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Consumer Preferences for Country-of-Origin of U.S. Beef Products: A Meta Analysis

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Consumer Preferences for Country-of-Origin of U.S. Beef Products: A Meta Analysis

Abstract:

By conducting a meta-analysis with 50 observations collected from 15 primary studies, we systematically analyze heterogeneities in consumer preferences for the Country-of-Origin (COO) of U.S. beef products. The main findings include that consumers in Asian countries (Korea and Japan) are willing to pay least for the COO of U.S. beef products compared with North American countries, and that the BSE incidence in the U.S. substantially damaged consumer preferences for the COO of U.S. beef products outside the U.S. but not in the U.S. The results also indicate that choice experiments yield larger WTP values and that the sample size is negatively correlated with WTP values.

Key Words: U.S. beef, COO, WTP, Meta analysis,

JEL: Q18, Q51

Consumer Preferences for Country-of-Origin of U.S. Beef Products: A Meta Analysis

Many developed countries, such as the U.S., the members of the EU, Japan and South Korea have introduced mandatory Country-Of-Origin Labeling (COOL) for food products, and it invokes a lot of arguments either from political perspectives or from academic perspectives (Carter and Zwane 2003, Krissoff et al. 2004). The U.S. beef industry is an important case, as the 2002 U.S. Farm Bill, taking effect in September 2004, mandated COOL for fresh and frozen food commodities[1].

Opponents of COOL argue that it may decrease the profits of both producers and retailers because of the high costs of labeling, record-keeping, and operating procedures, necessary to ensure compliance with these regulations, and it could also create "deadweight" loss because of the distorted producer and consumer prices. Furthermore, international trade conflicts could be raised because COOL is considered as a non-tariff barrier to trade (Carter and Zwane 2003; Brester et al. 2004). On the other hand, proponents of COOL insist that consumers have a "right to know" the country of origin (COO) of products and that COOL is a valuable marketing tool (Lusk et al. 2006). Product information is often asymmetric in markets and COOL can help consumers, at least partially, solve the problem of imperfect information because the country of origin can serve as a proxy for product quality. Growers and ranchers have largely supported COOL because they regard it as a non-tariff barrier to trade that can potentially provide producers with a competitive advantage in domestic markets (Carter and Zwane 2003; Umberger 2004).

[1] COOL was mandatory for fish and shellfish in 2004 and is required for beef, lamb, chicken and other covered commodities by September 30, 2008.

A meta-analysis of consumer preferences regarding the country of origin of food products by Ehmke(2006) indicates that consumers are willing to pay a premium for domestic food products , which can be explained by consumer ethnocentrism and patriotism (Lusk et al. 2006). In particular, a number of studies on consumer preferences for U.S. beef find that U.S. consumers are generally willing to pay a premium for "Certified U.S." beef products, indicating that they believe that the domestic beef might be safer, of higher quality and fresher. However, the variations of premiums are quite large across different studies and different regions (Umberger 2004; Gao, Shroeder and Yu 2010). Most studies on consumer willingness-to-pay (WTP) for U.S. food products support the policy of mandatory COOL in the U.S.

The attitudes of non-U.S. consumers towards U.S. beef products are quite dispersed across different regions. Studies in Japan (Aizaki et at. 2006), Korea (Chung et al. 2009; Unterschultz et al.1998), Norway (Alfnes et al. 2003; Alfnes 2004) and Germany (Tonsor et al. 2005) find that the WTP for U.S. beef products is negative in these countries compared with local beef, which implies that these consumers favor domestic beef products. However, studies in Spain (Beriain et al. 2009), France and the UK (Tonsor et al.2005) show positive WTP for U.S. beef products, which indicates that consumers in these countries prefer U.S. beef to local counterparts.

It would be very important to scrutinize the variations of consumer preferences for the COO with respect to U.S. beef products in the current literature, given the fact that the beef industry plays a very important role in U.S. agriculture and international trade. Table 1 shows the main exported markets of U.S. beef products. In 2009, the exported value amounted to $2.83 billion, about the 7.2% of the production, of which 90% is exported to Canada, Mexico, Korea

and Japan. It hence has important policy implications to study concumers' preference for U.S. beef products across countries.

Many factors can influence the estimates of consumer preferences for the COO of U.S. beef, including methodologies, samples, as well as study place and time (Umberger 2004; Ehmke 2006). In particular, the first case of BSE (Mad Cow Diseases) in the U.S. was reported in December 2003, which severely shocked the U.S. beef industry and in particular affected its exports (Ward, Von Baily and Jensen 2005). As shown in Table 1, beef export of the U.S. experienced a huge slump after 2004, and has not fully recovered so far. It implies that BSE do affect consumer preferences for U.S. beef.

The meta-analysis is widely used for synthesizing the empirical studies in economic analysis. In order to find out the systematic differences in consumer preferences for the COO of U.S. beef products across countries and to shed some light on current mandatory COO compliance as well, this paper conducts a meta-analysis to study consumer WTP for U.S. beef products from 15 primary studies, which employed different methods and provided a total of 50 observations of the WTP for the COO of U.S. beef products in different countries. Also, this paper also could give some implications of the methodological issues in the current literature.

Method

A few meta-analyses have studied consumer preferences for COO across different food products. For instance, Ehmke (2006) collected 13 studies with 27 observations of WTP for COO and finds that consumer WTP for COO depends on the number of other credence attributes included in product descriptions and the location of the consumers. However, to the best of our knowledge, no meta-analyses have specifically focused on COO of U.S. beef products, even

though the beef industry is a very important part of U.S. agriculture and many studies have been done regarding consumer preferences for U.S. beef products.

In an assessment of 130 meta-analyses in the field of environmental and resource economics, Nelson and Kennedy (2008) separate the estimation heterogeneity into factual and methodological heterogeneities. The methodological heterogeneity refers to the heterogeneities in the current literature are caused by methodological reasons, such as sampling methods, econometric models, or estimation approaches; while the factual heterogeneity means that the heterogeneities are caused by factual reasons, such as the differences in time, regions, cohorts or products .

Following Nelson and Kennedy (2008), first, we will separate the variation of consumer WTP for the COO of U.S. beef products into factual and methodological heterogeneity. Factual heterogeneity includes differences with respect to study location, study time and the products. We categorize the study locations into the U.S., Asia, and the remaining countries (European Countries, Canada and Mexico) and use dummy variables to control for this heterogeneity. In addition, we separate the full sample into a U.S. and a non-U.S. sample in two regressions to examine whether there are any systematic differences between consumer preferences in the U.S. and outside of the U.S.. As aforementioned, the impact of BSE on the U.S. beef industry is very significant. Therefore, we introduce a time dummy variable (before BSE and after BSE) to model the impacts. Furthermore, the definitions and attributes of beef products are slightly different in the primary studies, which are also regarded as factual heterogeneity. There are two types of beef products in primary studies: beef steaks and hamburgers, and the main attribute differences are hormone-free products and conventional beef.

Lusk and Schroeder (2004) also point out that methodological differences can impact the studies of WTP and that choice experiments usually lead to a higher probability of payments. In the current literature, contingent valuation methods (CVM), experimental auction, and choice experiment are three main methods used to estimate consumer WTP. In order to capture the methodological heterogeneities, we comprise methodological dummy variables (CE and auction as compared to CVM) in the regression. Nelson and Kennedy (2008) point out that the effect-size of samples in different primary studies can generate non-homogeneous variances and smaller variances are more reliable. In order to control the heterogeneities caused by sample size, we include the sample sizes as an independent variable.

Furthermore, the methods of choice experiments (CE) are increasingly used in this field. For instance, 30 of the 50 observations used in this study are obtained from CE methods. In order to study the heterogeneities in CE methods, we also perform a separate regression only using the 30 CE observations. It is well known that experiment designs (number of attributes), survey approaches (online survey or in-person) and estimation strategies (multinomial Logit or mixed multinomial Logit) play significant roles in the choice experiment (Gao, House, and Yu 2010; Gao, Schroeder and Yu 2010; Hensher 2006; Islam Louviere and Burke 2007). These methodological heterogeneities in choice experiments can also be scrutinized in this step, so that it might also be possible to derive important methodological implications for the use of choice experiments in the future.

Data

We collected 15 primary studies with 50 observations of the WTP values for the COO of U.S. beef products, out of which 26 observations relate to U.S consumers, 12 to European consumers, 10 to Asian consumers and the remaining 2 relate to Mexico and Canada. In the

appendix, we have listed all these primary studies and provided a brief introduction, including survey country, survey year, sample size, eliciting methods, estimation methods, type of the beef products, and WTP values. Table 2 in turn presents definitions and descriptive statistics with respect to all variables included in the meta-analysis.

The mean WTP of all observations is -1.84 $/lb, less than zero. However, all the U.S. observations are positive and their mean value is 3.40 $/lb. This implies that U.S. consumers are willing to pay 3.40 $/lb more for domestic beef compared with non-U.S. beef products without controlling for other variables, which shows that the current literature is quite consistent and indicates that COO does increase consumer welfare for beef products in the U.S.. On the other hand, the mean of the 24 non-U.S. observations is -7.53$/lb and less than zero. It implies that non-U.S. consumers are willing to pay 7.53$/lb less for U.S. beef products than for domestic products. These statistics also show that the perceptions of U.S. and non-U.S. consumers regarding U.S. beef products are quite different.

Second, the first case of BSE (Mad Cow Diseases) in the U.S. was reported in December 2003, which severely shocked the U.S. beef industry and in particular affected its exports (Ward, Von Baily and Jensen 2005). However, the impacts of BSE on consumer preferences regarding U.S. beef have not been well discussed so far, and this study attempts to shed some light on it. 18 of the 50 observations are obtained after the first case of BSE in December 2003, and the mean is -3.96; while the mean of the 32 pre-BSE observations is 0.65, significantly higher than the post-BSE observations.

In the current literature, WTP for the COO of U.S. beef products can be elicited by three different approaches: The contingent valuation method (CVM), the choice experiment (CE) and the experimental auctions. Out of the 50 observations, 30 are from choice experiments, 9 were

derived using the CVM, and the remaining 11 are based on experimental auctions. The mean WTP values are -3.26$/lb, 0.64$/lb, and -0.01$/lb for CE, CVM and auctions respectively. These figures indicate that the differences with respect to methods are significant, also consistent with the literature.

In the next part, we will statistically analyze the dispersion in consumer preferences for the COO of U.S. beef products by conducting a meta-analysis.

Results and Discussions

We estimate models from two different categories: the models using the full observations, and the models only considering the CE observations. The results are reported in Table 3 and Table 4 respectively.

- Full-Observation Models

Table 3 reports the estimation results comprising 4 models using the observations from all the methods. In particular, Models 1.1 and 1.2 are the results for all observations, while Models 1.3 and 1.4 respectively use only U.S. observations and only non-U.S. observations. The results of F-tests and the R-squares indicate that all models fit the data well.

Comparing Models 1.1 and 1.2, the likelihood-ratio test rejects Model 1.2 and favors Model 1.1($\chi_1^2 = 13.88$). The estimation results of Model 1.1 indicate that the coefficients with respect to study methods, study locations, study time and sample size of the primary studies are statistically significant, while the types of products are not important.

First, compared with the contingent valuation method (CVM), the values of WTP from auctions and choice experiments are 1.24 $/lb and 10.37$/lb higher respectively. However, only the coefficient for choice experiments is statistically significant and the coefficient for auctions is

not. This indicates that the method of choice experiments yields significantly higher WTP values than either CVM or auctions, which is consistent with the findings of Lusk and Schroeder (2004) and Boxall et al. (2009), while the methodological difference between CVM and auctions is not significant.

Second, the WTP for the COO of U.S. beef in the U.S. is 7.90 $/lb higher, and the WTP in Japan and Korea.is 14.67 $/lb lower than those from European and other North American countries, and both are statistically significant. This implies that the consumers' evaluation of U.S. beef in the U.S. is significantly higher than those in other countries, consistent with the current theory that people tend to pay higher price for domestic food products due to by consumers' ethnocentrism and patriotism (Lusk et al. 2006). Unfortunately, U.S. beef products receive the lowest evaluation in Asian Countries (Japan and Korea). If we include only one country dummy variable (U.S. vs. non-U.S.) in the regression, as shown in Model 1.2, we can compare the valuations of U.S. beef products between the U.S. and non-U.S. countries. The coefficient for the dummy variable is 17.65 and statistically significant, which implies that consumers in the U.S. are willing to pay 17.65$/lb more for U.S. beef products than consumers in other countries after controlling some factors of methodological and factual heterogeneities.

Third, the coefficient for the BSE variable is -88.50 and statistically significant at the 1% level, which indicates that BSE has a significantly negative impact on consumer preferences for U.S. beef in the world. Specifically, BSE reduced consumer WTP for U.S. beef by 88.50$/lb, due to the potential health risks in beef products. The coefficient for the interaction term between BSE and year is 7.57 and also statistically significant at 1% level. It implies that consumers' preference for U.S. beef products id recovering from the BSE crisis, and the WTP value

increases by 7.57 $/lb each year after the BSE incidence. Therefore, it would take about 12 years to fully recover to the pre-crisis level.

Finally, the coefficient for the effective sample size is -0.008 and statistically significant at the 5% level, which can partly be explained by the heteroskedasticity of effect-size estimates in primary studies (Nelson and Kennedy 2008). In particular, some outliers in the stated-preference methods (CVM or choice experiments) can push up the WTP values in primary studies and an increase in sample sizes will reduce the biases.

- U.S. and Non-U.S. observations

Models 1.3 and 1.4 reported the estimated results respectively with the 26 observations from U.S. consumers and with the 24 observations from the non-U.S. consumers. We use a likelihood ratio test to test the sample splitting, as Model 1.3 and Model 1.4 are nested from Model 1.1. The test value is $\chi_9^2 = 48.98$, statistically significant at 1% level, which indicates the sample splitting model is favored.

In Model 1.3 with only the U.S. observations, we find that only the CE variable is statistically significant, and other variables are not. The result indicates that only methodology matters for the U.S. observations, and the WTP values of U.S. consumers from choice experiments are 6.16$/lb higher than those from CVM, while the difference between auction and CVM is not statistically significant, similar with the results from the Model 1.1 with full observations. Surprisingly, the coefficient of the BSE variable is not statistically significant for the U.S. observations, which indicates that the impact of BSE on the U.S. consumer preference for U.S. beef is not significant. Other variables, such as the effective sample size and the types of beef products, are also not statistically significant.

Models 1.4 only comprises the 24 observations from non-U.S. consumers, and we find that only the coefficients for BSE , the dummy variable of Asia and the interaction term between BSE and year , which are mainly factual heterogeneities, are statistically significant. Specifically, the coefficient of the dummy variables of Asia is -13.29, statistically significant at the 5% level, which implies that the WTP for the COO of U.S. beef products in Asia countries (Mainly Japan and Korea) is about 13.29 $/lb less than the countries outside of the U.S.. The coefficient of the BSE variable is -96.00 and statistically significant at the 5% level, which implies that consumers outside of the U.S. reduced their WTP for the COO of U.S. beef products by -96.00$/lb right after the BSE incidence in 2003. The coefficient of the interaction term between BSE and year is 7.95 and also statistically significant, which implies that consumers in non-U.S. countries are recovering from the BSE shock and it would take about 12 years to fully recover, consistent with the results in the full-observation model, and reality in Table 1.

However, the methodological heterogeneities, such as elicitation methods and sample size, are not important for explaining the heterogeneities in non-U.S. observations.

- Choice-Experiment Observations

As CE approaches are increasingly used in the currently literature, there are many arguments regarding the methodological issues, such as experiment design and estimation methods (Boxall et al. 2009; Gao, House and Yu 2010).Out of the 50 observations in this study, 30 are obtained from choice experiments. We can also use only this subset of observations to examine the heterogeneities among them. Similarly, we divide the heterogeneity into factual and methodological heterogeneity.

Similar to the aforementioned analyses, the factors considered with respect to factual heterogeneity include study locations (the U.S., Asia and other countries), study time (before

BSE or after BSE) and the types of products (hormone-free beef steaks or conventional beef steaks[2]). Methodological heterogeneities in choice experiments are mainly caused by their design, such as in terms of the choices of attributes, sample size, survey methods and econometric methods. For instance, Hensher 2006 and Gao, House and Yu (2010) point out that the design of choice experiments can affect the results significantly. In particular, both the interaction between attributes and an increase in the number of attributes can increase the information load and cause confusions in answers of respondents. Therefore, the number of attributes and the effective sample size should be included in the meta-analysis. Gao, Schroeder and Yu (2010) find that there may be a non-linear relation between WTP values and the number of attributes, so that a second-order term of the number of attributes is included in the regression. Some studies use online surveys in choice experiments instead of traditional in-person surveys. Therefore, we include a dummy variable (online survey vs. other methods) in the regression in order to capture the heterogeneity. In addition, there are two major econometric methods for estimating choice experiments: The multinomial Logit model (MLM) and the mixed multinomial Logit model (MMLM), which may also cause some methodological heterogeneity in WTP. Consequently, a dummy variable capturing the choice of econometric methods is also included in the regression.

In order to compare the results and check the robustness, we reported the results with four different models in Table 4. Model 2.1, Model 2.3 and Model 2.4 are estimated by OLS, while Model 2.2 is estimated by Heckman two-step procedure in order to correct the possible sample selectivity problem. However, the t-test in Heckman sample selectivity model can not reject the hypothesis of no sample selectivity, and hence favors OLS model. As likelihood ratio tests also favor Model 2.1, when comparing it against Models 2.3 and 2.4. Clearly, the results in

[2] Hamburger products have not been considered in choice experiments.

Model 2.1 and Model 2.2 are very close. Then, the following discussion will be based on the Model 2.1.

The estimation results show that only the coefficients for Asia, Sample Size, Attributes and Attributes_Squared are statistically significant, and other variables are not so important for explaining the heterogeneity in the WTP.

First, sample size and the number of attributes belong to the factors of methodological heterogeneities. In particular, the coefficient of the sample size variable is -0.010 and is statistically significant at the 10% level, which implies that the WTP for U.S. beef will decrease as the sample size increases. Similar with the results in the full-observation model and consistent with the current literature (Boxall et al. 2009; Lusk et al. 2004), choice experiments often yield some high outliers of WTP values, and an increase in sample size can reduce some bias. The coefficients for the number of attributes and the number of attributes squared respectively are 22.37 and -2.12, and both are statistically significant. It implies that there is an inverted-U-shape relationship between the number of attributes and WTP values, consistent with Gao, House and Yu(2010). However, other factors of the methodological heterogeneities, such as survey approaches (online or not) and estimation strategies are not important for explaining the heterogeneities in WTP for COOL of U.S. beef products.

Regarding the factors of factual heterogeneities, only the coefficient for the dummy variable of Asian countries is statistically significant, and the value is -15.35, implying consumers in Japan and Korea should be compensated by 15.35$/lb in order to let them purchase U.S. beef. The signs of the coefficients for BSE and the interaction term between BSE and Year are consistent with the full-observation model, but not statistically significant, perhaps due to the fact that most studies of CE methods are conducted after the report of first BSE case in 2003, and

only few are obtained before the BSE incidence. In addition, the types of the products are also not important for WTP values.

Furthermore, we also included only one country dummy variable (U.S. or non-U.S.) in Model 2.4 in order to capture the difference between WTP in the U.S. and the corresponding value in other countries. The coefficient of this variable is 15.90 and it is statistically significant at the 1% level, which indicates that consumers in the U.S. are willing to pay 15.90 $/lb more than consumers outside of the U.S. in choice experiments after controlling some factors of methodological and factual heterogeneities .

Conclusion

In order to protect their domestic agriculture, many developed countries have introduced mandatory compliance of Country-of-Origin Labeling. This caused a lot of arguments both domestically and internationally. As an important agricultural product in the U.S., many studies on the consumer preferences for the country of origin for U.S. beef products have been conducted using different methods in different countries and the results are quite disperse.

This paper collected 50 observations of consumer WTP for the COO of U.S. beef products in different countries from 15 primary studies and uses a meta-analysis to systematically analyze the heterogeneities in WTP for U.S. beef products.

We divide the heterogeneities of WTP for the COO of U.S. beef products into factual and methodological heterogeneities. The results show that consumers in Asian countries (Japan and Korea) have the lowest WTP for the COO of U.S. beef products . The consumer WTP estimates in North American countries including the U.S., Canada and Mexico are the highest. Consumers

in the U.S. for example are willing to pay 3.40 $/lb more for U.S. beef than imported beef products, significantly higher than consumers in other countries.

As we know, the BSE incidence in the U.S. in 2003 has a significantly negative impact on the U.S. beef industry, particularly in the foreign countries . We find that consumers in foreign countries reduced their WTP for U.S. beef products by 96 $/lb right after the BSE incidence, and it will take about 12 year to fully recover to the pre-crisis level. However, this study also finds that the impacts of BSE on the consumer preferences for U.S. beef in the U.S. are not significant.

We also find that the factors of the methodological heterogeneities are statistically significant for studying consumer preferences for U.S. beef products. Lusk and Schroeder (2004) and Boxall et al. (2009) point out that choice experiments often yield higher estimates of WTP, which is consistent with the finding of this research that the WTP from choice experiments is 10.37 $/lb higher than that from the CVM, while the difference between auctions and CVM is not significant. The sample size is also important for explaining the heterogeneity of the WTP values. It is negatively correlated with these values, which may be explained by the facts that stated-preference methods often yield some high outliers of payments and that an increase in sample size can reduce some bias.

We also analyze the observations from choice experiments in a separate regression in order to exam methodological heterogeneities in the current literature for choice experiments. This study find that the survey approach and estimation strategy are not statistically significant for explaining the heterogeneity of the WTP values, while effective sample size and the number of attributes are important. In particular, the sample size is negatively correlated with the WTP

estimates and there is an inverted-U shape relationship between the number of attributes and WTP values. .

The findings in this study can give valuable implications both from a policy perspective as well as from a methodological perspective. For instance, since consumer preferences for U.S. beef products are quite different across countries, governments should adopt different policies with respect to the COOL of different products so as to avoid international trade conflicts and to maximize the social welfare. Furthermore, this study also indicates that we should pay attention to methodological heterogeneities when estimating the WTP for non-market goods in order to get more reliable results.

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Table 1 Top markets for U.S. Beef

Year	Japan		Mexico		South Korea		Canada		Total Export		
	Volume	Value	Volume	Value	Volume	Value	Volume	Value	Volume	Value	% of Production
	Million lbs.	$million	Million lbs.	$million	Million lbs.	$million	Million lbs.	$million	Billion lbs.	$Billion	%
2002	771	854	629	615	597	619	241	286	2.447	2.629	9.0
2003	918	1,182	586	623	587	754	227	309	2.518	3.186	9.6
2004	12	31	333	393	1	2	56	105	0.46	0.631	1.9
2005	17	50	464	584	1	3	106	194	0.697	1.031	2.8
2006	52	105	660	786	1	4	239	415	1.144	1.616	4.4
2007	159	294	586	732	78	124	339	575	1.433	2.186	5.4
2008	231	439	649	854	152	241	389	683	1.887	2.972	7.1
2009	275	496	563	690	141	215	362	621	1.868	2.828	7.2

Source: ERS, USDA

Table 2 Description of the Variables

Variables			Full Sample			US Studies			Non-US Studies			Choice Experiment		
			Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
Dependent Variable	WTP	WTP for US beef ($/lb.)	-1.84	-49.00	12.19	3.40	0.20	12.19	-7.53	-49.00	9.89	-3.26	-49.00	12.19
Methodological Heterogeneities	Auction	Obs from Auctions=1, otherwise=0	0.22	0	1	0.27	0	1	0.17	0	1	-	-	-
	CE	Obs from Choice Experiments=1, otherwise=0	0.60	0	1	0.38	0	1	0.83	0	1	-	-	-
	Sample_Size	Sample Size in the study	352.92	10	1066	241.73	74	1009	473.38	10	1066	455.80	10	1066
Factual Heterogeneities	BSE	Survey after BSE =1, otherwise=0	0.36	0	1	0.35	0	1	0.38	0	1	0.60	0	1
	US	Study in US=1, otherwise=0	0.52	0	1	1.00	1	1	0.00	0	0	0.33	0	1
	Asia	Study in Asia=1, otherwise=0	0.20	0	1	0.00	0	0	0.42	0	1	0.33	0	1
	Steak	The product is steak=1, otherwise=0	0.92	0	1	0.85	0	1	1.00	0	1	1.00	0	1
	Horm_Free	US beef is hormone-free =1, otherwise=0	0.16	0	1	0.00	0	0	0.33	0	1	0.17	0	1
Methodological Heterogeneities in CE	MMNL	Estimated by Mixed Multinomial Logit Model (MMNL, or Random Parameter Logit)=1; and by Multinomial Logit Model (MNL)=0	-	-	-	-	-	-	-	-	-	0.70	0	1
	Attributes	# of Attributes in Choice Experiment	-	-	-	-	-	-	-	-	-	4.33	2	7
	On-Line	Surveyed by internet=1 , otherwise=0	-	-	-	-	-	-	-	-	-	0.37	0	1
# of WTP Obs.			50			26			24			30		

Table 3 WTP for U.S. Beef for All, U.S. and Non-U.S. Observations

WTP	Full Sample				US Samples		Non-US Samples	
	Model 1.1		Model 1.2		Model 1.3		Model 1.4	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
Auction	1.241	4.106	2.711	4.636	0.294	1.313	-	-
CE	10.371	4.533**	10.030	5.143*	6.156	2.553**	4.689	6.768
BSE	-88.506	28.115***	-114.399	30.829***	1.036	2.506	-95.996	40.128**
US	7.908	3.945*	17.648	3.240***	-	-	-	-
Asian	-14.673	4.102***	-	-	-	-	-13.294	6.205**
Sample Size	-0.008	0.003**	-0.004	0.004	0.002	0.002	-0.007	0.006
Steak	0.721	4.851	0.413	5.504	-0.116	1.498	-	-
Horm_Free	0.071	4.305	9.284	3.914**	-	-	-2.141	6.255
BSE*Year	7.574	2.526***	9.885	2.771***	-	-	7.964	3.569**
Intercept	-5.826	5.572	-16.266	5.386***	0.182	1.196	0.975	7.007
Adj. R2	0.576		0.454		0.700		0.574	
R2	0.654		0.543		0.760		0.423	
Number of Obs.	50				26		24	

Note: 1, ***, ** and * denotes the significant level of 1%, 5% and 10%, respectively.
2, some independent variables are dropped in Model 1.3 and Model 1.4 due to collinearity.

Table 4 WTP for U.S. Beef for the Choice-Experiment Methods

WTP	Full Model 2.1		Sample Selectivity Model 2.2		Full Model 2.3		Full Model 2.4	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
BSE	-47.216	54.507	-46.821	44.428	-13.557	54.106	-121.187	44.825***
US	3.883	7.856	9.042	8.074	1.232	8.149	15.903	5.788***
Asia	-15.346	7.339**	-15.618	5.937***	-22.105	6.675***	-	-
Sample_Size	-0.010	0.005*	-0.009	0.004**	-0.013	0.005**	-0.004	0.004
MMNL	-5.567	6.107	-5.913	4.470	-6.670	6.415	0.043	5.930
Attributes	22.366	10.399**	20.816	9.089**	3.866	2.142*	32.062	10.062***
Attributes_Squared	-2.121	1.169*	-1.839	1.039*	-	-	-3.362	1.089***
On-Line	5.431	7.019	0.861	7.432	6.991	7.354	0.643	7.172
Horm_Free	-1.919	6.901	-1.993	4.765	-5.515	6.979	5.122	6.512
BSE*Year	4.083	4.828	3.755	3.968	0.680	4.696	10.803	3.895**
Intercept	-46.552	26.714*	-41.945	22.996*	-1.057	9.707	-79.115	23.463***
Adjust-R2	0.783		-		0.746		0.733	
R2	0.669		-		0.631		0.613	
Number of Obs.	30							

Note: 1, ***, ** and * denotes the significant level of 1%, 5% and 10%, respectively.
2, The dependent variables included in the selection function of the Sample Selectivity Model are U.S., year, and BSE which are considered as exogenous variables.

Appendix: Summary of the Primary Studies

#	Study	Country	Year	Sample size	Format	Method	Attributes	Estimation	Products	WTP	Units
1	Aizaki et at. (2006)	Japan	2005	351	mail	CE	2	MMNL	US beef	-1126	JPY/100g
	Aizaki et at. (2006)	Japan	2005	351	mail	CE	4	MMNL	US beef	-642	JPY/100g
	Aizaki et at. (2006)	Japan	2005	351	mail	CE	3	MMNL	US beef	-505	JPY/100g
2[a)]	Alfnes(2004)	Norway	2000	1066	In-person	CE	4	MMNL	US Hormone-free Beef	-47.80	NOK/Kg
	Alfnes(2004)	Norway	2000	1066	In-person	CE	4	MNL	US Hormone-free Beef	-52.89	NOK/Kg
	Alfnes(2004)	Norway	2000	1066	In-person	CE	4	MMNL	US Hormone-treated Beef	-226.75	NOK/Kg
	Alfnes(2004)	Norway	2000	1066	In-person	CE	4	MNL	US Hormone-treated Beef	-264.52	NOK/Kg
3	Alfnes et al.(2003)	Norway	2000	106	In-person	Auction			US hormone free	-5.78	NOK/ 0.5 Kg
	Alfnes et al.(2003)	Norway	2000	106	In-person	Auction			US hornome Treated	-14.94	NOK/ 0.5 Kg
	Alfnes et al.(2003)	Norway	2000	106	In-person	Auction			US hormone free	-10.61	NOK/ 0.5 Kg
	Alfnes et al.(2003)	Norway	2000	106	In-person	Auction			US hornome Treated	-21.38	NOK/ 0.5 Kg
4[b)]	Beriain et al. (2009)	Spain	2008	290	In-person	CE	3	MNL	US beef	11.73	% of price
5	Chung et al. (2009)	Korea	2007	1000	In-person	CE	7	MNL	US Beef	-13.35	$/lb
	Chung et al. (2009)	Korea	2007	1000	In-person	CE	8	MMNL	US Beef	-14.63	$/lb
6	Gao and Schroeder (2009)	US	2006	74	On-line	CE	3	MMNL	US Beef Steak	9.09	$/12 oz
	Gao and Schroeder (2009)	US	2006	74	On-line	CE	4	MMNL	US Beef Steak	6.31	$/12 oz
	Gao and Schroeder (2009)	US	2006	76	On-line	CE	4	MMNL	US Beef Steak	5.26	$/12 oz
	Gao and Schroeder (2009)	US	2006	76	On-line	CE	5	MMNL	US Beef Steak	9.14	$/12 oz
	Gao and Schroeder (2009)	US	2006	211	On-line	CE	3	MMNL	US Beef Steak	4.61	$/12 oz
	Gao and Schroeder (2009)	US	2006	211	On-line	CE	4	MMNL	US Beef Steak	3.03	$/12 oz
	Gao and Schroeder (2009)	US	2006	187	On-line	CE	4	MMNL	US Beef Steak	2.33	$/12 oz
	Gao and Schroeder (2009)	US	2006	187	On-line	CE	5	MMNL	US Beef Steak	3.89	$/12 oz
7	Killinger et al. (2004)	US	2002	124	In-person	Auction			US Beef Steak	0.86	$/lb
	Killinger et al. (2004)	US	2002	124	In-person	Auction			US Beef Steak	0.52	$/lb
8	Loureiro& Umberger (2002)	US	2002	243	In-person	Contingent		Single-Bounded	US Beef	1.9	$/lb

	Loureiro& Umberger (2002)	US	2002	243	In-person	Contingent		Single-Bounded	US Beef Hamburger	1.33	$/lb
9	Loureiro& Umberger (2005)	US	2003	632	mail	Contingent		Single-Bounded	US Beef Steak	0.198	$/lb
10	Loureiro& Umberger (2005)	US	2003	632	mail	CE	5	MNL	US Beef Steak	7.568	$/lb
11	Sitz et al.(2005)	US	2002	273	In-person	Auction			US Beef Steak	1.2	$/lb
	Sitz et al.(2005)	US	2002	273	In-person	Auction			US Beef Steak	0.38	$/lb
12	Tonsor et al.(2005)	UK	2002	121	In-person	CE	5	MMNL	US Hormone-free Beef	2.07	$/lb
	Tonsor et al.(2005)	Germany	2002	65	In-person	CE	5	MMNL	US Hormone-free Beef	-3.74	$/lb
	Tonsor et al.(2005)	France	2002	62	In-person	CE	5	MMNL	US Hormone-free Beef	5.96	$/lb
13 [a)]	Tonsoret al.(2007)	US	2006	1009	On-line	CE	6	MMNL	US Beef Steak	11.59	$/lb
	Tonsoret al.(2007)	Canada	2006	1002	On-line	CE	7	MMNL	US Beef Steak	9.89	$/lb
	Tonsoret al.(2007)	Japan	2006	1001	On-line	CE	8	MMNL	US Beef Steak	-29.62	$/lb
	Tonsoret al.(2007)	Mexico	2006	993	In-person	CE	9	MMNL	US Beef Steak	5.21	$/lb
14	Umberger et al.(2003)	US	2002	141	In-person	Contingent		Single-Bounded	US Beef Steak	0.36	$/lb
	Umberger et al.(2003)	US	2002	132	In-person	Contingent		Single-Bounded	US Beef Steak	0.48	$/lb
	Umberger et al.(2003)	US	2002	273	In-person	Contingent		Single-Bounded	US Beef Steak	0.42	$/lb
	Umberger et al.(2003)	US	2002	141	In-person	Contingent		Single-Bounded	US Beef Hamburger	0.36	$/lb
	Umberger et al.(2003)	US	2002	132	In-person	Contingent		Single-Bounded	US Beef Hamburger	0.36	$/lb
	Umberger et al.(2003)	US	2002	273	In-person	Contingent		Single-Bounded	US Beef Hamburger	0.36	$/lb
	Umberger et al.(2003)	US	2002	141	In-person	Auction			US Beef Steak	1.03	$/lb
	Umberger et al.(2003)	US	2002	132	In-person	Auction			US Beef Steak	0.57	$/lb
	Umberger et al.(2003)	US	2002	273	In-person	Auction			US Beef Steak	0.81	$/lb
15 [a) b)]	Unterschultz et al.(1998)	Korea	1995	43	In-person	CE	4	MNL	US Beef	-10.85	% of price
	Unterschultz et al.(1998)	Korea	1995	10	In-person	CE	4	MNL	US Beef	-19.51	% of price
	Unterschultz et al.(1998)	Korea	1995	11	In-person	CE	4	MNL	US Beef	-8.23	% of price
	Unterschultz et al.(1998)	Korea	1995	22	In-person	CE	4	MNL	US Beef	-10.96	% of price

Note: a) Alfnes(2004), Tonsoret al.(2007) and Unterschultz et al.(1998) did not calculate the WTP for the attributes of US beef products. We use the equation (5) in Nahuelhual et al. (2004) to compute the WTP values in stead.

b) Beriain et al. (2009) and Unterschultz et al. (1998) only give the WTP as percentage of prices, and we can get the WTP in cash by timing it with prices. Dardaji I. et al. (2009) gives the mean price of certified PGI beef is €3.37 /kg in Navarra region of Spain, the same region with the experiment field of Beriain et al. (2009), and it is used for calculating the WTP in cash in Unterschultz et al. (1998) . And Chung et al. (2009) gives that mean price of beef in Korea in 2007 is $30/kg which is used in calculating the WTP in cash for Unterschultz et al. (1998).