

Valuing Quality Attributes and Country Equity in the Korean Beef Market

by

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Since the liberalization of imported beef market in 2001, Korea has continuously increased beef imports, and the market share of imported beef has increased up to 53% of total beef consumption in 2003. In recent years the market share of imported beef has decreased considerably after the Korean government banned imports of U.S. beef due to the BSE problem. Since the import ban was lifted in early 2007, the market share of imported beef is expected to go back to its previous level within a year or so. Major sources of imported beef in Korea include the United States (U.S.), Australia, New Zealand, and Canada, and corresponding market shares among imported beef are 68%, 21%, 9%, and 2%, respectively. Overall, prices of imported beef are approximately 3.5 times lower than the price of Korean beef at the retail level. Among imported beef products, the U.S. beef price is significantly higher than the price of beef from Australia, New Zealand, and Canada.

The source of this price differential between domestic and imported beef in the Korean beef market is unclear despite liberalization. In particular, why is the price of Korean beef significantly higher than the U.S. beef? Both Korean and U.S. beef cattle are grain-fed, and many consumers believe the quality and taste of U.S. beef are similar to Korean beef. If consumers have complete (or at least close to complete) information about quality characteristics and taste from two different origins, the price of U.S. beef should be within a close price range of Korean beef.

As for the price differential between Korean beef and beef from Australia, New Zealand, and Canada, the price gap may be attributable to the fact that Korean beef is a grain-fed beef while these countries export grass-fed beef to Korea. Korean consumers may have a preference for grain-fed beef, but it is unclear if the grass-fed beef has 3.5 times lower quality and taste than Korean beef to the Korean consumer. A 1995 discrete choice study by Unterschultz et al. (1998)

found that while chefs, both Korean and non-Korean, preferred U.S. beef, purchasing managers for hotels preferred Korean beef. They also found that Australian beef was not significantly preferred or disfavored by chefs and was significantly less desirable to hotel managers. However, Unterschultz et al. did not survey Korean consumers, who are on average less likely to be as knowledgeable and experienced in purchasing beef as hotel chefs and purchasing managers. This paper will examine Korean consumer's willingness to pay for country-equity, quality and price attributes of domestic versus imported beef in the retail supermarket setting.

The primary purpose of this study is to examine how consumers value product origin and quality attributes in the Korean beef market. Specifically, the study will measure the country equity of Korean beef, and imported beef from U.S., Australia, New Zealand, and Canada. The study will also estimate values of quality attributes such as marbling, freshness, taste, and the use of GMO feed ingredients and antibiotics. The estimation will be conducted under various socioeconomic environments such as income, price, gender, education, etc. Choice-based conjoint analysis is used in this study because beef consumption and price data by country-of-origin and targeted quality attributes are not available at the retail level. In fact, retail stores have just started labeling country-of-origin, but many butcher-shops and restaurants still do not label the origins.

Other technical objectives of this proposed study include comparing estimates from consumers' choice values with consumers' perceived values (choice values are from conjoint choice sets while perceived values are obtained from separate questions in the survey). We also examine the sensitivity of estimated results to the attribute ordering, the number of choice sets included in each questionnaire, and the range of values of economic variables (e.g., Holmes and

Kramer, 1995; Carlsson and Martinsson, 2001; DeShazo and Fermo, 2002; Chien, Huang, and Shaw, 2005).

Previous Research

Recent studies in the marketing and business literature suggest that consumers tend to prefer products from their own country because of an affinity for their home (e.g., Sharma, Shimp, and Shin, 1987; Verlegh and Steenkamp, 1999; Srinivasan and Subhas, 2003). In recent years, marketers have extended the anthropological concept of ethnocentrism to “consumer ethnocentrism,” which relates to how individuals’ buying habits are influenced by loyalties towards their own countries and/or antipathy towards other countries. For example, the U.S. Congress passed the 2002 Farm Bill that included the mandatory country-of origin labeling of beef, pork, fish, and pork. The legislation intends to promote the U.S. products using consumer loyalty towards “Made-in-U.S.A.” Another good example is a famous slogan from various Korean farmer organizations, “Sin-To-Bul-E,” which is translated as “the best food products for Korean people are those produced from Korean soil.” The slogan is based on an Asian belief that by nature human beings are created to consume food products grown in nearby local area. Obviously, Korean farmers are using “consumer ethnocentrism” for their own marketing purpose.

Several studies of willingness to pay for beef based on its origin and based on specific country or consumer attributes have been conducted in the economics literature, principally motivated by recent issues of food safety and bovine spongiform encephalopathy (BSE) or “Mad Cow” disease. A contingent valuation survey of Japanese consumers by McCluskey et al (2005) found that women and those with concern about food safety had increased willingness to pay for BSE-tested beef. Loureiro and Umberger (2005) conducted a contingent valuation survey of U.S.

consumers for certified U.S. meat products under a country of origin labeling program, and found that U.S. consumers believe they have the safest meat in the world. However, consumers' willingness to pay for certification as a result was small. However, consumers may also value attributes other than country of origin. Umberger et al (2002) look at U.S. consumer preferences for Argentine grass-fed beef and U.S. grain-fed beef to find that twenty three percent of their sample was willing to pay \$1.36 USD/pound for Argentine grass-fed beef over American corn-fed beef. We focus on those studies that use discrete choice or conjoint choice analysis to look at the effects of each attribute on utility or willingness to pay.

Discrete choice experiments and conjoint choice methods have been used in a variety of settings to test for willingness to pay for specific attributes of food products, beef in particular. McCluskey et al (2005b) use a discrete choice experiment to examine the importance of health benefits of grass-fed beef among U.S. consumers. They find that price, fat, and omega-3 fatty acids influence choice most in that order. Tonsor et al (2005) tested for national differences in preferences for hormone-free, G.M. free, country of origin, and farm source verification in Germany, France, and the U.K. However, they allowed for actual purchase of these goods, avoiding potential hypothetical bias problems when no money is exchanged (Lusk and Schroeder, 2004). Tonsor et al find heterogeneous preferences within and across consumers in these three countries in regard to genetically modified beef and hormone-free beef. Perhaps because the survey occurred prior to the discovery of BSE in the US, they find no significant difference in willingness to pay for domestic beef over U.S. beef. Another U.S. study by Mennecke et al (2006) found that U.S. state region was the most important characteristic to consumers, followed by animal breed, traceability, type of feed, and beef quality. However, they found that consumers

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country of origin did not significantly factor into their consumption decisions. Women, however, were more likely to be concerned about food safety and health.

Model

A discrete choice model is used to examine the marginal willingness to pay for different attributes of beef in the Korean market, including country of origin, marbling, freshness, taste, and the use of GMO feed ingredients and antibiotics. A discrete choice experiment is a stated preference method that has a distinct advantage over contingent valuation in that it can measure the willingness to pay for multiple attributes simultaneously. Furthermore, statistical design will allow for the reduction of collinearity among the variables. (Holmes and Adamowicz, 2003). Respondents are asked to make a choice of one bundle or treatment combination of attributes at a given price over a different bundle of the same attributes at different levels, quality, or quantity. The implicit value of changes in one attribute holding all else constant is then computed.

Following Lancaster's hedonic theory, a random utility model is used to represent utility of quality characteristics and origin of beef in the Korean beef market. The random utility model for individual i is denoted by:

$$(1) \quad U_{ij} = X_{ij}\beta + \varepsilon_{ij},$$

where X_i is a vector of quality characteristics and country-of-origin and β represents corresponding parameter vector. The error term, ε_{ij} , is assumed to be independently and identically distributed with the extreme value distribution. The probability that individual i chooses j_{th} option from the choice set S_i is:

$$(2) \quad P(j) = P(X_{ij}\beta + \varepsilon_{ij} \geq X_{ik}\beta + \varepsilon_{ik}; \text{ for all } k \in S_i) .$$

For the conditional logit, we assume that each respondent i chooses alternative j as a function of levels of the other attributes shown according to the following probability:

$$(2) \quad P_i(j) = \frac{e^{X_{ij}\beta}}{\sum_{k=1}^J e^{X_{ik}\beta}} = \frac{1}{\sum_{k=1}^J e^{(X_{ik}-X_{ij})\beta}} \quad \text{for } i = 1 \dots I; k = 1 \dots J .$$

Then, the deterministic part-individual i 's indirect utility of choosing option j , $V_{ij} = X_{ij}\beta$, can be specified as:

$$(3) \quad V_{ij} = \beta_1 + \beta_2 \text{Price}_{ij} + \beta_3 \text{Marbling1}_{ij} + \beta_4 \text{Marbling2}_{ij} + \beta_5 \text{Marbling3}_{ij} + \beta_6 \text{Marbling4}_{ij} \\ + \beta_7 \text{Freshness1}_{ij} + \beta_8 \text{Freshness2}_{ij} + \beta_9 \text{Taste1}_{ij} + \beta_{10} \text{Taste2}_{ij} + \beta_{11} \text{Refrigerate}_{ij} \\ + \beta_{12} \text{Antibiotics}_{ij} + \beta_{13} \text{GMO}_{ij} + \beta_{14} \text{Origin2}_{ij} + \beta_{15} \text{Origin3}_{ij},$$

where Price refers to the retail price of beef (per 600g which is equivalent to 1.32 pounds: traditionally Korean consumers purchase meat per “gun” which equals to 600g) which ranges from 10,000 won (\$10.00) to 32,500 won (\$32.50); Marbling1 to Marbling4 are dummy variables that represent the grade of marbling: Marbling1 = 1 if beef is extra premium grade, 0 otherwise; Marbling2 = 1 if beef is premium grade, 0 otherwise; Marbling3 = 1 if beef is 1st grade 0 otherwise; Marbling4 = 1 if beef is 2nd grade 0 otherwise. The 3rd grade of marbling has been dropped to avoid a collinearity problem. Freshness1 and Freshness2 are dummy variables that represent the extent of beef freshness with three different levels: Freshness1=1 if beef is highly fresh, 0 otherwise; Freshness2=1 if beef is moderately fresh, 0 otherwise. The dummy variable for the lowest freshness is used as a base. Pictures and description of each level of marbling and freshness were prepared and presented to the participants before they made choices. There are also three dummy variables for the degree of taste with the lowest degree of taste as a base: Taste1=1 if beef is highly tasty, 0 otherwise; Taste2=1 if beef is moderately tasty, 0 otherwise. Refrigerate, Antibiotics, and GMO are dummy variables that represent as follows: Refrigerate=1 if beef is freshly chilled (instead of frozen), 0 otherwise; Antibiotics=1 if beef is produced without feeding antibiotics to cattle, 0 otherwise; GMO=1 if beef is produced without feeding GMO feed ingredients to cattle. Finally, there are three country-of-origin variables for

beef considered in this study: Korea, U.S., and other. Origin2 and Origin3 are dummy variables that represent beef from U.S. and other countries such as Australia, New Zealand, and Canada with Korean beef as a base: Origin2=1 if beef is imported from U.S., 0 otherwise; Origin3=1 if beef is imported from other countries (stated above), 0 otherwise.

In this case, marginal rates of substitution among any attributes x_i and x_j can be calculated as the ratio of the coefficients. Marginal willingness to pay (MWTP) or the marginal value of an attribute can be estimated by dividing the estimated coefficient for the attribute divided by the payment vehicle, i.e., when β_k is the estimated coefficient for the *Price* attribute, as in Equation (4).

$$(4) \text{ MWTP} = -\beta_j/\beta_k$$

If marginal willingness to pay is calculated for the sample as a whole, then we assume that the sample is homogeneous in its preferences. Because differences in willingness to pay likely exist among individuals, interaction terms for demographic variables and perception questions are also included in the empirical model.

Data

Data was collected via in person consumer survey targeted toward Korean beef consumers. The survey was conducted in January and February of 2007. Eleven interviewers conducted surveys with 1,000 consumers. The interviewers were sent to small and large grocery stores in Seoul, Korea, and survey participants were solicited at store gates. Using choice experiments (often referred to as conjoint analysis), respondents were asked what type of beef they would buy among choice sets in the survey. Each choice set included alternative types of beef with various levels of price, quality and country-of-origin attributes.

To provide data for equation (3), orthogonally-designed conjoint choice sets were presented to survey participants. To test the effect of number of attribute levels in estimation results, we include different attribute levels ranging from 3 to 12 for each attribute in each conjoint choice set. Because of the vast number of attributes and attribute levels in each full choice set, a full factorial design results in 10,800 scenarios. An example of a choice set with 8 options, including not to buy beef, is illustrated in Figure 1. We also experimented with the effect of number of conjoint questions faced by participants. For this purpose, we randomly chose the number of questions included in each survey, which ranges from 1 to 20. Therefore, survey participants not only faced different number of questions, but also each one of their conjoint scenario sets had a different number of attribute levels.

Results

Table 1 presents summary statistics of demographic characteristics of survey participants. Out of 1,000 participants, 61.49% were in their 40s and 50s, and only 6.32% were in their 20s. The gender ratio was heavily skewed towards women, having 16.15% male and 83.65% Female in the sample. This is not surprising because most grocery shoppers in Korea are traditionally female. As for the education level, almost 60% of participants had some college experience, college, or post-college graduates. The majority of participants, 59.89%, were full-time housewives. Low income (less than \$3,000 per month), medium income (between \$3,000 and \$4,900 per month), and high income (more than \$5,000 per month) households made up 13.51%, 57.62%, and 28.87% of the sample, respectively. Married people represented 92.42%, while only 7.58% of the sample was single. We also asked participants if they traveled to foreign countries in the last five years or lived in foreign countries in the last 10 years. These questions

were asked to see if traveling or residing a particular country influenced consumer's preference on beef from this country. Approximately 60% of participants have traveled to foreign countries recently, but only 10% had lived for any period of time in foreign countries. In particular, about 10% traveled to U.S. while about 6% responded that they lived in U.S. Two questions were asked about consumer's beef purchasing and cooking behavior. Consumers were asked how likely they would purchase packaged beef rather than purchasing beef from butcher-shop. Approximately 50 % responded that they strongly prefer the packaged beef to the butcher-shop beef while only 14.56% responded that they are most likely to buy beef from butcher shop. When consumers are asked how much they enjoy cooking, about 57% responded that they enjoyed cooking (measured as a 4 or 5 on a 1-5 scale).

The regression results of the conditional logit model in Table 2 indicate that the selection of option numbers does affect regression results. For example, the coefficient of Marbling1 is 0.3957 with 6 options while the corresponding coefficient with 12 options is 0.5252. The coefficient of Antibiotics is -0.4085 with 6 options while it is -0.5244 with 12 options. Most coefficients were significant at the 5% level and showed expected signs except the case where the number of options was 3. This implies that attributes used in this study play important role in improving beef consumer's utility. Based on these results, marginal willingness to pay(MWTP) was calculated using equation (4) and was reported in Table3. Overall consumers are willing to pay for better marbling grade, and the MWTP differential between base grade and the highest grade ranges from 603 won (\$0.60) to 7,852 won (\$7.85) per 600g (1.32 pounds). Results also imply that consumers value the freshness of beef ranging from 699 won (\$0.70) to 7,133 won (\$7.13) per 600g. Taste variables (Taste1 and Taste2) show mixed results. Results from options from 3, 6, and 12 are different from those with option 9. These mixed results seem to be caused

by the subjectivity of perception on taste. Estimates from Refrigerate, Antibiotics, and GMO show expected results. Fresh and chilled beef are valued more than frozen beef by the amount ranging from 78 won (\$0.08) to 2,516 won (\$2.52)/600g while other quality factors remain constant. Antibiotics and GMO-feed would cost from 2,222 won (\$2.22) to 7,116 won (\$7.16)/600g and from 2,419 won (\$2.42) to 5,739 won (\$5.74)/600g, respectively. Finally, the country-equity from Korean beef was from 4,761 won (\$4.76) to 23,588 (\$23.59)/600g won compared to the U.S. beef while it ranges from 4,174 won (\$4.17) to 21,970 (\$21.97)/600g compared to imported beef from Canada, Australia, and New Zealand. It seems that the relative country equity of U.S. in the Korean beef market is a bit lower than those of other beef exporting countries. This is because the survey was conducted when the U.S. beef was banned from Korean market due to the BSE problem and many Korean consumers had negative perception on the U.S.-Korea Free Trade Agreement.

The remaining analysis will be continuously conducted, and complete results will be presented at the meeting.

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Table 1. Summary Statistics on Demographic Characteristics of Survey Participants (N=1000)

Variable	Percent	Variable	Percent	Variable	Percent
<u>Age</u>		<u>Monthly Income</u>		<u>Preference</u>	
20s	6.32	Under \$1,000	7.04	1	47.81
30s	14.67	\$1,000 ~ \$1,900	6.47	2	9.56
40s	26.91	\$2,000 ~ \$2,900	20.87	3	9.72
50s	34.58	\$3,000 ~ \$3,900	17.14	4	18.36
Over 60	17.52	\$4,000 ~ \$4,900	19.61	5	14.56
		\$5,000 ~ \$5,900	11.63		
<u>Gender</u>		\$6,000 ~ \$6,900	5.23		
Male	16.15	\$7,000 ~ \$7,900	3.53	<u>Clife</u>	
Female	83.65	\$8,000 ~ \$8,900	2.19	1	15.39
		\$9,000 ~ \$9,900	1.97	2	13.02
		Over \$10,000	4.32	3	14.76
<u>Education</u>	4.84			4	27.23
Less than high school	35.56	<u>Marriage</u>		5	29.60
High school	52.66	Married			
Some college /College	6.94	Single	92.42		
Graduate school			7.58		
		<u>CTravel</u>			
<u>Occupation</u>		America	9.54		
Professional job	9.27	Canada	1.76		
Housewife	59.89	Australia	1.71		
Office worker	8.20	New Zealand	0.82		
Public official	2.44	Other country	45.47		
Own business	8.54	No travel	40.70		
Unemployed	11.66				
		<u>CStay</u>			
		US	6.05		
		Canada	0.84		
		Australia	0.26		
		New Zealand	0.63		
		Other country	2.85		
		No stay	89.37		

Table 2. Conditional Logistic Regression Results

Variable	Number of Options			
	3	6	9	12
Price	-0.0000427 (0.000154)	-0.000182 (0.000124)	-0.000062 (0.000113)	-0.000236* (0.000118)
Marbling1	0.2234 (0.1250)	0.3957* (0.0995)	0.3803* (0.0870)	0.5252* (0.0906)
Marbling2	0.3353* (0.1260)	0.2542* (0.0984)	0.3051* (0.0921)	0.3741* (0.0935)
Marbling3	0.2597* (0.1221)	0.3661* (0.0997)	0.3364* (0.0909)	0.3922* (0.0946)
Marbling4	0.1732 (0.1286)	0.1097 (0.1029)	0.1152 (0.0934)	0.2149* (0.0981)
Freshness1	0.2977* (0.0996)	0.3858* (0.0751)	0.3469* (0.0684)	0.4242* (0.0707)
Freshness2	0.3046* (0.0970)	0.1273 (0.0794)	0.0445 (0.0742)	0.2219* (0.0751)
Taste1	-0.002983 (0.0957)	0.3060* (0.0776)	0.1281 (0.0690)	0.1133 (0.0707)
Taste2	-0.0552 (0.0988)	0.3183* (0.0787)	0.0433 (0.0703)	0.1721* (0.0701)
Refrigerate	0.0237 (0.0788)	0.0142 (0.0619)	0.1560* (0.0567)	0.1388* (0.0567)
Antibiotics	-0.1111 (0.0803)	-0.4085* (0.0641)	-0.4412* (0.0590)	-0.5244* (0.0605)
GMO	-0.2269* (0.0802)	-0.4403* (0.0649)	-0.3558* (0.0575)	-0.5729* (0.0614)
Origin2	-1.0072* (0.1040)	-1.1143* (0.0884)	-1.1854* (0.0840)	-1.1237* (0.0864)
Origin3	-0.9381* (0.1002)	-1.0728* (0.0847)	-1.0873* (0.0802)	-0.9851* (0.0771)

* Estimates are statistically significant at the 5% level.

Table 3. Marginal Willingness to Pay for each Attribute (per 600g of beef in Korean won, 1000 won = 1USD)

Variable	Number of Options			
	3	6	9	12
Marbling1	5,232	2,174	6,134	2,225
Marbling2	7,852	1,397	4,921	1,585
Marbling3	6,082	2,012	5,426	1,662
Marbling4	4,056	603	1,858	911
Freshness1	6,972	2,120	5,595	1,797
Freshness2	7,133	699	718	940
Taste1	-70	1,681	2,066	480
Taste2	-1,293	1,749	698	729
Refrigerate	555	78	2,516	588
Antibiotics	-2,602	-2,245	-7,116	-2,222
GMO	-5,314	-2,419	-5,739	-2,428
Origin 2	-23,588	-6,123	-19,119	-4,761
Origin 3	-21,970	-5,895	-17,537	-4,174

Figure 1. Example of Choice Set Used in Conjoint Experiment

	Option 1	Option 2	Option 3	Option 4
Price (won)	15,000	15,000	17,500	10,000
Marbling Grade	1	1	Premium	Extra Premium
Freshness	High	High	Moderate	Moderate
Fresh/Chilled(vs. Frozen)	Yes	No	Yes	Yes
Taste	Low	Low	Moderate	High
Antibiotics	No	Yes	Yes	Yes
GMO Feed ingredient	Yes	Yes	Yes	Yes
County of Origin	US	Other	Korea	Other
I would choose...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Option 5	Option 6	Option 7	
Price (won)	15,000	10,000	20,000	None of the Options Given
Marbling Grade	Premium	2	3	
Freshness	Moderate	High	Low	
Fresh/Chilled (vs. Frozen)	No	No	No	
Taste	High	High	High	
Antibiotics	No	Yes	No	
GMO Feed ingredient	Yes	No	No	
County of Origin	Other	Other	Korea	
I would choose...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>