57.2%
	Post-graduate		7.2%
Income	Less than 1 million		0.8%
	1 to 1.99 million		5.0%
	2 to 2.99 million		18.8%
	3 to 3.99 million		24.8%
	4 to 4.99 million		21.0%
	5 to 5.99 million		13.2%
	6 to 6.99 million		7.2%
	7 to 7.99 million		5.4%
	Higher than 8 million		3.8%
Preferred country ⁴	Korea		67.6%
	US		1.2%
	Australia		28.2%
	Canada		0.4%
	Other countries		1.2%
Concern	None		1.4%
	First concern	Country of Origin	
	Second concern	Safety	
	Third concern	Price	

¹ Frequency of buying beef a month.

² Quantity of buying beef once (unit: g).

³ Frequency of eating beef at home or outside home a month.

⁴ Preferred country of origin when they buy beef in the market.

As previously mentioned, consumers' purchasing behaviors could be affected by their risk perceptions about food safety (Lusk and Coble 2005; Angulo *et al.* 2005; Angulo and Gil 2007; McCluskey *et al.* 2005). Therefore, survey participants were asked to answer risk perception questions using a Likert scale used by Lusk and Coble (2005) since they concluded that risk perception was a critical determinant of accepting food safety.

Table 3 indicates the specific statements and mean values of the responses to the risk perception questions. The results show that consumers expressed the highest risk value to the question related to imported beef, and lower value to the question related to domestic beef. This implies that consumers are more concerned about the safety of imported beef. In addition, consumers strongly agree with BSE labeling on beef products.

Table 3. Risk perception on Beef Consumption

Statement	Mean ¹⁾ (Std.)
Absence of BSE testing in slaughtered domestic cattle that are 21 months or older will pose risks to my family and me	6.99 (1.64)
My family and I could be exposed to risks from beef imported from countries which are not certified as BSE-free	8.25 (1.14)
My family and I might be exposed to BSE risk when we buy or eat beef	6.81 (1.62)
BSE free Labeling on beef will reduce risks to my family and me	7.47 (1.45)
Not implementing BSE testing for all domestic beef will pose risks to my family and me.	7.14 (1.58)
Sum of Scales	36.66 (5.42)

Response to Scale Question (1=Strongly Disagree; 9=Strongly Agree)

We assumed that there might be heterogeneity in consumers' valuation on attributes with respect to their risk perceptions on beef consumption. To verify this assumption, we divided

our sample into groups. We conducted k-means clustering based on individual risk perception scale. Considering the difference of standard deviation among groups, we concluded that dividing the sample into two groups (i.e., low risk perception vs. high risk perception) is the most reasonable course of action (Appendix 2). Since sample distribution of risk perception is slightly negative skewed (i.e., relatively few low values; Appendix 3), the differences between standard deviation gets larger as the number of groups increases. Average risk perception is shown in Appendix 3. The average risk perceptions of the high risk perception group and low risk perception group are 8.1 and 6.2, respectively.

Demographic characteristics may also influence consumers' WTP with respect to BSE testing and country of origin labeling. Therefore, we conducted sub-sample analyses by dividing respondents into groups using mean values of education and age through k-means clustering (Appendix 4; Appendix 5). The respondent is included in the high education group, if she has a university degree, and in the low education group, otherwise. A respondent who is between 20 and 39 years old would be included in younger group while a respondent who is at least 40 years old would be included in older group.

To analyze the choice experiment data, we applied the mixed logit model since this has been widely used in previous studies to capture unobserved heterogeneity (Alfnes, 2004; Hu *et al*, 2005; Lim *et al*, 2012). The mixed logit model is flexible so this model can approximate any discrete choice model (McFadden and Train, 2000). It precludes the three limitations arising from standard multinomial logit by allowing for random taste variation, unrestricted substitution patterns, and correlation in unobserved factors (Train, 2003). The mixed logit also assumes that the unknown vector β of regression coefficients is random, and this property allows one to overcome the independence from irrelevant alternatives (IIA) assumption.

The mixed logit probability can be derived from utility maximizing behavior. The utility function of consumer i from alternative j in choice situation t is denoted by

$$U_{ijt} = x_{ijt}\beta_i + \epsilon_{ijt}$$

where x_{ijt} represent the attributes that relate to the alternative j in choice situation t . The coefficients of the variables, β_i , for consumer i representing that person's tastes, and ϵ_{ijt} is a random term that is iid extreme value. The model estimates the unknown parameter, β_i . The probability conditional on β_i is

$$L_{ij}(\beta_i) = \frac{e^{x_{ijt}\beta_i}}{\sum_{k=1}^J e^{x_{ikt}\beta_i}}$$

However, we do not know β_i , so the unconditional choice probability is the integral of $L_{ij}(\beta_i)$ over all possible variables of β_i :

$$P_{ijt} = \int \frac{e^{x_{ijt}\beta_i}}{\sum_{k=1}^J e^{x_{ikt}\beta_i}} f(\beta) d(\beta)$$

The utility function can be divided into an observable part and an error part according to the specification of the mixed logit.

$$V_{ijt} = \alpha' p_{ijt} + \beta_i' x_{ijt}$$

p_{ijt} is the price scalar and coefficient of price is fixed to avoid an unrealistic positive coefficient associated with price. Moreover, x_{ijt} represent a vector of beef attributes; in our case BSE testing (presence or absence) and country of origin (Canada, United States, Australia, and Korea).

Results

Table 4 shows the estimated coefficients of each attribute while Table 5 exhibits the marginal WTP values for the attributes, estimated by dividing each of the coefficients of the attributes by the coefficient of price.

Table 4. Results from mixed logit models

Grouping	Pooled	By risk perception		By education		By age	
		High risk	Low risk	High edu	Low edu	Older	Younger
Price	-0.0001*** (4.82e-06)	-0.0001*** (7.39e-06)	-0.0001*** (6.29e-06)	-0.0001*** (6.18e-06)	-0.0001*** (7.89e-06)	-0.0001*** (5.71e-06)	-0.0001*** (8.43e-06)
BSE	2.415*** (0.119)	3.033*** (0.186)	1.749*** (0.153)	2.562*** (0.154)	2.269*** (0.204)	2.219*** (0.144)	2.628*** (0.206)
Domestic	2.928*** (0.143)	2.974*** (0.193)	2.739*** (0.204)	2.938*** (0.179)	2.826*** (0.232)	2.709*** (0.168)	3.119*** (0.240)
Australia	1.338*** (0.113)	1.167*** (0.159)	1.556*** (0.159)	1.437*** (0.142)	1.153*** (0.198)	1.202*** (0.139)	1.604*** (0.192)
Canada	-0.714*** (0.155)	-1.143*** (0.217)	-0.157 (0.205)	-0.760*** (0.200)	-0.485** (0.232)	-0.804*** (0.195)	-0.392* (0.229)
Log likelihood	-2903.75	-1592.87	-1287.41	-1865.37	-1030.34	-1878.60	-1028.34
Number of obs.	12000	7008	4992	7728	4272	7584	4416

*** denotes significance at 1% level; ** denotes significance at 5% level; * denotes significance at 10% level.

Base product in the estimation is US beef without BSE test label. Results indicate that respondents are willing to pay 19,864 won (US \$18.06) per kg more on the BSE test labeled US beef than on US beef without BSE test label. This value suggests that consumers desire to

have BSE testing and labeling on beef products. This is not surprising given that the BSE issue has received enormous public attention and has raised food safety concerns among Korean consumers in 2008 when the Korean government decided to allow re-importation of US beef.

With regards to our findings on the country of origin information, consumers are willing to pay more for domestic beef than imported beef. Specifically, compared to US beef, respondents are willing to pay 24,081 won (US \$21.9) more for domestic beef, 11,006 won (US \$10) more for Australian beef, and 5,868 won (US \$5.3) less for Canadian beef. These results clearly show that Korean consumers have a strong preference for domestic beef vis-à-vis imported beef and a preference for imported beef from a country which has not experienced a BSE outbreak over imported beef from a country which has experienced a BSE outbreak.

As previously mentioned, we also conducted separate analysis between respondents with low and high risk perception about beef consumption. The results suggest that the high risk perception group is willing to pay 21,324 won (US \$19.4) for BSE testing, while the low risk perception group is willing to pay 17,516 won (US \$15.9) for BSE testing. On the other hand, the low risk perception group tends to value country of origin more than the high risk perception group. These results indicate that the more important factor determining the WTP of consumers with high risk perception is BSE testing while the more important factor determining the WTP of consumers with low risk perception is country of origin.

The separate analysis between respondents with low and high education suggests that the high education group is willing to pay more for BSE testing than the low education group. Specifically, the high education group is willing to pay 20,806 won (US \$18.9) while the low education group is willing to pay 18,641 won (US \$16.9) for BSE testing. Interestingly, we

also found that the younger group (20~39) is willing to pay 21,119 won (US \$19.2) for BSE testing, while the older group (40~69) is willing to pay 18,963 won (US \$17.2) for BSE testing. Moreover, the high education group and the younger group tend to value imported beef from countries which have not experienced BSE outbreaks more than the low education group and the older group. These results indicate that high educated and younger consumers are more concerned about the safety of beef.

These findings suggest that policymakers should realize that consumers' reaction to food safety can be significantly different depending on their level of risk perception about beef consumption and socio-demographic characteristics. Hence, food safety policies could be differentiated for different segments of the population based on levels of risk perceptions and socio-demographic characteristics.

Table 5. Willingness to pay (WTP) for each attribute

Grouping	Pooled	By risk perception		By education		By age	
		High risk	Low risk	High edu	Low edu	Older	Younger
BSE	19864*** (833.06)	21324*** (1056.33)	17516*** (1393.25)	20806*** (996.06)	18641*** (1472.15)	18963*** (1066.40)	21119*** (1392.67)
Domestic	24081*** (936.85)	20914*** (1052.92)	27444*** (1758.12)	23865*** (1148.58)	23224*** (1560.81)	23154*** (1159.18)	25064*** (1417.12)
Australia	11006*** (864.85)	8207*** (1046.04)	15585*** (1462.15)	11669*** (1052.46)	9475*** (1530.33)	10271*** (1095.99)	12889*** (1542.88)
Canada	-5868*** (1297.59)	-8036*** (1539.48)	-1573 (2071.58)	-6170*** (1649.15)	-3982** (1934.81)	-6870*** (1692.11)	-3148* (1863.86)

*** denotes significance at 1% level; ** denotes significance at 5% level; * denotes significance at 10% level.

Conclusions

Food safety is one of the most important issues in Korea. Since reports of the occurrence of BSE infected cattle in the mid-2000s in Canada and US, many beef importing countries have been concerned about consuming beef products. For example, the Japanese central government implemented BSE testing of all slaughtered cattle of all ages in 2001. Korean consumers also have significant concerns about the safety of imported beef after the occurrence of BSE in beef exporting countries.³ Thus food safety concerns on imported beef resulted in strengthening of the country of origin indication system and the introduction of the traceability system in Korea. However, unlike in Japan, the Korean government only tests specified risk materials (SRM) suspected beef products only during the quarantine process, and does not require BSE test labeling in beef products despite calls from consumer groups for mandatory BSE test labeling in beef products. In the absence of mandatory BSE testing for all slaughtered cattle of all ages in Korea and from exporting countries, consumer's willingness to pay for BSE testing for beef is uncertain. Therefore, this study focuses on finding Korean consumers' willingness to pay for BSE testing and country of origin labeled beef using a choice experiment.

In addition to analysis using the pooled sample, this study also conducted sub-sample analyses by dividing the sample into different groups using k-means clustering based on different levels of risk perception about beef consumption and different age and education levels.

³ The tens of thousands of people demonstrated more than three months after the Korean government announced to reverse the ban of US beef without preparing any food safety guaranteeing system of imported beef in April 2008.

Results from the whole sample suggest that consumers are willing to pay 19,864 won (US \$18.06) per kg more on the BSE test labeled US beef than on US beef without BSE test label. Results also suggest that Korean consumers have a strong preference for domestic beef over imported beef and for imported beef from a country which has not experienced BSE outbreak over imported beef from a country which has experienced a BSE outbreak in both the whole sample and two risk perception sub-groups. This is not surprising given that the BSE issue has received enormous public attention and has raised food safety concerns among Korean consumers. Interestingly, however, respondents in the high risk perception group tend to value BSE test labeling more than country of origin labeling while respondents in the low risk perception group tend to value country of origin labeling more than BSE test labeling. In addition, this study also showed that high educated and younger consumers are willing to pay more for BSE testing than their counterparts, implying that these groups of consumers tend to be more concerned about the safety of beef than others. These findings imply that policymakers should consider differences in consumers' reaction to food safety issues and make appropriate strategies for improving food safety in beef consumption.

Notwithstanding the heterogeneity in WTP estimates across different consumer segments analyzed in this study, the findings tend to imply that Korean consumers are generally willing to support and pay for a policy that would require mandatory BSE testing of beef and country of origin labeling in the country. Since this policy would entail costs to the beef industry, these costs should, among others, be weighed-in with the public's WTP values to determine the feasibility of adopting such a policy.

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Appendix

Appendix 1. Cheap talk script

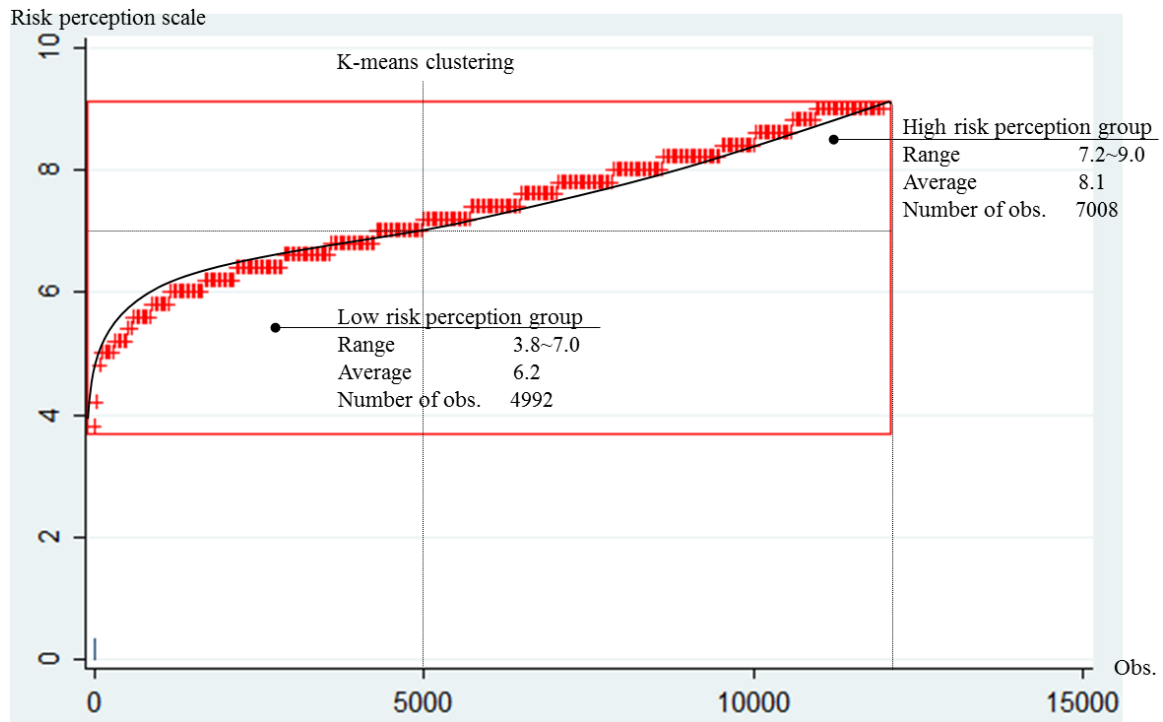
The experience from previous similar surveys is that people often state a higher willingness to pay than what one is actually willing to pay for the good. For instance, a recent study asked people whether they would purchase a new food product similar to the one you are about to be asked about. This purchase was hypothetical (as it will be for you) in that no one actually had to pay money when they indicated a willingness to purchase. In the study, 80% of people said they would buy the new product, but when a grocery store actually stocked the product, only 43% of people actually bought the new product when they had to pay for it. This difference (43% vs. 80%) is what we refer to as hypothetical bias.

Accordingly, it is important that you make each of your upcoming selections like you would if you were actually facing these exact choices in a store, i.e., noting that buying a product means that you would have less money available for other purchases.

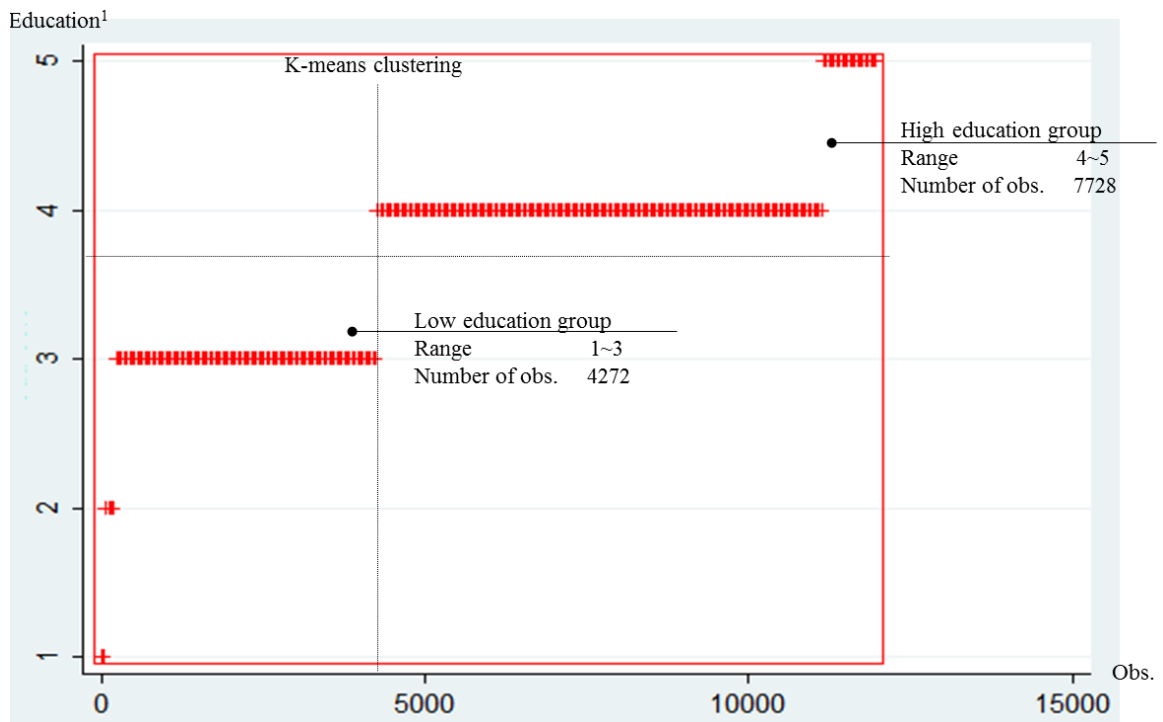
Appendix 2. K-means clustering based on individual risk perception scale

Number of Groups		Obs	Mean	Std. Dev.	Min	Max
Two groups	Group 1	4992	6.264	0.623	3.8	7
	Group 2	7008	8.092	0.586	7.2	9
Three groups	Group 1	1656	5.542	0.487	3.8	6
	Group 2	4824	6.834	0.393	6.2	7.4
	Group 3	5520	8.304	0.470	7.6	9
Four groups	Group 1	3600	6.017	0.561	3.8	6.6
	Group 2	3432	7.190	0.273	6.8	7.6
	Group 3	2976	8.071	0.213	7.8	8.4
	Group 4	1992	8.848	0.175	8.6	9

Appendix 3. K-mean clustering: high risk perception group and low risk perception group



Appendix 4. K-mean clustering: high education group and low education group



¹ 1: Elementary school, 2: Middle school, 3: High school, 4: University, 5: Post-graduate.

Appendix 5. K-mean clustering: older group and younger group

