Valuing Information on GM Foods in the Presence of Country-of-Origin Labels

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Abstract

Information on production methods (genetic modification or organic production) and locations (country of origin) are commonly found on food package labels. Both pieces of information may be used as a proxy for food safety and quality by consumers. Our study investigates the interactive effects between information on production method and COOL by conducting choice experiments in the European Union, United States and Japan. This study also investigates the effect of information about potential benefits of biotechnology on consumer acceptance of GM foods. Results indicate that consumers preferred GM foods produced domestically to GM foods imported from foreign countries, and individuals with information on consumer benefits, producer benefits, and environmental benefits were willing to pay more than individuals without information in some cases, but the effect of information varied by type of information, location, and the country of origin of the products.

Keywords: *Genetically modified food, biotechnology, country of origin, consumer attitudes*

1 Introduction

The debate over the relative advantages and disadvantages of use/consumption of genetically modified (GM) foods has continued over decades. The dispute involves consumers, government regulators, non-government organizations, biotechnology companies, scientists, and social economists. Many social science researchers, especially agricultural economists have studied consumers' knowledge, acceptance, and preferences of GM foods, and they found that consumers' preferences vary by locations, their prior knowledge of GM technology, and the information provided in public (Hoban, 1997; Hoban and Katic, 1998; Gaskell et al., 1999; Baker and Burnham, 2001; Lusk *et al*., 2004; House *et al*., 2004). For example, Lusk *et al*. (2004) find that information on health and environmental benefits of biotechnology significantly reduces the amount of monetary compensation that consumers require to purchase GM foods. They also find that the effect of information varies with the type of information and the location of where the information is released.

Often research on consumer perception of GM foods focuses on the technology used but does not include information on country of origin. However, in the market consumers are faced with considering multiple attributes at the same time. For example, in the European Union (EU), regulations call for labeling food products containing authorized GM ingredients as well as country-of-origin labeling (COOL) for certain foods (such as fresh fruits and vegetables). Since both the GM label and location attribute can be used as a proxy for food safety and quality by consumers, the availability of COOL in the market may change consumers' attitudes towards GM foods, both with respect to their willingness to pay (WTP) for GM foods and to their response to the positive information on why producers use biotechnology. Thus, when

investigating the value the information on GM foods, adding COOL in the study may lead to a more realistic understanding of consumer acceptance of GM foods.

It is reasonable to believe that there are interactive effects between COOL and GM attributes. One reason is public trust in biotechnology from foreign countries. Consumers, particularly those in Europe, have shown health and food safety concerns about GM foods in general. When it comes to GM foods from foreign countries, these concerns may increase if consumers have greater trust in their own country's technology and regulations than in those countries that the GM foods are imported from. Thus trust in this information may vary depending on the source country. In addition, consumers' patriotism and willingness to promote their own country or local economy (Shimp and Sharma 1987) could also restrain their purchase of imported GM foods.

The goal of this paper is to investigate the interactive effect between information on COOL and production methods (GM, traditional and organic). In addition, we use different information treatments to determine if the consumers' reaction to positive information on reasons for the use of biotechnology varies with country of origin.

2 Literature Review

Many researchers have examined consumers' acceptance of GM foods and they reach a general conclusion that consumers are willing to pay premiums for GM-free over GM foods when there is no benefit information provided for GM foods (Baker and Burnham 2001; Burton et al. 2001; Lusk et al. 2001). More recently, several studies have found that information and knowledge on biotechnology could change consumers' acceptance over GM product (Lusk *et al*. 2002; Rousu *et al*. 2002; Lusk *et al*. 2004; House *et al*. 2004).

Rousu *et al*. (2002) studied both negative and positive information effects on consumers' WTP for GM foods and found that consumers who received positive information about GM foods placed higher value on some GM foods than non-GM labeled foods, consumers who received negative information about GM foods discounted the GM foods, and consumers who received both sides of information placed lower price for GM foods than non-GM foods. Lusk *et al*. (2004) pointed out that Rousu eta al. (2002) gave little insight into which specific type of information has the largest influence on consumer acceptance. Lusk *et al*. (2004) contributed to the literature by studying the effects of information about environmental benefits, health benefits and benefits to the third world of biotechnology on consumers' WTP for GM foods. By conducting auction in the United States, UK, and France, they concluded that though positive information significantly decreased the amount of money consumers demanded to consume a GM cookie versus a cookie with no GM ingredients (except for French consumers), the same information did not have the same effect in all locations.

As Frewer *et al*. (1998) pointed out, the credibility of the information sources and prior attitudes towards the technology significantly influenced individuals' reactions to biotechnology information. One should not overlook the effect of COOL on the credibility of information related with GM products. When consumers have certain prior attitudes or purchasing experiences on products from one country, the information provided by that country could also affect consumers' trust of the positive biotechnology information provided by the suppliers.

A large body of research has studied country-of-origin effects. Schooler (1965) was the first study to use empirical tests to show the influence of COOL on consumers' acceptance of

products. Since then, a growing body of literature has studied consumers' preferences for COOL. Most research confirms that consumers prefer foods produced in their own country or region (Verlegh and Steenkamp 1999; Loureiro and Umberger 2003; Loureiro and Umberger 2005; Chambers et al. 2007). For example, Loureiro and Umberger (2003) showed that U.S. consumers are willing to pay $1.53 and $0.70 per pound more for steak and hamburger produced in the United States. In their subsequent article (Loureiro and Umberger 2005), the results from a nationwide survey show that consumers are willing to pay a (relatively small) price premium for U.S. produced meat due to their concerns about food safety issues associated imported products.

Researchers have found different reasons why COOL information affects consumers' purchasing decisions. Some of them showed that country of origin is a cognitive cue; that is, consumers use COOL to infer the quality of a product (e.g., Bilkey and Nes 1982; Steenkamp 1990; Loureiro and Umberger 2007). Moreover, many studies have shown that country of origin is not merely a cognitive cue, but also has symbolic and emotional meaning (e.g., Verlegh and Steenkamp 1999; Agrawal and Kamakura 1999; Ehmke, Lusk, and Tyner 2008). They showed that COOL affects consumer behavior through country image, along with consumers' animosities,[1] ethnocentrism,[2] and trust in certificate authorities. For example, Verlegh and Steenkamp (1999) using meta-analysis found that differences in economic development are important factors underlying the country-of-origin effect. Ehmke, Lusk, and Tyner (2008) conducted a conjoint experiment in four countries at different levels of economic development and found that consumers prefer food from their own location indicating ethnocentric tendencies play a role in COOL preferences.

It has been over ten years since Lusk *et al.* (2004) conducted auctions with information treatment on consumers' preferences on GM foods in European countries and the United States in 2001. Our study conducted in six countries across Europe, Asia, and North America would reveal more information about consumers' acceptance and preference on GM products and illustrate whether attitudes have changed in the past ten years. In addition, our article contributes to the body of literature by studying the interactive effects between GM label and COOL.

3 Survey Design

3.1 Choice Experiment

Participants were randomly recruited adult primary grocery shoppers from six countries (the United States, Japan, Belgium, France, Germany, and Spain). A choice experiment in which the respondent was presented with four alternatives for purchasing fresh apples—GM, traditional, organic apples, and "I would not choose any product" was presented. For each type of apple, price and country of origin were provided. There were five different price levels within one location, and the median price was designed to be consistent with the prevailing retail market price in that location. We assigned the first three lowest price levels to GM apples, the middle three price levels to traditionally grown apples, and the highest three price levels to organic apples. Details of the price attribute are reported in Table 1. Country of origin had three levels:

[1] *Animosity* is defined as anger related to previous or ongoing political, economic, or diplomatic events.

[2] *Ethnocentrism* is defined as a belief that it is inappropriate, or even immoral, to purchase foreign products because to do so is damaging to the domestic economy, costs domestic jobs, and is unpatriotic.

China, New Zealand, and the home country. These three levels were selected represent a developing country (China), a developed country (New Zealand), and the home country. All six locations[3] produce apples, making "produced domestically" a realistic choice for consumers to consider. In total, each valid respondent completed 18 choice sets in the choice experiment. Studying different countries will help us understand whether the interactive effect is common in these countries.

Table 1. Price levels in the Choice Experiment

Location	GM	Organic	Traditional
Belgium (€/kg)	0.94	1.40	1.87
	1.40	1.87	2.34
	1.87	2.34	2.81
France (€/kg)	1.24	1.85	2.47
	1.85	2.47	3.09
	2.47	3.09	3.71
Germany (€/kg)	0.94	1.40	1.87
	1.40	1.87	2.34
	1.87	2.34	2.81
Spain (€/kg)	0.94	1.40	1.87
	1.40	1.87	2.34
	1.87	2.34	2.81
Japan (yen/kg)	249	369	492
	369	492	615
	492	615	738
The United States ($/lb)	0.99	1.49	1.99
	1.49	1.99	2.49
	1.99	2.49	2.99

3.1 Information Treatment

Each participant in the survey was randomly assigned to receive one "information treatment" or receive no information before choice experiment. Each information treatment provided one of three types of information on the reason for the use of biotechnology: consumer benefits; producer benefits; and environmental benefits as follows:

1) Consumer benefits: *In the case of biotechnology, the apple has a special protein, which increases the shelf life of the apple. Because of this method, the apple will stay fresher longer and it is less likely to have bruises (soft brown spots).*

2) Producer benefits: *There is currently an insect that transmits a disease in apples. This disease causes the apple tree to produce less, or in extreme cases, die. As a result, apple production could decrease, and the average cost of apples would start increasing. In the case of biotechnology, the apple has a special protein, which makes it resistant to this insect. This will allow apple farmers to stay in business, and keep apple prices from increasing over time.*

3) **Environmental benefits:** *In the case of biotechnology, the apple has a special protein, which makes it resistant to certain insects. This allows the farmer to use less pesticides when producing the apple. Reducing the use of pesticides is good for the environment. A lot of*

[3] In order to clarify the notation of the six countries where we conducted the survey (Belgium, France, Germany, Spain, Japan, and the United States) and the country of origin on the product labels (domestic, China, and New Zealand), in this paper "location" refers to the six countries where we conducted the survey, and "country" in COOL refers the country of origin that on the product in the choice experiment.

research shows that the usage of pesticides damages the environment and threatens the survival of many creatures in wild.

4) No information: *No information was given, participants went directly to the choice experiment.*

To ensure participants read the information treatment before making choice decisions, we added validation questions after the information treatment to check if they read the information. For example, after the consumers benefits information, we asked the following question: "In this example, biotechnology is used to increase shelf life of the apple. A. True B. False." Those who didn't correctly answer this question were removed from the study.

Furthermore, even if participants have received the information, they may suspect the correctness of the GM benefits, especially when the GM apples are imported from foreign countries. To capture this information trust issue, we directly asked a question about if they trust the biotechnology and benefits claimed for the apples from China and New Zealand. Both the validation question and the follow up trust question about the information could help us have more information about consumers' attitudes towards the information treatments.

4 Multinomial Logit Model

Consumer choice decision process is modeled within a random utility framework (Bockstael, Hanemann, and Kling 1987; Bockstael, McConnell, and Strand 1989; Kaoru, Smith, and Liu 1995). The utility level of the i^{th} product for the n^{th} respondent at a given choice occasion *t* can be written as:

(1) $$U_{nit} = V_{nit} + \varepsilon_{nit}. \quad n = 1, \dots, N, i = 1, \dots, I, t = 1, \dots, T$$

where V_{nit} is the deterministic component and ε_{nit} is the random component. ε is assumed to have an *iid* extreme value distribution.

In this article we assume the usual linear-in-parameter utility functional form that consumer n in selecting alternative i from a finite set of J alternatives at choice occasion *t* is defined as:

(2) $$U_{nit} = \beta_p p_{it} + \beta_1 O_{it} + \beta_2 COOL_{it} + \beta_3' O_{it} \times COOL_{it} + \varepsilon_{ni},$$

where p represents the price of product i, vector $COOL$ represents the dummy vector of the country of origin, and O represents the dummy vector of the operating methods of the foods (traditional, organic, and GM).

Under the assumption that ε_{nit}'s are *iid* with an extreme value distribution, the probability of consumer n choosing alternative i at given choice occasion t is given by the multinomial logit (MNL) model:

(3) $$\mathrm{Prob}(y_{nit}|\beta) = \frac{\exp(-\beta_p p_{it} + \beta_1 O_{it} + \beta_2 COOL_{it} + \beta_3' O_{it} \times COOL_{it})}{\sum_{j=1}^{J} \exp(-\beta_p p_{jt} + \beta_1 O_{jt} + \beta_2 COOL_{jt} + \beta_3' O_{jt} \times COOL_{jt})}$$

The utility parameters are not directly informative for considering consumer behavior implications. Instead, previous research usually converts them into money values (i.e., WTP). WTP estimates are derived by determining the value difference between two products with different attribute levels. In our analysis, we use choice option "none of these product" as the base in the regression. The WTP value for a certain level of attribute m compared to consuming nothing is the negative value of the ratio of the coefficient of this attribute to the price coefficient: $-\beta_m/\beta_p$.

5 Results

5.1. Samples and data

The final sample size was 1,446 with all validation questions answered correctly. Sample size per country varied (Table 2), from 176 observations in Belgium, 197 in France, 177 in Germany, 188 in Spain, 331 in Japan, to 377 in the United States. Summary statistics of selected variables in six locations are shown in Table 3.

Tables 4 - 7 report summary statistics regarding prior knowledge of GM foods, acceptance and satisfaction of domestic and imported GM foods, and whether consumers trust the benefit information claim if the GM food is imported. Before jumping into the results of choice experiments, these questions could help us understand consumers' preferences regarding the COOL and GM labels.

Table 2. Sample size by country

	Location					
	Belgium	France	Germany	Spain	Japan	USA
Consumer benefits	41	59	41	46	67	96
Producer benefits	35	49	43	43	79	91
Environmental benefits	48	42	44	49	84	94
No explanation	52	47	49	50	101	96
Total	176	197	177	188	331	377

Table 3. Summary Demographic Statistics

		Locations					
Variable	Definition	Belgium	France	Germany	Spain	Japan	USA
Age	age<=24 yrs old	28.4%	25.4%	30.0%	26.1%	21.8%	27.9%
	age 25~54	66.5%	68.0%	68.9%	72.9%	76.7%	60.2%
	age over 55	5.1%	6.6%	1.1%	1.0%	1.5%	11.9%
Edu.	Undergraduate degree or higher	68.2%	64.5%	33.9%	75.0%	64.1%	54.6%
	Other wise	31.8%	35.5%	66.1%	25.0%	35.9%	45.4%
Income	Household income >=$50,000 year	48.3%	39.6%	63.3%	34.0%	95.8%	29.7%
	Otherwise	51.7%	60.4%	36.7%	66.0%	4.2%	70.3%
Employ.	Full time job	66.5%	68.0%	76.3%	71.3%	64.7%	53.6%
	Otherwise	33.5%	32.0%	23.7%	28.7%	35.3%	46.4%
Family size	Number of family members	2.744 (1.189)	2.975 (1.423)	2.774 (1.316)	3.112 (1.115)	3.276 (1.298)	2.745 (1.385)
Children	Number of children age <=18	0.733 (0.969)	0.924 (1.138)	0.756 (1.004)	0.840 (0.869)	0.827 (0.957)	0.688 (1.107)
Obser.	Number of observations	176	197	177	188	331	377

Participant subjective (self-rated) knowledge of facts and issues concerning genetic modification was collected on a scale of one (not at all knowledgeable) to nine (extremely knowledgeable). The average scores suggest that participants considered themselves relatively unknowledgeable of facts and issues concerning genetic modification, and among all the countries, respondents from Germany considered themselves relatively more knowledgeable than respondents from other countries did.

Table 4. Subjective knowledge
1=not at all knowledgeable; 9=extremely knowledgeable

	Location					
	Belgium	France	Germany	Spain	Japan	USA
Mean score	3.852	4.045	5.215	4.606	4.668	4.140
Std. Dev.	(1.980)	(2.026)	(2.158)	(2.012)	(1.751)	(2.185)

Table 5. Importance of country-of-origin labels
1= not at all important; 5=extremely important

	Location					
	Belgium	France	Germany	Spain	Japan	USA
Mean score	3.727	3.893	3.665	3.636	3.903	3.610
Std. Dev.	(0.959)	(0.963)	(1.114)	(0.937)	(0.854)	(1.020)

The perception of the importance of COOL is summarized in Table 5. Respondents from all six countries consistently considered COOL as an important piece of information with average scores above 3.5 on a scale of one (not at all important) to five (extremely important). Moreover, when it comes to the safety concerns over fresh fruits produced domestically, in New Zealand, and in China, the average scores of satisfaction had the same pattern in all six locations: respondents were satisfied with domestic produced fresh fruits the most, followed by fruits from New Zealand, then fruit from China had the lowest satisfaction scores (Table 6).

Table 6. Satisfaction with the safety of fresh fruits from different countries
1=very dissatisfied; 5=very satisfied

	Location					
	Belgium	France	Germany	Spain	Japan	USA
Domestic country	4.204	4.178	3.910	4.401	4.021	4.090
(Std. Dev.)	(0.728)	(0.829)	(0.881)	(0.895)	(0.907)	(0.827)
New Zealand	3.657	3.429	3.411	3.457	3.549	3.344
(Std. Dev.)	(0.786)	(0.939)	(0.866)	(0.819)	(0.764)	(0.765)
China	2.602	2.327	2.659	2.690	1.612	2.681
(Std. Dev.)	(0.926)	(1.021)	(0.924)	(0.892)	(0.826)	(0.946)

This article focuses on the interactive effect between COOL and GM labels, thus when we included an information treatment on the benefits of GM foods. A further question is whether or not respondents believe the information presented, and if they feel differently about it depending on where the food was produced.Trust in the claim did vary when the food was from different countries. Respondents were asked if they trust the benefit claim if the products are imported from New Zealand or China. On a scale of one (don't trust at all) to five (trust strongly), respondents gave fairly low score (around 1.5 to 2) to products from China, and higher scores (around 2.5 to 3) to products from New Zealand.

Table 7. *I don't trust the claim* (1=don't trust at all; 5=trust strongly)

	Location					
	Belgium	France	Germany	Spain	Japan	USA
Produced in China	1.568	1.484	1.719	2.082	1.405	1.840
(Std. Dev.)	(0.822)	(0.859)	(1.023)	(1.140)	(0.641)	(1.123)
Produced in New Zealand	2.768	2.574	2.742	3.126	3.094	3.050
(Std. Dev.)	(1.318)	(1.348)	(1.447)	(1.110)	(0.882)	(1.310)

5.2 WTP Results

WTP values from the multinomial logit for GM apples produced domestically, imported from China, and imported from New Zealand are reported in Table 8. In all six locations, the order of WTP from highest to the lowest is domestic GM apples, GM apples imported from New Zealand, and GM apples imported from China. All European countries with the exception of Spain had negative WTP value for GM apples imported from China, and respondents in Japan also had negative WTP values for GM apples imported from China, indicating that those consumers would prefer consuming no apples to consuming GM apples from China under some circumstances. In all six locations, respondents were willing to pay a premium value for apples grown traditionally or organically compared (values for WTP for traditional or organic apples are not presented as the focus is GM apples).

WTP differences between groups with and without information are also presented in Table 8. The differences between the WTP values were generated by bootstrap methods with 1000 replications for each products in each group. Differences between these values are used to obtain the WTP difference and its standard deviation.

Table 8. WTP for GM apples under different information treatments

	WTP				ΔWTP		
	Consumer benefits	Producer benefits	Environ. benefits	No explanation	Diff_1[a]	Diff_2[b]	Diff_3[c]
Belgium (€)							
Domestic	3.53***[d] (0.68)[e]	2.58*** (0.44)	2.84*** (0.33)	1.47*** (0.18)	2.25*** (0.93)	1.21** (0.72)	1.44*** (0.48)
China	0.15 (0.56)	-1.39 (0.95)	-0.99* (0.58)	-0.97** (0.50)	1.07*** (0.89)	-0.68 (1.71)	-0.06 (0.91)
NZ	1.83*** (0.38)	0.42 (0.48)	1.13*** (0.24)	0.17 (0.30)	1.73*** (0.55)	0.16 (0.82)	0.98** (0.42)
France (€)							
Domestic	1.25*** (0.14)	1.90*** (0.19)	1.67*** (0.16)	2.02*** (0.17)	-0.78*** (0.23)	-0.13 (0.27)	-0.36 (0.24)
China	0.15 (0.24)	-0.83* (0.50)	-0.79* (0.43)	0.15 (0.32)	0.01 (0.41)	-1.02* (0.64)	-0.96** (0.56)
NZ	0.69*** (0.18)	0.62** (0.28)	0.52** (0.25)	1.19*** (0.21)	-0.50** (0.28)	-0.59* (0.37)	-0.67** (0.33)
Germany (€)							
Domestic	-0.69 (0.66)	1.54*** (0.20)	1.64*** (0.18)	0.18 (0.36)	-1.03 (1.96)	1.44*** (0.46)	1.53*** (0.46)
China	-2.35** (1.13)	-0.35 (0.42)	-0.23 (0.37)	-1.19* (0.65)	-1.45 (2.95)	0.92 (0.88)	1.04 (0.87)
NZ	-1.76* (0.95)	0.40 (0.29)	0.80*** (0.22)	-0.37 (0.47)	-1.66 (2.42)	0.83 (0.65)	1.26** (0.64)
Spain (€)							
Domestic	2.76*** (0.33)	2.08*** (0.16)	2.38*** (0.16)	2.15*** (0.19)	0.62 (0.47)	-0.09 (0.26)	0.22 (0.27)
China	0.69** (0.30)	0.36 (0.23)	1.45*** (0.14)	0.53** (0.25)	0.16 (0.42)	-0.17 (0.36)	0.94*** (0.31)
NZ	1.40*** (0.24)	1.14*** (0.15)	1.62*** (0.14)	1.19*** (0.19)	0.21 (0.31)	-0.06 (0.25)	0.44** (0.24)
Japan(¥)							
Domestic	520.50*** (33.12)	527.80*** (28.20)	476.75*** (31.67)	444.40*** (21.27)	53.737 (41.76)	111.818*** (38.89)	58.264 (41.09)
China	-183.04** (91.73)	-105.90 (68.42)	-150.54** (76.03)	-92.78* (56.03)	83.40*** (35.32)	-14.57 (90.99)	-63.42 (96.713)
NZ	291.26*** (35.86)	392.27*** (26.51)	341.37*** (31.74)	204.76*** (27.98)	32.35 (38.14)	189.08*** (37.44)	136.82*** (43.25)
US ($)							
Domestic	1.86*** (0.11)	2.50*** (0.12)	2.76*** (0.15)	1.59*** (0.10)	0.28** (0.15)	0.92*** (0.16)	1.18*** (0.18)
	0.73***	1.22***	1.08***	0.39**	0.34*	0.83***	0.70***

China	(0.14)	(0.12)	(0.14)	(0.17)	(0.28)	(0.20)	(0.22)
	1.20***	1.92***	2.22***	0.79***	0.43***	1.14***	1.45***
NZ	(0.11)	(0.16)	(0.12)	(0.14)	(0.19)	(0.17)	(0.18)

[a]Diff_1 is the difference between Group 1(consumer benefits) and 4 (no explanation), the mean difference and the standard deviation were obtained by 1000 times bootstrap of the contingent logit model.

[b]Diff_2 is the difference between Group 2 (producer benefits) and 4,), the mean difference and the standard deviation were obtained by 1000 times bootstrap of the contingent logit model.

[c]Diff_3 is the difference between Group 3 (environmental benefits) and 4,), the mean difference and the standard deviation were obtained by 1000 times bootstrap of the contingent logit model.

[d] * p<0.1; ** p<0.05; *** p<0.01.

[e] Numbers in parentheses are standard deviations.

All three information treatments significantly increased consumers' WTP for GM products only in the United States. All other countries had scenarios where the WTP values from information treatment groups were not significantly higher than respondents without information. In some cases French consumers' WTP for GM apples significantly lowered compared to the group without information. The results are consistent with Lusk *et al.* (2004), where they found that positive information had significantly positive effects on respondents in the United States while it had the opposite effects on respondents in France. The consistency of these results, even over time, indicates that the respondents' reaction to positive information on biotechnology has changed little in France and the United States.

For the remainder of the countries (Belgium, Germany, Spain, and Japan), information showed positive effects on respondents in some cases, but were not always significant. The magnitudes of the effects were different as well. For example, in Belgium, information on consumer benefits had positive effects of more than one euro, and for domestic GM apples, groups with this benefit information were willing to pay 2.2 euros more than the group without this information. However, for those respondents in Belgium who read information on the producer benefit, their WTP for imported GM apples was not significantly different from those who had no information at all. For respondents in Germany, the story is totally different: there was no significant effect from information on consumer benefits, but there was a significant WTP discrepancy between individuals who read about environmental benefits and who did not have any information for domestic GM apples and GM apples imported from New Zealand. In summary, the impact of positive information differed on respondents in different locations, and different types of information had different influences as well.

5.3 Tests for information effect differences

To further study the information effects across locations and country of origin, a sequence of anova tests to test the equality of WTP changes was conducted. This allows for a test of whether the information treatment affects respondents differently across location or country of origin, and if different information treatments affect equivalently. In sum, three types of tests were conducted as following:

1) Country Affect: if information had the same effect across all countries. In total, there were nine sub tests as shown in the first panel of Table 9[4].

[4] Since the currencies are different among these countries, we converted all the WTP changes into euros in order to test the

$\Delta WTP_{diff\_1}^{Belgium} = \Delta WTP_{diff\_1}^{France} = \cdots = \Delta WTP_{diff\_1}^{USA}$

2) Information Affect: Test if WTP differed in each country given different information treatments, holding location of production constant. In total, there were three tests for each location, resulting in 18 total subtests. The results are shown in the second panel of Table 9.

$\Delta WTP_{diff\_1}^{domestic\ GM} = \Delta WTP_{diff\_2}^{domestic\ GM} = \Delta WTP_{diff\_3}^{domestic\ GM}$

3) Location of Production: Tests were conducted to determine if WTP differed given the same information treatment, comparing only the location of production. The results are shown in the third panel of Table 9.

$\Delta WTP_{diff\_1}^{domestic\ GM} = \Delta WTP_{diff\_1}^{GM\ China} = \Delta WTP_{diff\_1}^{GM\ New\ Zealand}$

All the F value, p value, and the degree of freedoms for each test are reported in Table 9. All the zero p values show that the hypothesis of each equality test was rejected, indicating that each information treatment had significantly different effects across locations and country of origins and different information had different effects on the same type of apples.

Table 9. Test for differences in information effect across information treatment, country, and country of origin

Hypothesis tested		**F value**	**p value**	**Degrees of freedom**
Tests for the equality of effect of a given information treatment across country				
1. Consumer benefit information had the same effect in all locations				
1)	Domestic produced GM apples	1598.98	0.000	5
2)	GM apples imported from China	448.13	0.000	5
3)	GM apples imported from New Zealand	1220.00	0.000	5
2. Producer benefit information had the same effect in all locations				
1)	Domestic produced GM apples	2620.58	0.000	5
2)	GM apples imported from China	670.64	0.000	5
3)	GM apples imported from New Zealand	2775.74	0.000	5
3. Environment benefit information had the same effect in all locations				
1)	Domestic produced GM apples	4359.08	0.000	5
2)	GM apples imported from China	1475.24	0.000	5
3)	GM apples imported from New Zealand	3614.94	0.000	5
Tests for the equality of effect of information treatments within a given country				
1. All information treatments had the same effect in Belgium				
1)	Domestic produced GM apples	552.38	0.000	2
2)	GM apples imported from China	520.10	0.000	2
3)	GM apples imported from New Zealand	1625.02	0.000	2
2. All information treatments had the same effect in France				
1)	Domestic produced GM apples	1757.62	0.000	2
2)	GM apples imported from China	1117.13	0.000	2
3)	GM apples imported from New Zealand	65.16	0.000	2
3. All information treatments had the same effect in Germany				
1)	Domestic produced GM apples	1469.91	0.000	2
2)	GM apples imported from China	580.71	0.000	2

equality of the absolute value of WTP change across locations within one currency.

3)	GM apples imported from New Zealand	1114.56	0.000	2
4. All information treatments had the same effect in Spain				
1)	Domestic produced GM apples	1058.54	0.000	2
2)	GM apples imported from China	2439.87	0.000	2
3)	GM apples imported from New Zealand	841.94	0.000	2
5. All information treatments had the same effect in Japan				
1)	Domestic produced GM apples	633.18	0.000	2
2)	GM apples imported from China	186.78	0.000	2
3)	GM apples imported from New Zealand	1431.83	0.000	2
6. All information treatments had the same effect in the United States				
1)	Domestic produced GM apples	7782.66	0.000	2
2)	GM apples imported from China	1376.04	0.000	2
3)	GM apples imported from New Zealand	8344.62	0.000	2
Tests for the equality of effects of information treatments across COOL within a given country				
1. information treatment had the same effect across COOL in Belgium				
1)	Consumer benefit information	535.30	0.000	2
2)	Producer benefit information	649.86	0.000	2
3)	Environment benefit information	1450.35	0.000	2
2. information treatment had the same effect across COOL in France				
1)	Consumer benefit information	1605.53	0.000	2
2)	Producer benefit information	956.32	0.000	2
3)	Environment benefit information	557.89	0.000	2
3. information treatment had the same effect across COOL in Germany				
1)	Consumer benefit information	16.99	0.000	2
2)	Producer benefit information	226.93	0.000	2
3)	Environment benefit information	137.67	0.000	2
4. information treatment had the same effect across COOL in Spain				
1)	Consumer benefit information	1058.54	0.000	2
2)	Producer benefit information	2439.87	0.000	2
3)	Environment benefit information	841.94	0.000	2
5. information treatment had the same effect across COOL in Japan				
1)	Consumer benefit information	1909.37	0.000	2
2)	Producer benefit information	2832.95	0.000	2
3)	Environment benefit information	2365.03	0.000	2
6. information treatment had the same effect across COOL in the United States				
1)	Consumer benefit information	143.42	0.000	2
2)	Producer benefit information	784.47	0.000	2
3)	Environment benefit information	3731.52	0.000	2

Note: ANOVA tests of equality were conducted. The null hypotheses were rejected at 1% significance level for all tests.

6 Conclusion

Our paper studies the interactive effect between the GM label and COOL, and the effects of positive information on biotechnology on consumers' WTP for GM foods in six locations (Belgium, France, Germany, Spain, Japan, and the United States).

We found that in all six locations, consumers preferred organic or traditional growing apples to GM apples, and among GM apples, consumers preferred domestically growing apples to imported apples from New Zealand or China. Four information treatments (consumer benefits, producer benefits, environmental benefits information, and no information) were conducted in the choice experiments. For respondents from the United States, individuals' WTP for GM apples with positive information were significantly higher than those without any information; but for respondents from France, some WTP for GM apples of those who had information

treatment were significantly lower than those who had no information treatment. Anova tests rejected the equality hypotheses of the information treatment effects across location and across country of origin.

In sum, our paper studies the interactive effects between the GM label and COOL with information treatments. We believe this will add to the body of literature and generate discussion about how WTP and reaction to information differs in the presence of COOL, as well as how this differs across cultures.

References:

Agrawal, J. and Kamakura, W. A. (1999). Country of origin: A competitive advantage? *International Journal of Research in Marketing* 16 (4): 255-267.

Baker, G.A. and Burnham, T.A. (2001). Consumer Response to Genetically Modified Foods: Market Segment Analysis and Implications for Producers and Policy Makers. *Journal of Agricultural and Resource Economics* 26: 387-403.

Bilkey, W. J. and Nes, E. (1982). Country-of-origin effects on product evaluations. *Journal of International Business Studies* 13 (1): 89-99.

Burton, M., Rigby, D., Young, T. and James, S. (2001). Consumers Attitudes to Genetically Modified Food in UK. *European Review of Agricultural Economics* 28: 479-498.

Bockstael, N. E., Hanemann, W. M., and Kling, C. L. (1987). Estimating the Value of Water Quality Improvements in a Recreational Demand Framework. *Water Resources Research* 23 (5): 951-960.

Bockstael, N. E., McConnell, K. E., and Strand, I. E. (1989). A random Utility Model for Sportfishing: Some Preliminary Results for Florida. *Marine Resource Economics* 6 (3): 245-260.

Chambers, S., Lobb, A., Bulter, L., Harvey, K., and Traill, W. B. (2007). Local, National and Imported Foods: A Qualitative Study. *Appetite* 49 (1): 208-213.

Ehmke, M. D., Lusk, J. L., and Tyner, W. (2008). Measuring the Relative Importance of Preferences for Country of Origin in China, France, Niger, and the United States. *Agriculture Economics* 38: 277-285.

Frewer, L.J., Howard, C., and Shepherd, R. (1998). The Influence of Initial Attitudes on Response to Communication about Genetic Engineering in Food Production. *Agriculture and Human Values* 15: 15-30.

Hoban, T. (1998). Trends in Consumer Attitudes about Agricultural Biotechnology. AgBioForum, 1(1). Available on the World Wide Web: http://www.agbioforum.org.

Hoban, T., and Katic, L. (1998). American Consumer Views on Biotechnology. *Cereal Foods World* 43(1), 20-22.

House, L., Lusk, J., Jaeger, S., Traill, W.B., Moore, M., Valli, C., Morrow, B., and Yee, W.M.S. (2004). Objective and Subjective Knowledge: Impacts on Consumer Demand for Genetically Modified Foods in the United States and the European Union. AgBioForum, 7(3), 113-123.

Gaskell, G., Bauer, M., Duran, J., & Allum, N. (1999). Worlds apart? The reception of Genetically Modified Foods in Europe and the U.S. *Science*, 285: 384-388.

Kaoru, Y., Smith, V. K., and Liu, J. L. (1995). Using Random Utility Models to Estimate the Recreational Value of Estuarine Resources. *American Journal of Agricultural Economics* 4 (1): 141-151.

Loureiro, M. L. and Umberger, W. J. (2003). Estimating consumer willingness to pay for country-of-origin labeling. *Journal of Agricultural and Resource Economics* 28 (2): 287-301.

—— . (2005). Assessing consumer preferences for country-of-origin labeling. *Journal of Agricultural and Applied Economics* 37 (1): 49-63.

—— . (2007). A choice experiment model for beef: What US consumer responses tell us about relative preferences for food safety, country-of-origin labeling and traceability. *Food Policy* 32: 496-514.

Lusk, J. L., Daniel, M.S., Mark, D.R. and Lusk, C.L. (2001). Alternative Calibration and Auction Institutions for Predicting Consumer Willingness-to-pay for Non-genetically Modified Corn Chips. *Journal of Agriculture and Resource Economics* 26: 40-57.

Lusk J.L., Moore, M., House, L. and Morrow, B. (2002). Influence of Brand Name and Type of Modification on Consumer Acceptance of Genetically Engineered Corn Chips: a preliminary Analysis. *International Food and Agribusiness Management Review* 4:373-383

Lusk, J.L., L.O. House, C. Valli, S.R. Jaeger, M. Moore, B. Morrow, J.L. Morrow, and W.B. Traill. (2004). Effect of Information about Benefits of Biotechnology on Consumer Acceptance of Genetically Modified Food: Evidence from Experimental Auctions in United States, England, and France. *European Review of Agricultural Economics* 31: 179-204.

Rousu, M., Huffman, W.E., Shogren, J.F., and Tegene, A. (2002). The Value of Verifiable Information in a Controversial Market: Evidence from Lab Auctions of Genetically Modified Food. Department of economics Series, Working Paper 02003. Ames, IA: Iova State University.

Schooler, R. D. (1965). Product bias in the Central American common market. *Journal of Marketing Research* 2 (4): 394-397.

Shimp, T. A. and S. Sharma. (1987). Consumer ethnocentrism: Construction and validation of the CETSCALE. *Journal of Marketing Research*, 26:280-89.

Steckel, J.H. and W.R. Vanhonacker (1988). A Heterogeneous Conditional Logit Model of Choice. *Journal of Business and Economics Statistics*, 66(30): 391-398.

Steenkamp, J. B. E. M. (1990). Conceptual model of the quality perception process. *Journal of Business Research* 21 (4): 309-333.

Verlegh, P. W. J. and Steenkamp, J. B. E. M. (1999). A review and meta-analysis of country-of-origin research. *Journal of Economic Psychology* 20 (5): 521-546.