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Consumer's Attitude Towards Labeled and Unlabeled GM Food Products in Italy

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Abstract

Based on survey data collected on a sample of 500 Italian consumers, this paper evaluates the consumer's attitude towards foods obtained from the application of biotechnologies and foods labeled as "GM free". Results from the application of probit models shows that the probability to purchase GM products is lower for individuals more adverse to risk, older, with higher education and less confident in institutional guarantees. Willingness to Pay for GM free products is positively related to information, risk aversion, age, trust in institutional environment, negatively to the degree of agreement with the application of biotechnologies.

Introduction

The cultivation of biotech crops is continuously expanding worldwide. According to the International Service for the Acquisition of Agri-biotech Applications (ISAAA), 58.7 million hectares were planted with Genetically Modified (GM) crops in 2002, an increase of 12% over the previous year. United States (66.4%), Argentina (23.0%), Canada (6.0%) and China (2.1%) have the largest world share of transgenic crops.

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Also new countries are emerging: in 2002, India, Colombia and Honduras grew biotech crops for the first time.

The development of biotechnologies in the agricultural sector and in the food industry has offered the opportunity to increase crop and animal productions, to decrease production costs and to improve food quality and food safety, but on the other hand poses the important problem of their acceptance by consumers. In a previous study for Italy, Boccaletti and Moro (2000) showed that consumers had a low degree of knowledge of the issue, but an overall positive attitude towards GM foods. However, recent food crisis in Europe, such as "mad cow" or "dioxin chicken", as well as the generally more negative attitude versus biotechnologies have lowered those consumers positive feelings. Especially when compared for example to American consumers (Hoban, 1997). These crises have also contributed to decrease consumer's trust in science and public institutions and increase the coverage of media on food safety problems.

Moreover, as a response to public concern about food safety, the European Union (EU) regulation requires labeling of foods as GM when containing more than 1% of GM ingredients (Regulations 49/2000/EC and 50/2000/EC of 10 January 2000). This is in line with a precautionary approach that led the EU to formally ban the approval and commercialization of new GM products in Europe (Sheldon, 2002)[1]. Also some agribusiness firms and retail chains decided to voluntary label their products as "GM free", therefore sustaining the costs of control and preservation of the identity of non-GM products. The consumer is likely to react differently to the two labeled products. Among the factors that will influence the purchasing decision, the quality attributes of the product and factors such as brand equity and store loyalty will play a central role.

The aim of this study is two-fold:

- to assess the evolution over time of consumer's knowledge about GM products in Italy, describing in particular the perception of advantages and problems related to the biotechnology application;
- to evaluate the consumer's attitude towards foods obtained from biotechnologies and those labeled as "GM free", where the measure of this attitude entails the elicitation of the individual Willingness To Pay (WTP) for both branded and unbranded products.

[1] According to the European Commission, specific rules on Genetically Modified Organisms (GMOs) for human consumption were introduced in 1997, in the Regulation on Novel Foods and Novel Food Ingredients (258/97/EC of 27 January 1997). The Regulation sets out rules for authorisation and labelling of novel foods including food products containing, consisting or produced from GMOs. Under this Regulation no products consisting of or containing live GMOs have so far been authorised. Several products derived from GMOs such as flour, starch or oil from a GM maize are authorised to be placed on the market following a notification to the Commission.

Survey and sample

The analysis is based on data available from a survey, conducted in October 2002, with personal interviews on a sample of 500 Italian consumers. Interviews were conducted in the province of Piacenza, located in the region Emilia-Romagna in the North of the country. Following some recent work on the subject (Ferguson et al., 2002, Hossain et al., 2002, Boccaletti and Moro, 2000), the main features of the questionnaire can be classified in four sections:

Section I: Assessment of the degree of individual knowledge about biotechnologies.
Section II: Assessment of individual attitudes toward biotechnology application, public institutions, and labeling.
Section III: WTP elicitation for "GM free" and "GM" labeled product. For both types of product the influence on WTP of the brand /private label is evaluated.
Section IV: socio-demographic characteristics of respondents.

The first purpose of the paper is basically addressed in sections I and II of the questionnaire and the elicitation of WTP in section III.

The evaluation of the individual knowledge follows the approach of Hossain et al. (2002): to obtain an objective measure, a set of simple questions about biotechnology were asked to the respondents. Given the constraint of questionnaire length, the questions were limited to three cases: "did you heard about GMO?", "do you know the meaning of GMO?", and a multiple choice question where only one answer was correctly defining the difference between conventional and GM products. After this initial section and before proceeding with the questionnaire, the person was correctly informed about the meaning and characteristics of the biotech technology. The information given about biotechnology had to be carefully selected in order to avoid biased answers. Hence, only the method of obtaining GM organisms was explained and comments about properties of GM food and consequences of biotech application were carefully avoided[2].

The assessment of individual attitudes toward biotechnology can be divided in four parts:

1. *Evaluation of public opinion towards properties of GM technology application*. Following Ferguson et al. (2002) eight different attributes were identified: higher nutritional value, higher production, higher quality and taste, disease resistance, lower food cost, application on plants, animals and microorganisms. A scale from 1 to 10 was used, with 1 being very unfavorable and 10 being very favorable.

[2] A GM food was defined as "produced form plants and animals containing within their DNA genes introduced using laboratory techniques. These genes can change specific characteristics of plants and animals".

2. *Assessment of the perceived risk linked to the biotechnology application*. In this case respondents were asked to rank the incidence of GM products on human health and the environment using a scale from –5 to +5, where the negative sign indicates negative effects.

3. *Assessment of the level of trust in public institutions*. This was measured, using a scale from 1 to 10, with questions related to the trust on government regulatory ability and the behavior of researchers and firms.

4. *Assessment of the level of confidence in "GMOs-free" labeling*. Respondents were asked to choose which of the following options they would prefer in terms of reliability as guarantees of the statement "GMOs-free" on a product label (two answers were allowed): government permits the sale, government is controlling, independent institutions are controlling, the brand is trustworthy, the store is trustworthy.

The evaluation of the previous attitudes can reveal important factors influencing the WTP for GM food. This will be underlined in the discussion of the results.

Elicitation of WTP can be conducted using alternative Contingent Valuation methods: continuous elicitation, either open ended or assisted (bidding game, payment card), or discrete (dichotomous choice, where a subject responds yes or no to a hypothetical question about paying a specified price for the product). The choice depends on the type of survey, for example if the goods are already marketed a discrete elicitation may be preferred, while for virtual goods continuous elicitation may be better, even if it requires a higher effort by interviewers (Buzby et al., 1995; Fox et al., 1995).

We decided to apply an assisted continuous method, where respondents were initially asked if they would buy the product. If so, respondents were asked to rate their WTP choosing among 5 classes of price premiums for "GMO free" products: less than 5%, 6 to 10%, 11 to 15%, 16 to 20%, 21 to 25% and greater than 25%. In the case of products where the presence of GM ingredients is explicitly indicated, four classes of price discount were proposed: less than 5%, 6 to 10%, 11 to 15%, and greater than 15%. In this case the discount represents a sort of Willingness To Accept (WTA) GM foods. WTPs for GM-free and GM products were both elicited separately for unbranded (generic) and branded products, leading to four final options. First, the respondent was asked to evaluate his WTP for a generic product and successively for a branded one. The latter question was similar to the former, but it was stressed that we referred to the brand that the respondent would usually purchase or to the private label of his usual grocery store.

Socio-demographic characteristics were collected in the final section of the questionnaire. They included information on place of residence, family size, presence of children under age 14, number of employed individuals in the family, number of retired components, age, gender, education, employment status of the respondent, and family income level. For this last information four income intervals were proposed.

Data description and summary statistics

Table 1 provides summary statistics of the socio-demographic characteristics of the sample. Of the 500 interviews, 41 were excluded from the sample because of unreliable responses in some consistency check questions or because they were identified as having yea- or nay- saying patterns or middle-of-the-road- patterns (Burns and Bush, 2000).

Respondents were almost equally distributed in gender, had an education mainly at the high school level, covered different types of employment status, and had a median age between 40 and 49 years. They were mainly usual shoppers, given that part of the interviews were conducted outside grocery stores. More than half of the interviewed persons live in urban areas. The average family size is 3.4 and in less than one third of the households there are children. Most of the respondents willing to declare their monthly family income indicated the class from 1,300 to 2,600 euros. However, the data show a high rate of non-responses, over 50%: there have probably been some problems in the way the question was defined or posed by the interviewers.

Compared to the survey of 1999 by Boccaletti and Moro (2000), relative to the same province, the degree of knowledge about biotech is much higher. In the present survey almost 70% of the respondents heard about GM organisms (table 2), while in 1999 the percentage was only 51%. Moreover, 65% of respondents know the meaning of the GMO acronym and also that it refers to DNA artificial transfer.

The reliability of a GM-free label on food seems to depend mostly on the presence of an external certifying institution (table 3). Moreover, almost 30% of respondents trust the government ability to control, while the percentage is much lower when the confidence is linked to the brand or to the store. An interesting result is that at least 20% of the sample declared they would never trust such labels.

Table 4 shows the different attitudes and how biotechnology is perceived by the consumer. Respondents associate GM foods mainly to higher production levels and improved pest resistance, while properties such as nutritional value and quality are seen as having a very low impact. This underlines the fact that biotechnologies are generally viewed by the public as a method to reduce production costs, mainly at the

farm and processing levels, and not as a technology addressed to a better satisfaction of consumer's needs. This perception is consistent with the characteristics of the first wave of biotech innovations.

The attitude towards biotech utilization shows how consumers view with more favor the application on plants, while that on animals is seen with much more concern. Consumers are also not neutral about the consequences of GM utilization: in a scale from –5 to +5 (where +5 is the maximum positive effect and –5 is the maximum negative effect) the median respondent indicated the value of –2. Moreover, more than 20% indicated the maximum negative effect and 17.6% were neutral. These results are very different to those previously published by Boccaletti and Moro (2000), where 46% of respondents indicated a positive attitude towards biotechnology and less than 30% declared a negative attitude, a result that reveals a likely change in the public perception of GM foods in the past 3 years.

One last element of table 4 is the evaluation of consumer's trust in the institutional environment, including firms, government, and scientists. Scores were generally low, in particular for firms, indicating a general distrust of respondents. This may also stem from the food scandals registered in Europe in recent years.

Model estimation

The second objective of this study is to identify and estimate the effects of consumers' socio-economic characteristics and attitude towards GM products on their WTP for GM and GM free foods. This analysis of the WTP results from direct elicitation was based on econometric techniques. The discrete structure of the dependent variables implied the adoption of either binomial or multinomial probit/logit like procedures. For the dichotomous NP variables a binomial probit model was applied. Instead, the WTP dependent variables present an ordinal ranking; therefore, when they were included in the estimated models, the ordered version of probit was applied (Greene, 1990). The TSP econometric software was used for estimations.

Dependent variables

Table 5 provides all the dependent variables used in the estimated models with the percent distribution of respondents across the different modalities. NP^G and NP^B are dichotomous variables for the never purchase (1) and purchase (0) decision. Respondents were informed that the use of GM ingredients allows lower production costs. The attitude towards generic or branded food items seems to be about the same: in both cases, a slight majority of the respondents (51.20% and 52.29% respectively) would not buy GM products at any price conditions.

WTA^G and WTA^B refer to the willingness to accept generic or branded GM products

for those respondents who do not preclude the purchase of GM food. They indicate the discount applied to regular price at which the lower utility from the consumption of GM foods would be compensated by a price discount, i.e. the reduction necessary to accept a GM product. The distribution shows two peaks, at 6-10% and more than 15% discount rate levels. This result clearly emphasizes that more than one fourth of the respondents in the group of potential purchasers of GM foods would buy only if a relatively large discount is applied. Which in turn implies that only those genetic technologies with a strong impact on production costs may result in a large-scale commercial use.

Moreover, respondents do not perceive the presence of a leading brand as a guarantee, i.e. as a signal for product "safety". This is probably one of the reasons behind the current behavior of both food producers and supermarket chains in Italy, which guarantee the absence of GM components rather than trying to introduce them.

WTP^G and WTP^B capture this "guarantee" effect: they represent the willingness to pay for GM free generic and branded products respectively. Apparently, respondents do not believe that the actual institutional environment can guarantee with a sufficient degree of reliability the absence of GM ingredients: more than 45% would not pay anything more than regular price for guaranteed GM free products, and another 40% would not pay more than a 10% premium.

Independent variables

The economic literature indicates that WTP generally depends on socio-demographic factors such as income, education, demographic characteristics, place of residence. Moreover, specific studies on the acceptance of agricultural GM food products suggest that other factors are also crucial: degree of knowledge/information, attitude towards risk (Caswell et al., 1994). In our survey, in addition to these factors, we also included three other variables that in the recent literature on public perception of GM food are considered crucial (Hossain et al., 2002). They are trust in the institutional environment, the perception of GMOs usefulness and a measure of the individual agreement with the application of GMOs. All these factors clearly have a potential impact on the decision to buy or not GM food and on the probabilities of choosing a particular WTP range.

In order to offer a measure of these qualitative variables, we constructed a series of five additive indexes from the questions posed in the questionnaire, simply adding the scores obtained from the answers and normalizing the result to a 0-1 range. Referring to the items in tables 2 and 4, the indexes were obtained from the following questions:

Know: 2.1 + 2.2 + 2.3
Risk: 4.9 + 4.10
Trust: 4.11 + 4.12 + 4.13
Useful: 4.1 + 4.2 + 4.3 + 4.4 + 4.5
Agree: 4.6 + 4.7 + 4.8

All the other explanatory variables refer to the socio-demographic characteristics of respondents provided in table 1.

Empirical results and discussion

In the end, six different models were chosen and estimated. Two of them regarded the "never purchase" decision for both generic and branded GM foods, two the negative WTP (or WTA) that the respondent would accept in order to buy generic or branded GM foods, and finally two modeled the WTP to avoid GM foods, i.e. the price premium that respondents would pay for GM free generic or branded products.

Model significance was verified calculating the chi-square statistics resulting from doubling the log-likelihood ratio between the restricted (all parameters but the constant set equal to 0) and unrestricted models.

Results of the probit analysis for the decision buy/not buy GM food are provided in table 6. The dependent dichotomous variables show the respondent's intention to purchase (0) or not purchase (1) a GM generic food product (model 1) or a branded food product (model 2). Both models were of good fit: the likelihood ratio test calculated between the restricted (zero coefficients) and unrestricted model is highly significant ($p<0.01$).

In model 1, most of the estimated coefficients were significantly different from 0: RISK, TRUST and AGE at the 0.01 level, EDU at the 0.05 level and KNOW at the 0.1 level. The expected positive sign of RISK supports the hypothesis that the probability to exclude GM foods from the consumer's purchase increases as his attitude towards risk increases. In fact, higher values of the risk variable indicate a more negative perception of the effects of GM products on human health and on the environment. A positive coefficient also characterises AGE and EDU: older individuals show higher probability of refusing GM products, and the same is true for respondents with a higher level of education. The negative sign of TRUST allows a straightforward interpretation, because higher levels of trust in government. Producers and scientists seem to decrease the individual probability to avoid GM foods. The implication is that respondents feel confident with the guarantee offered by the institutional environment, which will prohibit the use of unhealthy GMOs in food products and will inform final consumers on the products containing (safe) GM ingredients. The inverse relationship between the respondent's degree of knowledge

on GMOs (KNOW) and his intention to purchase could be supported by the idea that informed individuals are probably aware not only of the uncertain negative consequences of GM products, but also of the certain benefits from the use of the technology. They are therefore are more willing to purchase GM foods.

In model 2, the direction of all the effects is the same as in model 1, but the relevance of the explanatory variables differs: RISK, TRUST and KNOW, have about the same impact as in model 1. The only difference is that the degree of education (EDU) is not significant: probably the brand is an easily readable signal and therefore it reduces the educational requirement for the decision to purchase GM foods. In other words, it simplifies the consumer's perception process.

For qualitative choice models, the estimated coefficients should be interpreted in the sense that they affect the probability that a certain event would occur. In order to extract this effect, marginal probabilities (probability derivatives) must be calculated. For the two dichotomous models they are provided in table 6 (marginal effects): the two marginal effects, one for each modality of the dependent variable, are clearly symmetric with opposite signs and therefore only one is shown (an increase in the probability of one modality is reflected in a decrease in the probability of the other modality). RISK is the variable with the largest effect in both models.

Results of the ordered probit analysis for the willingness to accept and willingness to pay models are provided in table 7. In all cases, the likelihood ratio test is highly significant ($p<0.01$). Marginal effects can be calculated also in the case of multinomial dependent variables, but they are of difficult interpretation and therefore not provided. Moreover, estimated coefficients for normalized explanatory variables, such as the five indexes included in our models, are comparable.

Models 3 and 4 evaluate the WTA GM food products for those respondents not excluding a priori the possibility of purchase. Only TRUST and AGE achieve a sufficient degree of statistical significance for generic food products: younger people are willing to accept a higher compensation for buying GM products, and the same is true for individuals with a lower degree of trust in institutional environment producers. This result reflects the generally higher sensitivity of young people towards delicate issues such as GMOs and the fact that, in order to decide to buy a potentially risky product, consumers would expect some sort of institutional guarantee on a credence attribute such as food safety. In the case of branded food products KNOW and AGREE are also significant: individuals with higher knowledge and those who agree more on the application of genetic technologies demand a higher discount to accept to buy GM products. One reason could be the fact that informed subjects and those in favor of the application of genetic technologies have a higher degree of awareness about the benefits of genetic applications on production costs and therefore want to be part of the game claiming

higher compensations.

Models 5 and 6 measure the impact of the explanatory variables on the WTP for GMOs free products. They interpret more closely the present situation in Italy where, at least officially, GM food products are not sold and where both producers and supermarket chains are trying to guarantee the GMOs free attribute by means of full traceability of the marketing chain. For general food products (model 5) most of the variables reach a 0.10 level of significance and the signs are in the expected directions: positive for KNOW, RISK, TRUST and AGE, negative for AGREE. Respondents with higher information, presenting high risk aversion, therefore perceiving GM products as risky ones, who trust government producers and scientists in their activities of control and monitoring, are willing to pay more to buy a product guaranteed as GMOs free. In other words, they believe that the "GMOs free" statement indicated on food products can be trusted. This position becomes weaker for individuals who explicitly agree with the application of genetic technologies, as indicated by the negative sign of AGREE.

When the elicitation of the WTP regards branded products, then RISK and TRUST are not significant anymore: apparently the brand indicates that producers/distributors bear the risk if they are trusted, working as a sort of insurance for individuals. If this could be confirmed on a larger scale, than it would indicate that brand owners are increasing their power thanks to the current debate on the use of GMOs in food products. With this scenario, accurate control systems to avoid the presence of unwanted GMOs may become strategic in order to increase market shares through consumer's loyalty.

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Table 1 - Descriptive information of survey respondents (N= 459)

Gender		**Usual Shopper**	
Female	56.21%	No	39.22%
Male	43.79%	Yes	59.69%
Education		**Place of residence**	
University	18.95%	Urban (city centre)	19.83%
High school	44.23%	Urban (suburbs)	28.32%
Up to grade 8	24.62%	Rural	51.85%
Up to grade 5	12.20%		
Employment status		**Family monthly income**	
Unemployed	0.44%	< 800€	4.79%
Retired	15.03%	800 - 1,300€	7.19%
Student	16.12%	1,300 - 2,600€	27.23%
Housewife	8.71%	>2,600€	9.37%
Employee	33.12%	No answer	51.42%
Self-employed	17.65%		
Other	8.93%	**Children under 14 in the family**	
		No	69.50%
Age		Yes	30.50%
> 20 years old	11.98%		
20 - 29	16.78%	**Household size**	
30 - 39	19.61%	1.00	5.45%
40 - 49	23.75%	2.00	16.12%
50 - 59	15.90%	3.00	29.19%
60 - 69	9.37%	4.00	32.46%
> 70	2.61%	5.00	13.07%
		6.00	3.27%
		7.00	0.44%

Table 2 - Consumer awareness and knowledge of GMO (N= 459)

	No	Yes
2.1 Heard about GMO	31.59%	67.97%
2.2 Know meaning of GMO	35.08%	64.92%
2.3 Know what GMO is about	25.27%	74.73%

Table 3 – Consumer confidence in a GMO-free label on food (N= 459)

	No	Yes
Government allows the sale	88.24%	11.76%
Government is controlling	70.81%	29.19%
An external institution is certifying	61.66%	38.34%
I trust the brand	76.69%	23.31%
I trust the store	81.70%	18.30%
I never trust	79.30%	20.70%
I always trust	96.51%	3.49%

Table 4 – Individual attitude towards biotechnologies

Judgment about GMOs properties

	Level of agreement on GMOs benefits											
	Low	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	***High***	n.a.	Median
4.1 Higher nutritional value	32.90%	10.68%	9.15%	8.93%	15.03%	9.15%	6.32%	2.61%	1.53%	2.61%	1.09%	3
4.2 Higher production	6.32%	1.09%	5.88%	5.45%	5.88%	9.37%	12.20%	17.86%	13.51%	21.79%	0.65%	8
4.3 Higher quality	27.89%	10.89%	14.16%	10.24%	15.47%	8.28%	5.23%	4.36%	0.87%	1.53%	1.09%	3
4.4 Higher pest resistance	5.23%	1.96%	4.36%	4.14%	6.75%	8.71%	9.80%	16.56%	15.03%	25.93%	1.53%	8
4.5 Lower food cost	19.61%	8.93%	6.54%	9.15%	13.29%	8.71%	9.59%	8.71%	3.92%	10.02%	1.53%	5

Judgment about GMOs utilization

	Level of agreement on GMOs application											
	Low	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	***High***	n.a.	Median
4.6 Use on vegetables	7.41%	2.40%	4.58%	5.88%	9.80%	7.84%	10.02%	13.73%	9.80%	27.89%	0.65%	8
4.7 Use on animals	22.00%	9.59%	12.20%	8.06%	13.51%	6.32%	3.70%	7.19%	3.70%	12.64%	1.09%	4
4.8 Use on microorganisms	12.20%	6.10%	6.97%	6.10%	20.70%	8.28%	7.63%	6.97%	4.58%	16.34%	4.14%	5

Judgment about incidence on human health

	Negative	***-4***	***-3***	***-2***	***-1***	***Neutral***	***1***	***2***	***3***	***4***	***Positive***	n.a.	Median
4.9	20.04%	5.88%	15.47%	9.80%	9.15%	17.65%	5.01%	4.14%	5.01%	0.44%	2.40%	5.01%	-2

Judgment about incidence on the environment

	Negative	***-4***	***-3***	***-2***	***-1***	***Neutral***	***1***	***2***	***3***	***4***	***Positive***	n.a.	Median
4.10	25.49%	7.63%	12.20%	8.93%	8.28%	17.65%	5.01%	5.23%	2.40%	0.87%	1.96%	4.36%	-2

Judgment about trust in the institutional environment

	Level of agreement											
	Low	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	***High***	n.a.	Median
4.11 Firms interest on consumers' health	42.70%	9.37%	10.02%	10.46%	12.64%	5.01%	4.14%	3.49%	0.65%	1.31%	0.22%	2
4.12 Government ability to control	23.09%	10.46%	9.37%	12.64%	15.03%	11.98%	6.97%	4.36%	1.09%	4.58%	0.44%	4
4.13 Scientists ethical behavior	15.69%	5.23%	10.24%	13.51%	22.66%	14.81%	5.66%	6.10%	1.96%	3.49%	0.65%	5

Table 5 – Dependent variables: distribution of respondents (%)

	No (0)	**Yes (1)**					
Never purchase generic GM food at any price level (NP^G)	48.80%	51.20%					
Never purchase branded GM food at any price level (NP^B)	47.71%	52.29%					
	None	**1 - 5 %**	**6 - 10 %**	**11 - 15 %**	**> 15 %**	**Never purchase**	
Expected discount for a GM food (WTA^G)	5.23%	9.59%	13.29%	5.88%	14.81%	51.20%	
Expected discount for a branded GM food (WTA^B)	3.70%	10.02%	13.29%	6.10%	14.60%	52.29%	
	None	**1 - 5 %**	**6 - 10 %**	**11 - 15 %**	**16 - 20 %**	**21 - 25 %**	**> 25 %**
Price premium for a GM-free labeled food (WTP^G)	45.10%	27.45%	13.94%	5.88%	2.61%	1.31%	3.70%
Price premium for a branded GM-free labeled food (WTP^B)	47.93%	27.45%	14.16%	3.70%	2.61%	1.31%	2.83%

Table 6 - Regression results of the "buy/never buy" decision for unbranded (model 1) and branded (model 2) GM food products (Binomial Probit Analysis)				
Variable	Model 1		Model 2	
	Estimated Coefficient (t-ratio)	Marginal Effects (never buy)	Estimated Coefficient (t-ratio)	Marginal Effects (never buy)
Constant	-1.2042** (-2.37)		-0.9065* (-1.81)	
Know	-0.3107* (-1.64)	-0.0890	-0.3113* (-1.70)	-0.0925
Risk	2.3497*** (7.25)	0.6733	2.2834*** (7.17)	0.6784
Trust	-2.8802*** (-6.68)	-0.8254	-2.6343*** (-6.22)	-0.7826
Useful	-0.3086 (-0.69)	-0.0884	-0.1617 (-0.3722)	-0.0480
Agree	0.0650 (0.22)	0.0186	0.3098 (1.07)	0.0920
Age	0.0152*** (3.23)	0.0044	0.0093** (2.00)	0.0028
Edu	0.1832** (2.10)	0.0525	0.0755 (0.89)	0.0224
Unrestricted LL	-230.896		-239.411	
Restricted LL	-315.917		-315.636	
chi-square	169.995***		152.450***	

One, two or three asterisks indicate significance at the .10, .05 or .01 level respectively.

Table 7 - Regression results for the willingness to accept "lower cost" GM products and willingness to pay for GMOs free food products (Ordered Probit Analysis)

Variable	Model 3: WTA^G	Model 4: WTA^B	Model 5: WTP^G	Model 6: WTP^B
Constant	2.9680*** (4.97)	2.4585*** (4.23)	-0.9116** (-2.29)	-0.7194* (-1.78)
Know	0.1107 (0.5314)	0.3321* (1.62)	0.3362** (2.32)	0.4094*** (2.81)
Risk	0.2321 (0.6430)	0.1353 (0.36)	0.5794** (2.42)	0.3128 (1.28)
Trust	-0.8343* (-1.76)	-0.8092* (-1.72)	0.5535* (1.73)	0.2947 (0,91)
Useful	0.1583 (0.31)	0.3254 (0.62)	0.0210 (0.06)	-0.1652 (-0.47)
Agree	0.1050 (0.29)	0.6082* (1.67)	-0.3831* (-1.67)	-0.3984* ((-1.73)
Age	-0.0144*** (-2.90)	-0.0123** (-2.42)	0.0070* (1.91)	0.0100*** (2.71)
Edu	0.0441 (0.47)	-0.0339 (-0.37)	0.0454 (0.69)	0.0272 (0.41)
Unrestricted LL	-342.914	-323.698	-642.599	-612.556
Restricted LL	-352.598	-333.718	-651.181	-621.634
chi-square	19.368***	20.040***	17.164**	18.157***

One, two or three asterisks indicate significance at the .10, .05 or .01 level respectively.