

Is There a Market for Genetically Modified Foods in Europe? Contingent Valuation of GM and Non-GM Breakfast Cereals in the United Kingdom

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Our study provides a descriptive analysis of contingent valuation survey data to examine whether there is market for genetically modified (GM) foods in the European Union (EU). Thus far, consumers in the EU have not had opportunities to make choice between GM and non-GM foods largely because food manufacturers and retailers have not offered GM foods in the supermarkets. However, with the European Union likely to replace the current moratorium on approving GM crops with mandatory labeling and traceability with 0.9 % tolerance level, consumers in the EU may see GM food products in the supermarkets. Using CV survey data collected in the United Kingdom (UK), two types of UK consumers who will choose GM over non-GM foods were identified: (a) consumers who embrace GM technology, and (b) consumers who are price conscious.

Key words: contingent valuation survey, market for GM food, UK consumers.

Introduction

Public concerns about potential risks that genetically modified organisms (GMOs) may pose for human health and environments have stirred unprecedented turmoil and disarray in domestic and international food supply chains (Josling, 2000; Sheldon, 2001; Zepeda, 2001). The controversy over GMOs is believed to have originated from the European Union (EU), a part of the world already devastated from food-related scares such as mad cow disease. To mollify consumers' concern about foods, in 1998 the EU imposed a moratorium that precluded approval of new genetically modified (GM) crops. As a result, ever since the EU approved Roundup Ready soybean and Bt corn several years ago, more recent versions of GM crops (such as Roundup Ready and Yieldgard Rootworm corn) remain unwelcome in EU markets.

Evidence available thus far does not support the alleged health and environmental hazards attributed to GMOs. In fact, dissatisfied with the slow progress of the EU in eliminating the moratorium, the United States and other countries (including Argentina, Canada, and Egypt) announced in May 2003 that they would begin to file a formal World Trade Organization dispute to resolve the EU's moratorium on GM crops. The EU has been finding it increasingly difficult to justify its moratorium under these circumstances. Finally, in July 2003 the European Parliament approved mandatory traceability and labeling legislation as a preliminary step toward eventual replacement of the current moratorium.

Food manufacturers and food retailers in Europe have historically avoided GM foods, in line with the prevailing popular sentiment there against agrobiotechnology. That is, European food supply chains strategically decided to focus on non-GM foods instead of allowing consumers to independently choose between non-GM and GM foods (Kalaitzandonakes & Bijman, 2003). However, the new policy regime may signal to European food manufacturers and retailers that GM foods are acceptable and marketable. In fact, Muth, Mancini, and Viator (2002) indicate that food manufacturers' decisions regarding GM ingredients are influenced by the regulatory environment—particularly approval and labeling rules. Should GM foods be introduced in the supermarkets in Europe, retail prices may differ between non-GM and GM foods, with the magnitude of the difference equal to or higher than the costs of segregation and labeling. Some food manufacturers and retailers may offer GM foods in order to entice price-conscious or GM-technology-embracing consumers. European consumers will then truly have the opportunity to choose between non-GM and GM food products.

Given this potential policy shift, our study probes into how consumers in the United Kingdom would behave when faced with the choice between GM and non-GM breakfast cereals in the supermarkets. Previous research using contingent valuation or choice experiments have estimated willingness-to-pay for non-GM foods (Baker & Burnham, 2001; Burton & Pearse, 2003; Burton, Rigby, Young, & James, 2001; Chern, Rickertsen, Tsuboi, & Fu, 2003; Moon & Balasubramanian,

2003). Although these studies are useful in understanding consumer demand for non-GM foods, they offer relatively little insight into consumers who are willing to purchase GM foods. We use contingent valuation (CV) survey data collected in the United Kingdom to identify potential markets for GM foods.

Survey Design and Data Collection

A contingent valuation (CV) survey instrument was designed to measure behavioral intentions with a focus on consumers' willingness to pay a premium for breakfast cereals made of non-GM ingredients and willingness to accept a discount for breakfast cereals made of GM ingredients. The surveys were administered in December 2000 in the United Kingdom using household panels maintained by the National Panel Diary (NPD) group, a marketing consulting firm specializing in research on consumer behavior and food marketing. The survey instrument was administered to consumers in the United Kingdom using online methods (see Moon & Balasubramanian, 2003, for more information on the online survey method). Questionnaires were sent to about 9,000 participants of the online panel via electronic mails; 2,568 consumers completed the online survey within the next seven days. Table 1 shows the distribution of demographic characteristics, including education, income, gender, and age of UK respondents.

Measuring WTP and WTA

Contingent valuation questions are included in the survey instrument in the form of willingness to pay (WTP) and willingness to accept (WTA) in an effort to improve our understanding of consumer preferences about non-GM/GM breakfast cereals. In our survey instrument, respondents were asked to consider the following situation:

Consumers might have to pay a higher price for non-GM foods due to the costs of segregation in the production and marketing system plus the additional costs of testing, certification and labeling non-GM foods. Suppose that you walk into a grocery store and want to buy breakfast cereals. The grocery store carries breakfast cereals (e.g., corn flakes, frosted flakes, or corn pops) of two types: (1) made from GM crops, and (2) made from conventional non-GM crops.

Table 2 shows three different types of contingent valuation questions asked to respondents in relation to

Table 1. Distribution of demographic variables for UK consumers.

Variables	Description	Mean	Standard deviation
Education	1=grade school; 2=some high school; 3=graduated high school; 4=some college; 5=graduated college; 6=postgraduate	4.28	1.28
Age	Actual age (years)	34.3	11.5
Gender	1= male; 0=female	0.58	—
Income	1=<\$14,999; 2=\$15,000–\$24,999; 3=\$25,000–\$29,999; 4=\$30,000–\$34,999; 5=\$35,000–\$39,999; 6=\$40,000–\$44,999; 7=\$45,000–\$49,999; 8=\$50,000–\$59,999; 9=\$60,000–\$74,999; 10=\$75,000–\$99,999; 11=>\$100,000	5.95	3.45

Table 2. Contingent valuation questions for breakfast cereals in the United Kingdom.

Question format	Contingent valuation questions
Closed-ended WTP	Suppose that the price of breakfast cereals made from GM crops is \$4.00 per box and the price of conventional non-GM breakfast cereals is \$X per box. Would you be willing to pay the \$Y higher price to purchase a box of conventional non-GM breakfast cereals? (X ranges from \$4.10 to \$7.00; Y ranges from \$0.10 to \$3.00.)
Payment card WTP	Suppose the price of breakfast cereals made from GM crops is \$4.00 per box. The price of conventional non-GM breakfast cereals will be higher than \$4.00, but is not determined yet. What is the most above the current price of \$4.00 you would be willing to pay to purchase a box of conventional non-GM breakfast cereals? (The payment card ranges from \$0.00 to \$3.00 or higher.)
Payment card WTA	Suppose the prices of breakfast cereals of both types are identical at \$4.00. The grocery store offers a discount to promote the sales of GM breakfast cereals. What is the minimum amount of discount below the current price of \$4.00 that would make you want to purchase a box of GM breakfast cereals? (The size of discount ranges from \$0.00 to \$3.00 or higher.)

the above hypothetical situation in the grocery store. The CV questions included (a) closed-ended format WTP, (b) payment card format WTP, and (c) payment

card format WTA questions. Although these questions were originally designed to assess how strong UK consumers' preferences were for non-GM food products, our focus in this paper is to use UK consumers' responses to the above three CV questions along with follow-up questions (to be explained later) to infer whether there is a potential market for GM foods in the UK. More specifically, we attempt to identify two types of UK consumers who will consume GM food products: (a) GM-technology-embracing consumers, and (b) price-conscious consumers. The first category refers to consumers who do not oppose GM foods, whereas the second segment of consumers are those who are willing to buy GM foods to avoid paying potentially higher prices for non-GM foods.

Data Analysis

Prior to asking closed-ended and payment card WTP and WTA questions, two preliminary questions were posed in relation to a scenario involving breakfast cereals of two types: (a) made from GM crops, and (b) made from non-GM crops. The first question asks respondents: "Which would you choose between the two types of breakfast cereals if the prices of both types were identical at \$4.00 per box?" Respondents were given four options: (a) no preference, (b) breakfast cereals made from GM crops, (c) breakfast cereals made from non-GM crops, and (d) don't know. Table 3 shows that a majority of UK consumers (71%) prefer to purchase non-GM foods. Whereas only 2% indicated that they would buy GM foods, 23% of UK respondents responded that they had no preference between GM and non-GM foods.

The second question asked respondents: "Would you be willing to pay a premium if it costs more to purchase conventional non-GM than GM breakfast cereals?" Respondents were given three options: (a) yes, (b) no, and (c) don't know. When compared to the responses to the first question, the percent of UK consumers who would choose non-GM foods decreased measurably from 71% to 56%, while the percentage of don't know respondents increased from 4% to 22%. These changes suggest that a premium for non-GM foods would encourage a significant portion of consumers to choose lower-priced GM foods and make some consumers' preferences about GM/non-GM foods indeterminate (Moon & Balasubramanian, 2001).

The closed-ended format asked respondents if they would be willing to pay a particular amount of premium for a box of breakfast cereals (with a base price of

Table 3. UK consumers' purchase intentions between GM and non-GM breakfast cereals.

(1) No premium with non-GM foods: Which would you choose when the prices are identical between GM and non-GM foods?	(2) Premium with non-GM foods: Would you be willing to purchase non-GM breakfast cereal when it costs more?
(1) Non-GM breakfast cereals	71% (1) Yes 56%
(2) GM breakfast cereals	2% (2) No 22%
(3) No preference	23% (3) Don't know 22%
(4) Don't know	4%

Table 4. Distribution of responses for closed-ended CV question.

Premium sizes (\$)	Yes (%)	No (%)	Don't know (%)	Number of respondents
0.10	73.8	13.9	11.8	237
0.20	68.0	17.8	14.3	259
0.30	58.0	24.2	17.7	231
0.40	58.5	27.4	14.2	212
0.50	56.0	25.3	18.7	225
0.75	41.6	40.7	17.7	226
1.00	36.8	36.8	26.4	258
1.50	33.5	45.4	21.2	260
2.00	26.9	47.6	25.5	212
2.50	26.7	50.7	22.6	221
3.00	18.1	55.9	26.0	227
Overall	45.5	34.9	19.6	2,568

\$4.00) made of non-GM crops (Hanemann, 1984). The size of the premium was varied across respondents from \$0.10 to \$3.00. Respondents were given three options: (a) yes, (b) no, and (c) don't know. The last option captures respondents who believe that agrobiotechnology issues are inherently uncertain or feel that they do not have enough knowledge to form opinions on the issues. Table 4 presents the distribution of responses for each size of premiums for UK consumers. It clearly indicates that the percentage of respondents in the UK who are willing to pay a premium decreases as the size of premium is raised. For example, when the size of premium is \$0.10, only 13.9% of respondents indicated that they would not buy non-GM foods, whereas more than half of respondents (55.9%) said so when the size of premium was \$3.00.

Consumers who said "no" to the closed-ended CV questions can be grouped into three possible cases: (a) consumers who prefer GM and non-GM foods about equally, (b) those who think that the difference in price

Table 5. Distribution of responses to the follow-up question to the closed-ended question.

Question: ^a Which of the following best describes your opinion?			
Options	% of "no" responses (34.8%)	% of all respondents	Characterization
Prefer GM & non-GM about equally	37.8%	13.3%	GM technology embracing
Price is too high	40.0%	13.8%	Price conscious
GM foods are not necessary	22.2%	7.7%	Protest responses
Sum	100%	34.8%	

^a This question is asked only to those who answered "no" to the closed-ended CV question.

between GM and non-GM foods is too high, and (c) those who protest the idea of paying a premium for GM foods (i.e., who think that GM foods were not necessary from the beginning). A follow-up question was asked to identify these three groups. Respondents who answered "no" to the closed-ended question were asked to choose one of the three options that best described their opinions: (a) "I am not willing to pay more for conventional non-GM foods because I prefer non-GM and GM foods about equally;" (b) "the difference in price is too high;" or (c) "I am not willing to pay more for non-GM foods, because I believe that GM foods were not necessary from the start, and government should guarantee the availability of non-GM foods at the same price as before the biotechnology was introduced to the crop production."

Overall, 34.9% of respondents answered "no" to the closed-ended CV questions with various sizes of premiums. Table 5 presents the distribution of responses to the follow-up question, highlighting two groups of UK consumers: (a) GM technology embracing and (b) price conscious. Nearly 38% (out of the 34.9% "no" responses) chose the first option, indicating that about 13% (38% * 34.9%) of all UK respondents preferred GM and non-GM foods equally (GM technology embracing). Another 40% (out of the 34.9% "no" responses) indicated that the difference in price is too high. This group (13.9% = 40% * 34.9%) represents consumers who are price conscious and likely to buy GM foods when it costs more to purchase non-GM foods. About 6.5% of all respondents protested the idea of paying a premium for non-GM foods.

Table 6. Distribution of responses for payment card WTP and WTA formats.

Premium/discount (\$)	Percent of respondents for WTP (%)	Percent of respondents for WTA (%)
0.00	16.80	16.0
0.10	3.77	2.6
0.20	4.59	1.8
0.30	8.33	3.0
0.40	4.75	1.9
0.50	6.93	3.1
0.75	8.91	4.1
1.00	4.94	3.7
1.25	2.57	2.3
1.50	6.54	7.0
1.75	0.46	0.8
2.00	1.79	2.9
2.50	0.73	1.6
3.00 or higher	7.04	30.2
Don't know	21.70	19.0
Total	100.00	100.0

Contingent valuation questions in the form of payment cards contain an ordered set of threshold values (Cameron & Huppert, 1989). The payment card for this study includes various sizes of premium ranging from \$0.00 to \$3.00 for a box of breakfast cereals (with a base price of \$4.00) made of non-GM crops and identical range of discount for WTA measure. In this approach, consumers are asked simply to go over the range of values and to circle the highest amount they would be willing to pay.

Table 6 presents the distribution of WTP responses (second column) across the range of premiums for UK consumers. Nearly 17% of respondents selected \$0.00 as a size of premium to purchase non-GM breakfast cereals. Such respondents were asked a follow-up question to distinguish between respondents who embrace GM technology and those who protest the idea of paying premium for non-GM foods. Note that the payment card format does not detect price-conscious consumers, because respondents were given a wide range of prices instead of a single price (as in the closed-ended format). Two options were given: (a) "I am not willing to pay more for conventional non-GM foods, because I prefer non-GM and GM foods about equally;" or (b) "I am not willing to pay more for non-GM foods, because I believe that GM foods were not necessary from the start, and government should guarantee the availability of

non-GM foods at the same price as before the biotechnology was introduced to the crop production.”

The first option represents respondents who embrace GM technology, whereas the second option represents protest responses. About 70% out of those who selected \$0.00 (11.9% = 17% * 70% of all UK respondents) chose the first option, indicating that they do not oppose GM foods. This group is likely to choose GM foods when faced with the choice between non-GM and GM foods in the supermarkets. About 5% of all responses were identified to be protest responses.

Finally, the CV question was asked in the form of willingness-to-accept (WTA). In an effort to assess whether the portion of consumers who indicated they are willing to buy GM foods are robust across these two types of questions, our study examined consumer responses to the WTA question. Table 6 shows the distribution of WTA and WTP responses. About 16% of respondents selected \$0.00 as the size of discount (compensation) that would motivate them to purchase GM foods, indicating that they do not perceive GM foods as inferior to non-GM foods. More than 30% of UK respondents responded that they would need a discount of at least \$3.00 or higher to purchase GM foods. This group is likely to represent consumers who strongly oppose GM foods and who do not perceive GM foods as substitutable with non-GM foods. However, about 33% of respondents indicated that they would be willing to substitute GM foods with non-GM foods at some discounts ranging from \$0.10 to \$2.50. The percent of consumers who seek GM foods increased from 2.6% to 33%, as the premium of non-GM foods increased from \$0.10 to \$2.50.

Conclusions

This research provided a descriptive analysis of CV data in relation to consumer demand for GM and non-GM breakfast cereals in the United Kingdom. Our analysis shows that there is a non-negligible percentage of the UK population who are willing to buy GM foods if they become available in supermarkets—38% from the preliminary questions; 33% from the closed-ended CV question; 17% from the payment card WTP question; and 16% from the WTA question. The CV survey included follow-up questions that enabled us to further divide such consumers into two groups: (a) GM-technology-embracing consumers, and (b) price-conscious consumers. The percentage of consumers who are willing to consume GM foods from payment card format WTP and WTA questions was smaller when compared

to preliminary and closed-ended formats, because the former do not identify the price-conscious group of consumers.

Follow-up questions to closed-ended format disclosed that 13.3% of respondents could be characterized as GM technology embracing and 13.8% as a price-conscious group of consumers. The former refers to segments of consumers who support GM technology and are willing to consume GM foods at no discounts. The latter group represents consumers who would buy GM foods only if non-GM foods are costlier than GM foods. Although the percentage of consumers embracing GM technology are likely to be predetermined at a point in time, the percentage of consumers who will purchase GM foods due to potentially lower prices will hinge on the price differential between non-GM and GM foods or the magnitude of the premiums that non-GM foods may command.

In conclusion, our analysis of contingent valuation data predicts that food products made of genetically modified ingredients have a place in supermarkets in the United Kingdom. The recent decision of the European Parliament to adopt mandatory labeling and traceability to ultimately replace the moratorium on approval of new GM crops represents a significant change in the regulatory environment. The critical question is whether European food manufacturers and retailers take the policy change as a positive signal that GM foods are acceptable and offer GM foods to European consumers.

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