Willingness to Pay for Quality Attributes and Country Equity in the Korean Beef Market

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Background

- Lost market share: 68% in 2003 => less than 1% in 2006

- Big price differential

  Retail price (ribs): Korean beef - $30/lb
  AUS beef - $11/lb (tariff, 40%)

=> How can we recover the lost market share?

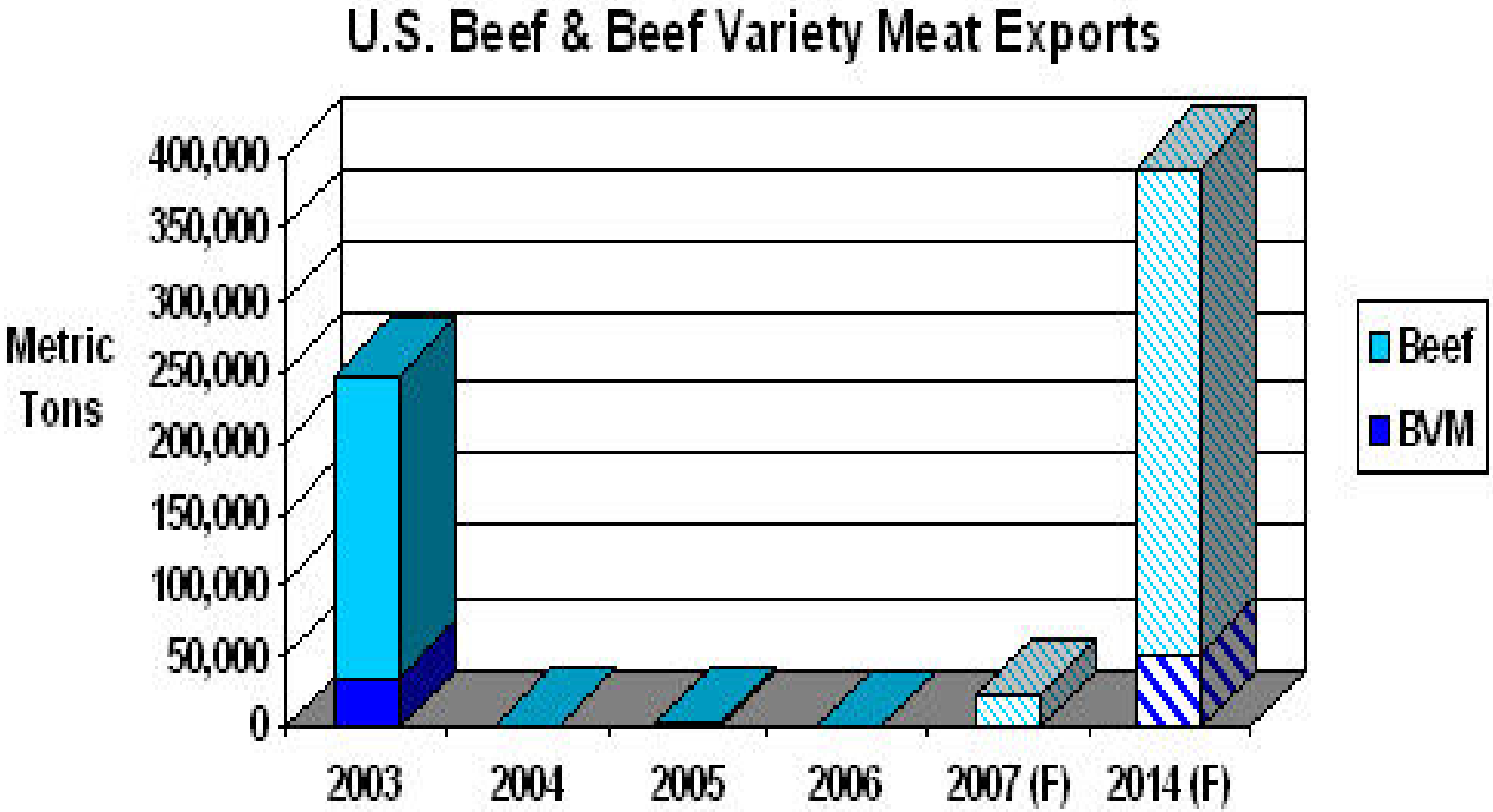
=> Why is there a big price differential between local and foreign beef in the Korean beef market?

Market Share of Imported Beef in Korea

Countries	Unit	Quantity			% Share		
		2003	2004	2005	2003	2004	2005
Australia	mt	78,018	99,066	139,798	21.44	56.31	71.20
New Zealand	mt	28,962	47,735	51,829	7.96	27.13	26.40
Mexico	mt	0	852	3,585	0.00	0.48	1.83
United States	mt	248,645	27,790	760	68.32	15.79	0.39
Canada	mt	8,066	348	33	2.22	0.20	0.02

Source: USMEF

U.S. Beef Export to Korea



Source: USMEF

Background - continued

- Factors affecting the price differential: country-of-origin, marbling, freshness, food safety issues, etc
- Market failure: limited country-of-origin labeling at supermarkets, butcher shops, and restaurants
- If information about country-of-origin and quality is given, how much do Korean consumers want to pay for "Made-in-USA" and other quality attributes?

=>What would be better marketing strategies for U.S. farmers to compete with Korean beef in Korean market ?

Objectives

1. Examine how Korean consumers value product origin in willingness to pay for US and other imported beef relative to the Korean beef

2. Estimate the value of quality attributes (marbling, taste, freshness, free of GMO feed, and free of antibiotics)

3. Estimate the value of country equity and quality attributes by demographic groups (gender, income, education….)

Objectives - continued

4. Test if heterogeneity in preference and survey design affect the estimated results

   - Mixed MNL

   - Heteroskedastic MNL

   Estimate optimal number of alternatives per choice set and optimal number of choice sets per survey

5. Estimate the importance of country equity and quality difference in explaining the price differential between domestic and imported beef

Model

- Multinomial Logit Model (MNL)

$$P_i(j) = \frac{e^{\alpha X_{ij}\beta}}{\sum_{k=1}^{J} e^{\alpha X_{ik}\beta}} = \frac{1}{\sum_{k=1}^{J} e^{(X_{ik}-X_{ij})\alpha\beta}} \qquad for\ i = 1...I;\ k = 1...J,$$

- Mixed Multinomial Logit Model (MMNL)

$$\beta_i = \overline{\beta} + du_i, \quad u_i \sim N(0,1)$$

Model

- Heteroskedastic Multinomial Logit Model (HMNL)

$$P_i(j) = \frac{e^{\alpha(C_S)\beta' X_{ij}}}{\sum_{k=1}^{J} e^{\alpha(C_S)\beta' X_{ik}}} = \frac{1}{\sum_{k=1}^{J} e^{\alpha(C_S)\beta'(X_{ik} - X_{ij})}}.$$

$$\alpha_S(C_S / \lambda) = e^{\sum_{l=1}^{4} \lambda_l c_l},$$

$$\alpha_S = \pi / \sqrt{6}\sigma$$

Survey Design/ Data

- Face-to-face consumer survey at 10 small and large grocery stores: 11 interviewers/ 1000 consumers
- Orthogonally-designed conjoined sets: 10,800 scenarios;
- Randomly selected scenarios => 3 to 12 options per choice set
- 1 to 20 choice sets per survey

Survey Design/ Data - continued

- Attributes and levels

Price: $10 - $35/lb (11 levels)
Marbling: 1 - 5
Freshness: H, M, L
Country-Of-Origin: KOR, US, OTH (AUS, CAN, NZ)
Chilled vs. frozen
Free of antibiotics
Free of GMO feed

	Option 1	Option 2	Option 3	Option 4
Price (won/lb)	15,000	15,000	17,500	10,000
Marbling Grade	A	A	Premium	Extra Premium
Freshness	High	High	Moderate	Moderate
Chilled (vs. Frozen)	Yes	No	Yes	Yes
Taste	Low	Low	Medium	High
Free of antibiotics	No	Yes	Yes	Yes
Free of GMO	Yes	Yes	Yes	Yes
County of Origin	US	Other	Korea	Other
I would choose…				

	Option 5	Option 6	Option 7	
Price (won/lb)	15,000	10,000	20,000	I would not choose either of these options
Marbling Grade	Premium	B	C	
Freshness	Moderate	High	Low	
Chilled (vs. Frozen)	No	No	No	
Taste	Moderate	High	Low	
Free of antibiotics	No	Yes	No	
Free of GMO	Yes	No	No	
County of Origin	Other	Other	Korea	

Likelihood Ratio Tests: MNL vs MMNL, MNL vs. HMNL

Models	χ^2 - statistic	No. of restrictions	χ^2 - critical value at 5%	Test for null hypothesis
MNL vs. MMNL	86	14	23.685	Rejected
MNL vs. HMNL	1,392	5	11.070	Rejected

Comparison of WTPs ($/lb): MMNL, vs. HMNL

Independent Variables	MMNL	HMNL
Marbling1	5.54	4.63
	(2.0524)	(1.4579)
Marbling2	4.57	3.93
	(1.7110)	(1.1167)
Marbling3	4.49	3.93
	(1.6327)	(1.1150)
Marbling4	2.15	2.50
	(0.7743)	(0.4330)
Freshness1	5.70	1.79
	(2.4311)	(1.0005)
Freshness2	2.84	1.78
	(1.0200)	(0.7266)

	MMNL	HMNL
Taste1	2.65	2.19
	(0.6521)	(0.3790)
Taste2	1.86	1.70
	(0.5921)	(0.2366)
Chilled	1.61	1.06
	(0.6007)	(0.3512)
Antibiotics	7.54	3.55
	(2.6737)	(1.4576)
GMO	7.12	3.16
	(3.2001)	(1.2399)
Origin-U.S.	-14.63	-9.45
	(7.8826)	(4.6678)
Origin-Other	-14.38	-8.78
	(7.9001)	(3.9988)

WTPs with Demographic Interaction Terms ($/lb)

	Age			
	Age 40-50	Age 60	Prefpac	Homemaker
Marbling1	4.93	2.05**	4.92**	3.91**
Marbling2	4.46	1.65	3.99**	3.34**
Marbling3	4.31	1.44	3.96**	3.36**
Marbling4	1.85	0.75	1.82**	1.66**
Freshness1	4.65	2.97*	3.87**	3.36**
Freshness2	2.35	0.67	2.08*	1.65**
Chilled	1.90	1.04*	1.73**	1.26**
Antibiotics	1.64	0.39	1.15**	1.13**
GMO	1.16	0.56	1.14*	0.88**
Taste1	5.53	2.39*	4.88*	3.58**
Taste2	5.15	2.16*	4.60*	3.40**
Origin2	-14.37	-6.26*	-11.40*	-9.52**
Origin3	-13.58	-5.87*	-10.41*	-8.68**

Estimation Results

WTPs for the following demographic groups were not statistically significant:

Income_L, < $24,000
Income_M, $24,001 ~ $60,000
Income_H, > $60,000

Edu_L, LT college degree
Edu_H GE college degree

Travel_US, Travel_OTH, Travel_NO, Gender, COOKlike,

Estimation Results - continued

Why is the price of Korean beef three times higher than imported beef? What are the most important factors that contribute to this large price differential?

A Simulation Model:

$$WTP_i = -\frac{\beta' z_i}{\beta_k}$$

Z_i: Korean consumers' perceived beef quality (based on attributes considered in the survey) for beef from country i

Estimation Results - continued

Consumers' Perception of Korean, U.S., and Other Imported Beef Quality

Attribute	Korea	U.S.	Other	Korea - U.S.	Korea - Other	U.S. - Other
Marbling1	**0.56**	**0.23**	**0.11**	**0.33****	**0.45****	**0.12****
Marbling2	**0.26**	**0.31**	**0.17**	**-0.05****	**0.09****	**0.14****
Marbling3	**0.10**	**0.27**	**0.26**	**-0.17****	**-0.16****	**0.01**
Marbling4	**0.05**	**0.08**	**0.30**	**-0.03****	**-0.25****	**-0.22****
Marbling5	**0.03**	**0.11**	**0.16**	**-0.08****	**-0.13****	**-0.05****
Freshness1	**0.88**	**0.38**	**0.36**	**0.50****	**0.52****	**0.02**
Freshness2	**0.11**	**0.54**	**0.50**	**-0.43****	**-0.39****	**0.04**
Freshness3	**0.01**	**0.08**	**0.14**	**-0.07****	**-0.13****	**-0.06**
Chilled	**0.93**	**0.21**	**0.32**	**0.72****	**0.61****	**-0.11**
Antibiotics	**0.33**	**0.14**	**0.21**	**0.19****	**0.12****	**-0.07***
GMO	**0.71**	**0.07**	**0.41**	**0.64****	**0.30****	**-0.34****

Estimation Results - continued

Decomposition of Consumers' WTP Differential - MMNL

	MMNL					
	Korea-US		Korea-Other		US-Other	
	Diff ($/lb)	%	Diff ($/lb)	%	Diff ($/lb)	%
Marbling	0.77**	3.3	1.65**	7.5	0.88**	-39.1
Freshness	1.63**	7.0	1.86**	8.5	0.23*	-10.2
Chilled	1.16**	5.0	0.98**	4.5	-0.17	7.6
Antibiotics	1.43**	6.2	0.90**	4.1	-0.53**	23.6
GMO	3.56**	15.4	2.13**	9.7	-2.41**	107.1
Origin	14.63**	63.1	14.38**	65.7	-0.25**	11.1
Total	23.18**	100	21.9**	100	-2.25*	100

Estimation Results - continued

Behavioral economics literature, e.g., Simon, 1955; de Palma et al., 1994; DeShazo and Fermo, 2002, looks into the relationship between choice set complexity and model consistency

The variance of the error term tends to decrease as no of options/ choice sets increase, but it increases after they reach a threshold number

Estimation Results - continued

Minimizing variance => maximizing scale factor

$$Max\ \alpha_S(C_S / \lambda) = e^{\sum_{l=1}^{4} \lambda_l c_l}$$

Threshold number: No of alternatives per choice set - 5

No of choice sets per survey - 6

Conclusions

1. How do Korean consumers value country-of-origin of US and other imported beef relative to Korean beef?

US: MMNL:-$15/lb
HMNL: -$9/lb

Other: MMNL: -$14/lb
HMNL: -$9/lb

Conclusions - continued

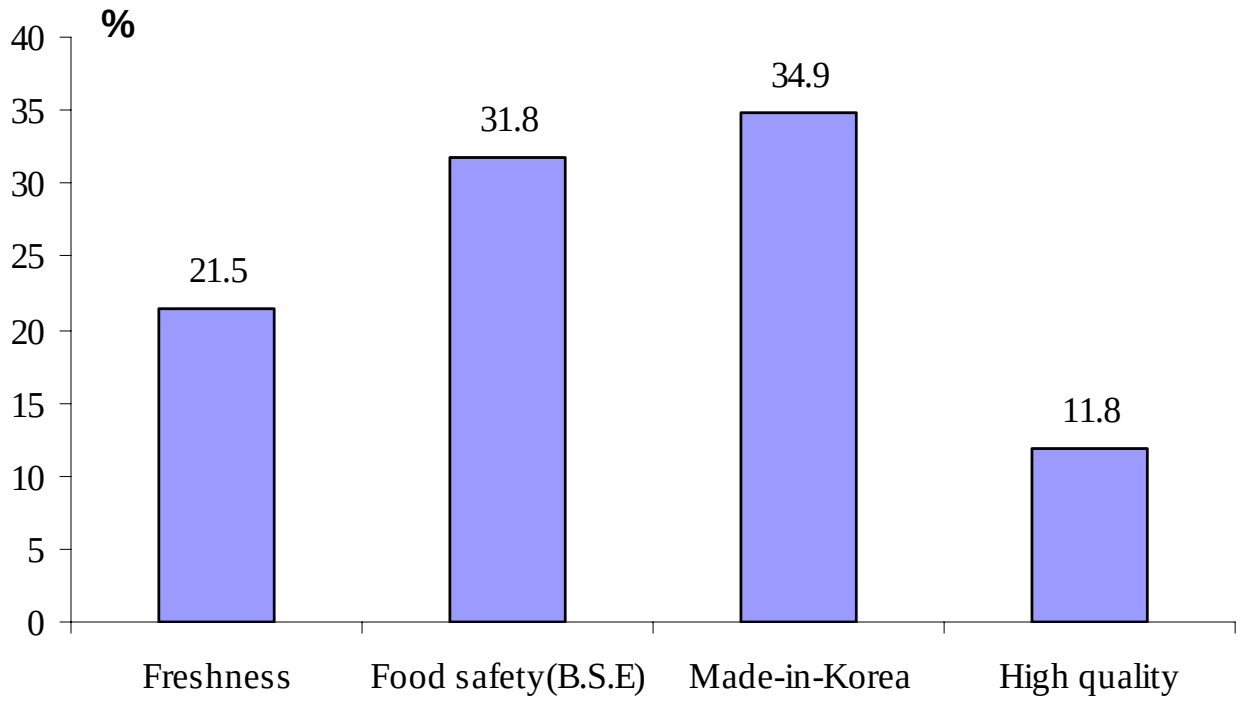
2. **What are the most important factors that contribute to the price differential ($20/lb)?**

Korea vs. US: origin (63-68%), GMO (15%), Chilled (5-6%),Freshness (3-7%), Antibiotics (5-6%), Marbling (3-4%)

Korea vs. Other: origin (66-68%), GMO (7-9%), Chilled (8-9%), Freshness (8-9%), Antibiotics (3-4%), Marbling (7-9%)

Results from another 1000 shoppers

Why do you purchase Korean beef even if it is 3 times more expensive than imported beef ?



Conclusions - continued

3. Do these values differ by demographic groups?

Yes, they differ by age, packaging/shopping preference, and homemaker group

4. Do estimates from MNL differ from MMNL and HMNL model?

Yes, they do, based on LR tests. MNL and MMNL tend to overestimate WTP compared to HMNL (controlling heterogeneity in information that each individual faces at the time of survey)

Conclusions - continued

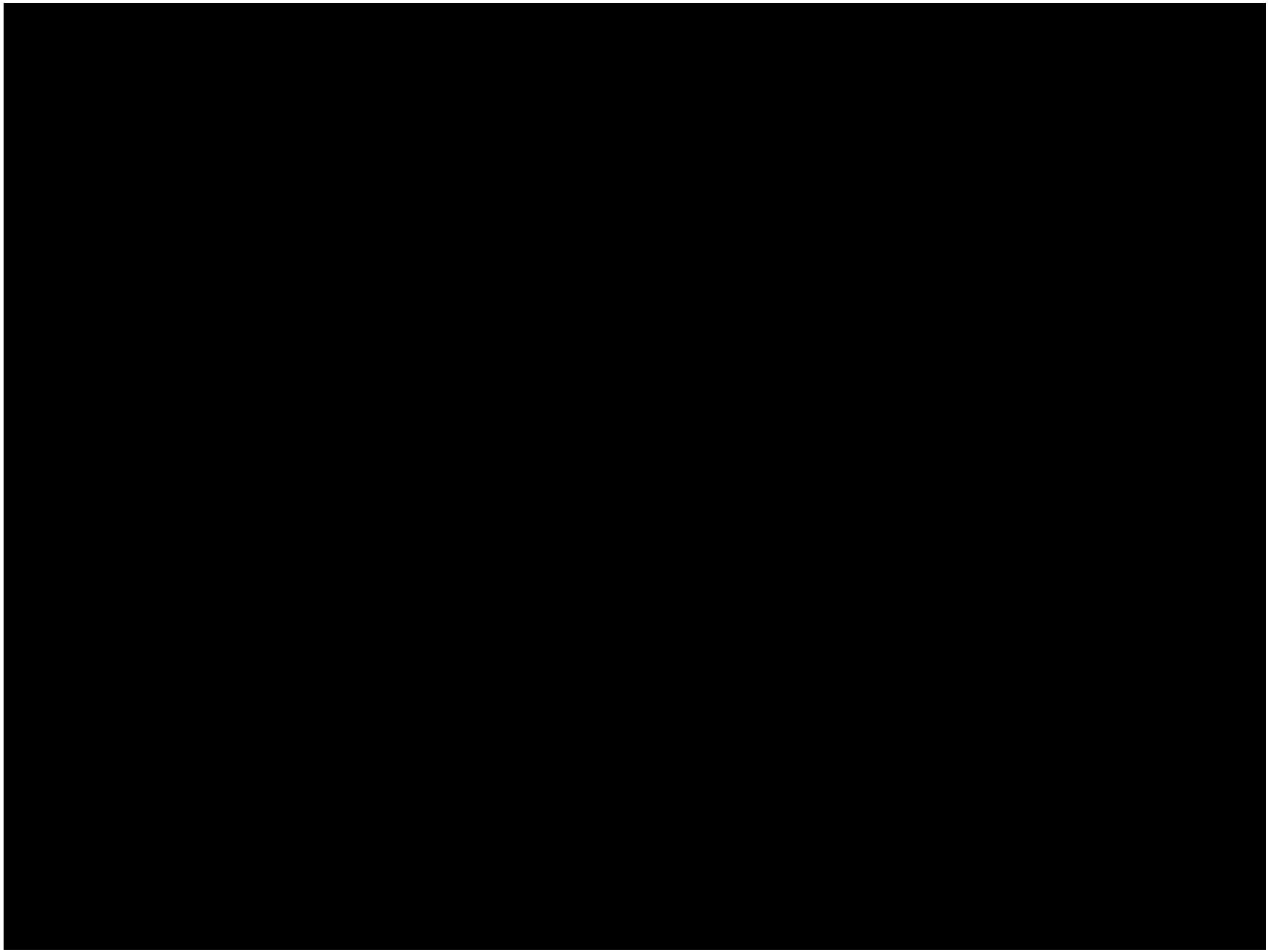
5. What would be the implication of the estimated results of the optimal number of alternative/conjoint questions?

   Individuals do respond differently when they face different amount of information they need to process
   => Do preliminary survey and analysis to figure out optimal no. of alternatives and conjoint questions
   => Further study on this issue for generalization

Conclusions - continued

6. What would be the implication of the estimated results for marketing strategies to increase US beef consumption in Korea?

- Reduce US beef price
- Lower the beef tariff via FTA and other trade negotiations
- Increase advertising/promotion effort to improve the brand image of “Made-in-USA” in Korea



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