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Consumer preferences for US beef products: a meta-analysis

By conducting a meta-analysis with 57 observations collected from 20 primary studies, we systematically analyze heterogeneities in consumer preferences for the Country-of-Origin-Labeling (COOL) of US beef products. We find that consumers often prefer their domestic beef products due to patriotism. Consumers in Asian (mainly, Korea and Japan) and European countries (such as France, Germany and UK) are willing to pay significantly lower prices for US beef products compared to their domestic products; while the US consumers are willing to pay more for the domestic products than the imported ones.

1. Introduction

Food labeling is an important tool for promoting and distinguishing food quality in many countries. In order to promote the competitiveness of domestic food products and provide better information to consumers, many countries (such as the US, 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 US beef industry is an important case, as the 2002 US 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 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

[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.

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is considered as a non-tariff barrier to trade (Carter and Zwane, 2003; Brester *et al.*, 2004a and 2004b). 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, to 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). Klain *et al.* (2014) find that the value of information conveyed in a label is positive for beef products in the US.

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). The US is the largest producer and consumer, and the fourth largest exporter for beef products in the world. In 2013, US produced 11.76 million metric tons of beef products, and about 10% is exported (USDA, 2014). Hence, it has attracted quite a number of studies on consumer preferences for US beef, which generally find that US consumers are 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 *et al.*, 2010b). Most studies on consumer willingness-to-pay (WTP) for US food products support the policy of mandatory COOL in the US.

The attitudes of non-US consumers towards US beef products are quite dispersed across different regions. Studies in Japan (Aizaki *et al.*, 2006; Peterson and Burbidge, 2012), Korea (Chung *et al.*, 2009; Unterschultz *et al.*, 1998; Lee *et al.*, 2013), Norway (Alfnes *et al.*, 2003; Alfnes, 2004), Germany (Tonsor *et al.*, 2005), and UK (Meas *et al.*, 2014) find that the WTP for US 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 US beef products, which indicates that consumers in these countries prefer US beef to local counterparts.

It would be very important to scrutinize the variations of consumer preferences for the COOL with respect to US beef products in the current literature, given the fact that US is the largest producer in the world. Table 2 shows the main exported markets of US beef products. In 2013, the exported value amounted to $ 5.71 billion, about the 10% of the production, of which 66% is exported to Canada, Mexico, Korea and Japan.

Tab. 1. World major producers, consumers, importers and exporters for beef and veal (1,000 metric tons)

	2010	2011	2012	2013
Production				
US	12,046	11,983	11,849	11,757
Brazil	9,115	9,030	9,307	9,675
EU	8,101	8,114	7,708	7,470
China	5,600	5,550	5,540	5,637
India	2,842	3,244	3,450	3,850
World Total	57,576	57,422	57,623	58,620
Consumption				
US	12,038	11,646	11,739	11,617
Brazil	7,592	7,730	7,845	7,885
EU	8,202	8,034	7,760	7,602
China	5,589	5,524	5,597	5,959
Argentina	2,346	2,320	2,458	2,664
World Total	56,427	55,718	56,090	56,825
Import				
US	1,042	933	1,007	1,021
Russia	1,058	994	1,032	1,031
Japan	721	745	737	760
HK	154	152	241	473
China	40	29	99	412
World Total	6,622	6,413	6,652	7,423
Export				
Brazil	1,558	1,340	1,524	1,849
India	917	1,268	1,411	1,765
Australia	1,368	1,410	1,407	1,593
US	1,043	1,263	1,113	1,172
New Zealand	530	503	517	529
World Total	7,822	8,095	8,164	9,165

Source: USDA (2014)

Tab. 2. Top markets for US beef

Year	Japan		Mexico		South Korea		South Korea		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	1.145	1.617	*4.4*
2007	159	294	586	732	78	124	339	575	1.434	2.187	*5.4*
2008	231	439	759	895	152	291	389	683	1.996	3.014	*7.5*
2009	274	495	628	770	141	215	363	622	1.935	2.909	*7.4*
2010	351	662	500	669	277	504	391	731	2.3	3.839	*8.7*
2011	456	873	488	791	380	661	500	1,039	2.785	5.041	*10.6*
2012	449	1,000	352	647	305	548	467	1,189	2.453	5.114	*9.4*
2013	671	1,283	403	738	253	567	463	1,190	2.584	5.711	*10.0*

Source: ERS, USDA

Many factors can influence the estimates of consumer preferences for the COOL of US beef, including methodologies, samples, as well as study place and time (Umberger, 2004; Ehmke, 2006). The meta-analysis is widely used for synthesizing the empirical studies in economic analysis (Nelson and Kennedy, 2009; Tian and Yu, 2012; Santeramo and Shabnam, 2015; Chen *et al*., 2016; Zhou and Yu, 2015). In order to find out the systematic differences in consumer preferences for US beef products across countries and to shed some light on current mandatory COOL compliance as well, this paper conducts a meta-analysis to study consumer WTP for US beef products from 20 primary studies, which employed different methods and provided a total of 57 observations of the WTP for US beef products in different countries. Furthermore, this paper could also give some implications of the methodological issues in the current literature.

2. 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. Such a meta-analysis ignored the heterogeneities of food products. Clearly the effect of COO on vegetables would be different from that on meat. Additionally, to the best of our knowledge, no meta-analyses have specifically focused on COO of US beef products, even though the beef industry is a very important part of US agriculture and many studies have been done regarding consumer preferences for US beef products.

In an assessment of 130 meta-analyses in the field of environmental and resource economics, Nelson and Kennedy (2009) separate the estimation heterogeneity into factual and methodological heterogeneities. The methodological heterogeneity refers to the heterogeneities in the current literature that 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 (2009), and Zhou and Yu (2015), first, we will separate the variation of consumer WTP for the COO of US beef products into factual and methodological heterogeneity. Factual heterogeneity mainly refers to study location. The current literature has pointed out that consumers usually prefer domestic to imported food products, as COO is linked to patriotism (Meas *et al*., 2014). It is reasonable that US consumers are willing to pay a

higher price for US beef products, while consumers in other countries on the contrary are willing to pay a lower price for it. We categorize the study locations into the US, Asia, and European countries, and the remaining countries (Canada and Mexico) and use dummy variables to control for this heterogeneity.

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 (CE) 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 (2009) 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. Considering that the 57 observations derive from 20 papers, it can be argued that some papers may produce multiple observations. This could lead to the issue of intra-paper correlation, which biases the standard errors. We use the clustered sandwich estimator to correct the standard errors.

Furthermore, the methods of choice experiments (CE) are increasingly used in this field. For instance, 37 out of the 57 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 by using only the 37 CE observations. It is well known that experiment designs (number of attributes), survey approaches (online survey or in-person), survey time, and estimation strategies (multinomial Logit or mixed multinomial Logit) play significant roles in the choice experiment (Gao *et al.*, 2010a; Gao *et al.*, 2010b; Hensher, 2006; Islam *et al.*, 2007; Yu *et al.*, 2014a). 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.

3. Data

Using the two academic search engines: Google Scholar and AgEcon Search, we collected 20 primary studies , which yield 57 observations of the WTP values for the COO of US beef products, out of which 27 observations relate to US consumers, 15 to European consumers, 13 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.

The mean WTP of all observations is -2.20$/lb, less than zero, though it is not much meaningful. When separating the samples, we found that all 29 US observations are positive and their mean value is 3.57$/lb. This implies that US consumers are willing to pay 3.57$/lb more for domestic compared with non-US beef products without controlling for other variables, thus showing that the current literature is quite consistent and indicates that COO does increase consumer welfare for beef products in the US.

On the other hand, the mean of the 28 non-US observations is -8.17$/lb and less than zero. It implies that non-US consumers are willing to pay 8.17$/lb less for US beef products than for domestic products. These statistics also show that the perceptions of US and non-US consumers regarding US beef products are quite different. Within the non-US observations, the mean WTP value for 13 Asian samples is -15.90$/lb, while the mean for 13 European countries is -2.86$/lb. Table 3 reports the t-tests for the difference between US, Asian and European consumers. It indicates that US consumers are willing to pay significant higher values for US beef than European consumers; whilst the WTP values for Asian consumers are significantly lower than those for European consumers.

Table 4 in turn presents definitions and descriptive statistics with respect to all variables included in the meta-analysis.

In the current literature, WTP for the COO of US 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 57 observations, 37 are from choice experiments, 9 were derived using the CVM, and the remaining 11 are based on experimental auctions. The mean WTP values are -3.53$/lb, 0.64$/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.

Tab. 3. Comparison of WTP values between different regions

Countries	Sample size	mean WTP	US	Asian	European
US	29	3.57 [0.73]		t=7.04	t=4.42
Asian	13	-15.90 [3.85]			t=3.16
European	13	-2.86 [1.46]			

Note: Standard Errors are reported in [ ]

t-ratios are reported for each pair

Tab. 4. 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)	-2.20	-49.00	12.19	3.57	0.20	12.19	-8.17	-49.00	9.89	-3.53	-49.00	12.19
Methodological Heterogeneities	Auction	Obs from Auctions=1, otherwise=0	0.19	0	1	0.24	0	1	0.14	0	1	0.00	0	0
	CE	Obs from Choice Experiments=1, otherwise=0	0.65	0	1	0.45	0	1	0.86	0	1	1.00	1	1
	CVMt	Obs from CVM=1, otherwise=0	0.16	0	1	0.31	0	1	0.00	0	0	0.00	0	0
	Sample Size	Sample Size in the study	388.33	10	1171	326.07	74	1171	452.82	10	1066	490.89	10	1171
Factual Heterogeneities	EU	Study in Europe=1, otherwise=0	0.22	0	1				0.46	0	1	0.24	0	1
	US	Study in US=1, otherwise=0	0.51	0	1							0.35	0	1
	Asia	Study in Asia=1, otherwise=0	0.23	0	1				0.46	0	1	0.35	0	1
	Other Countries	Study in Other countries=1, (Canada and Mexico); otherwise=0	0.02	0	1				0.04	0	1	0.03	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										0.76	0	1
	Attributes	# of Attributes in Choice Experiment										4.51	2	9
	Online	Surveyed by Internet=1, otherwise=0										0.49	0	1
# of WTP Obs.				57			29			28			37	

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

4. Results and Discussions

We estimate three meta-analysis models from two different categories: Model (1) and (2) using the full observations, and Model (3) only considering the CE observations. The results are reported in Table 5. We find that the results are quite consistent.

4.1 Full-Observation Models

The first two columns in Table 5 report the estimation results for full samples. Model (1) in the first column includes all possible variables (full model), while Model (2) in the second column only includes the dummy variables for country (region) difference (restricted model) for the purpose of comparison.

In general, we look at the factual heterogeneities, and we detect significant regional differences in WTP values for US beef products. In the full model, consumers' WTP values in Asian countries (mainly Japan and South Korea) and European countries are on average 23.01$/lb and 7.84$/lb respectively lower than those in US. The results are statistically significant at the levels of 1% and 5% respectively. Even though consumers in Canada and Mexico (other countries) have a higher WTP, it is not statistically significant. Similar results are found in the restricted model, and it shows robustness of the results. The results are consistent with the current literature in which consumers are usually willing to pay higher price for domestic products due to patriotism. Such a result mirrors a strong local preference for beef in most countries. The US beef is heavily discriminated in Japan, Korea and European countries, where the US and the local beef products are segregated by country-of-origin into two different markets, which cannot compete with each other.

Regarding the methodological heterogeneities, even though we find that coefficients for CE and Auction are respectively 7.48 and 1.59, unfortunately they are not statistically significant. It implies that the research approaches do not play significant roles for studying the WTP for COO of US beef products.

The coefficient for sample size is -0.007 and statistically significant at the level of 10%. It implies that estimated WTP for COO of US beef products would decrease when sample size increases. It is plausible that the distribution of the sample is not a symmetric normal distribution, and that it is slightly skewed toward to the left.

Tab. 5. WTP for US beef for the Choice-Experiment methods

Variables	All Sample		CE Sample
	(1)	(2)	(3)
Asia	-23.01***	-19.68***	-24.43***
	(4.534)	(6.573)	(4.254)
EU	-7.844**	-6.643**	-8.664
	(3.343)	(2.528)	(5.056)
Other Countries	2.386	1.430	6.739
	(3.860)	(1.567)	(6.830)
Auction	1.594		
	(1.414)		
CE	7.479		
	(4.752)		
Sample Size	-0.00708*		-0.0102***
	(0.00349)		(0.00308)
Online	0.0226		3.961
	(4.585)		(5.801)
MMNL			-10.92*
			(6.069)
Attributes			2.433
			(1.606)
Intercept	2.380**	3.783**	7.316
	(1.062)	(1.567)	(7.825)
Observations	57	57	37
R-squared	0.614	0.534	0.741

Note: ***, ** and * denotes the significant level of 1%, 5% and 10%, respectively
Cluster effect standard errors for papers in parentheses

Recently, online surveys have become more popular than the other survey methods, such as personal surveys and mail surveys. However, it is argued that online surveys may incur significant bias, because some consumers who do not use Internet are neglected. We hence include a dummy variable of online survey to control for the difference in survey methods. The estimated coefficient is 0.023, but not statistically significant. It implies that survey methods are not important for WTP results.

4.2 Choice-Experiment Observations

As CE approaches are increasingly used in the current literature, there are many arguments regarding the methodological issues, such as experiment design and estimation methods (Boxall *et al*., 2009; Gao *et al*., 2010a). Out of the 57 observations in this study, 37 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 US, Asia, Europe and other countries). 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 *et al*. (2010a) 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.

Similar to the above full sample regression, we also 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 (MNL) and the mixed multinomial Logit model (MMNL), 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.

The estimation results are reported in the third column in Table 5. We find that only the coefficients for Asia, Sample Size, and MMNL (mixed multinomial logit) are statistically significant, and other variables are not so important for explaining the heterogeneity in the WTP. Basically, the results are consistent with the Full Sample model (Model (1) and (2)).

First, similar to the results in Model (1) and (2), consumers of the Asian countries have a significantly lower WTP value for US beef products, compared with US consumers. The coefficient is -24.43. Then the coefficient for EU is -8.66, but not statistically significant any more here.

Second, sample size and MMNL 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 1% level, which implies that the WTP for US 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 and Anderson, 2004). In addition to the skewed dis-

tribution, it is also possible that choice experiments often yield some high outliers of WTP values, and an increase in sample size can reduce some bias.

The coefficient for MMNL is -10.92 and statistically significant at 10%. It implies that MMNL could yield significantly lower WTP values. It is well-known that MMNL could capture some heterogeneity in consumer preferences. Therefore, it could reduce the outliers in estimation process, and could make the WTP values more robust.

The results also indicate that other methodological-heterogeneity variables, such as survey methods (online vs. other survey methods), and the number of attributes, are not statistically significant.

5. 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 US, many studies on the consumer preferences for the country-of-origin of US beef products have been conducted using different methods in different countries, and the results are quite disperse.

This paper collected 57 observations of consumer WTP for the COO of US beef products in different countries from 20 primary studies and uses a meta-analysis to systematically analyze the heterogeneities within the observations.

We divide the heterogeneities of WTP into factual and methodological heterogeneities, and find that consumers' WTP values for US beef products in Asian countries (mainly Japan and South Korea) and European countries on average are 23.01$/lb and 7.84$/lb respectively, lower than those in US. The US beef is heavily discriminated in Japan, Korea and European countries, where the US and the local beef products are segregated by country-of-origin into two different markets, which cannot compete with each other.

In addition to a possible increase in consumer welfare by conveying more production information, COOL is also an effective instrument to promote the competitiveness of domestic beef products when producers face a sharp competition of imported products in the case of US beef products.

It is sure that COOL could increase consumer welfare due to better information provision. However, it may not promote the market competiveness of domestic products in some countries under a complicated situation of domestic food safety, in particular where consumers generally lack trust on the labeling (Yu *et al*., 2014a; Yu *et al*., 2014b). The policy makers should be cautious before introducing mandatory COOL, and more research hence is needed.

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Appendix: Summary of the Primary Studies

#	Study	Country	Survey Year	Sample size	Format	Method	Attrib-utes#	Estimation	Products	WTP	Units
1	Aizaki *et al.* (2006)	Japan	2005	351	Mail	CE	2	MMNL	US Beef	-1126	JPY/100g
	Aizaki *et al.* (2006)	Japan	2005	351	Mail	CE	4	MMNL	US Beef	-642	JPY/100g
	Aizaki *et al.* (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	-47.8	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 Hormone-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 Hormone-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	Online	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	Online	CE	4	MMNL	US Beef Steak	5.26	$/12 oz
	Gao and Schroeder (2009)	US	2006	76	Online	CE	5	MMNL	US Beef Steak	9.14	$/12 oz
	Gao and Schroeder (2009)	US	2006	211	Online	CE	3	MMNL	US Beef Steak	4.61	$/12 oz
	Gao and Schroeder (2009)	US	2006	211	Online	CE	4	MMNL	US Beef Steak	3.03	$/12 oz
	Gao and Schroeder (2009)	US	2006	187	Online	CE	4	MMNL	US Beef Steak	2.33	$/12 oz

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#	Study	Country	Survey Year	Sample size	Format	Method	Attrib-utes#	Estimation	Products	WTP	Units
	Gao and Schroeder (2009)	US	2006	187	Online	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 and Umberger (2002)	US	2002	243	In-person	Contingent		Single-Bounded	US Beef	1.9	$/lb
	Loureiro and Umberger (2002)	US	2002	243	In-person	Contingent		Single-Bounded	US Beef Hamburger	1.33	$/lb
9	Loureiro and Umberger (2005)	US	2003	632	Mail	Contingent		Single-Bounded	US Beef Steak	0.198	$/lb
10	Loureiro and 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)]	Tonsor *et al.* (2007)	US	2006	1009	Online	CE	6	MMNL	US Beef Steak	11.59	$/lb
	Tonsor *et al.* (2007)	Canada	2006	1002	Online	CE	7	MMNL	US Beef Steak	9.89	$/lb
	Tonsor *et al.* (2007)	Japan	2006	1001	Online	CE	8	MMNL	US Beef Steak	-29.62	$/lb
	Tonsor *et 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

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#	Study	Country	Survey Year	Sample size	Format	Method	Attrib-utes#	Estimation	Products	WTP	Units
	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
16	Abidoye *et al.* (2011)	US	2005-2006	1171	Online	CE	9	MNL	US beef	2.01	$/lb
17	Lee *et al.* (2013)	Korea	2012	500	Online	CE	3	MNL	US beef	-21.09	$/kg
18	Lim *et al.* (2014)	US	2010	1000	Online	CE	5	MNL	US beef	7.33	$/lb
	Lim *et al.* (2014)	US	2010	1000	Online	CE	5	MNL	US beef	5.75	$/lb
19	Meas *et al.* (2014)	UK	2013	402	Online	CE	5	MNL	US beef	-4.34	Pound/pack (.375 kg)
20	Peterson and Burbidge (2012)	Japan	2006	313	Online	CE	5	MNL	US beef	-501	yen/100 g
	Peterson and Burbidge (2012)	Japan	2009	103	Online	CE	5	MNL	US beef	-276	yen/100 g

Note: a) Alfnes (2004), Tonsor *et 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. Bardají I. *et al.* (2009) give 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) give 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).