Perceived Risks of Agro-biotechnology and Organic Food Purchase in the United States

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Abstract *This study examined the role of consumers' perceived risks and benefits of agro-biotechnology in shaping the purchase pattern for organic food among US consumers. Consumers' general purchase behavior, knowledge of GM technology, and socio-demographic variables were examined in relation to their impact on organic food purchase. The sample data indicated that less than one fourth of the consumers bought organic products at least sometimes. Only 2% of the consumers bought organic food very often. Perceived risks of agro-biotechnology played a dominant role in influencing organic food purchase decisions. Consumers who were concerned about negative attributes of agro-biotechnology including long-term health and environmental hazards, inequity in the distribution of benefits from the technology, and adverse effects to small and medium farms were the potential organic food consumers. Benefits of agro-biotechnology did not play an important role in shaping the purchase pattern for organic food. Food safety was the most important consideration while making organic food purchase decisions. Importance of food safety while making food purchase decisions and consumers' trust in the ability of grocery stores to supply safe food were other important factors in determining purchase pattern for organic foods. In this study, prices of food products did not play important role in determining purchase pattern for organic foods. Growth in organic food market is largely dependent on continued reinforcement of consumers' belief that organic foods are safer than conventional foods.*

Keywords *Agro-biotechnology, food safety, organic food*

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Introduction

Consumption of organic food products has grown significantly throughout the industrialized world. Sale of organic foods in Europe, North America, Australia and Japan has exceeded $114.5 billion (Makatouni, 2002). In the United States (U.S.), organic products are available in nearly 20,000 natural foods stores, and are sold in 73% of all conventional grocery stores (Dimitri and Greene, 2002).

Studies have shown that consumers' selections of foods are influenced by many factors including health concern (Rimal et al., 2000; Steenkamp, 1997), convenience (Kinsey and Senauer, 1996), and environment (van Ravenswaay, 1986). Recent incidents of foot-and-mouth disease and mad cow disease have further increased consumers' food safety consideration while selecting food items (Verdurme et al., 2002). In a separate study, more than 54 percent of the respondents in Georgia, USA perceived pesticide residues to be a serious or extremely serious food safety threat (Rimal et al., 2001). Growth hormones, animal drug residues, bacteria, food additives, irradiation, and naturally occurring toxins followed pesticide residues.

Application of biotechnology in agriculture and medicine has produced a growing number of organisms and products. Along with the increasing commercial success of application of biotechnology, a widespread debate focusing on the ecological, human health and socio-economic effects of biotechnology is taking place at national and international level. Although American consumers have been largely supportive of application of biotechnology in food production (Moon and Balasubramanian, 2001),

increasing public concerns of food safety issues including use of GM organisms, pesticide residues, hormones, are likely affect markets for foods produced by alternative processes such as organic and integrated paste management (IPM). This study investigated whether consumers' perceived risks and benefits of agro-biotechnology had any influence on the choice of organic food. In addition, a consumers' general purchase behavior, knowledge of GM technology, and socio-demographic variables were examined in relation to their impact on organic food purchase. Findings from this study will be useful for organic food and GM food industry in designing and implementing programs against the backdrop of existing controversy relating to biotechnology. The identification and comparison of factors influencing purchase of organic food provide valuable information in formulating short and long term marketing programs. Many studies have sited reasons why consumers purchase organic food products. For example, Kuchler et al., (2000) reported that organic food consumers differed from conventional consumers based on the importance attached to the specific attributes of organic foods. Are the perceived risks of agro-biotechnology powerful enough that marketers of organic food can use them to attract more consumers?

Materials and Methods

Data Collection

A survey instrument was designed to evaluate the relationship between organic food consumption and perceived risks and benefits of agro-biotechnology. The data collected from the survey, therefore, was based on the perception of survey respondents instead of actual safety and nutritional attributes of organic or GM foods. The surveys

were administered by mail in the US using household panels maintained by the National Panel Diary (NPD) group, a marketing consulting firm specializing research on consumer behavior and food marketing. Survey methods that use an established panel are called "permission-based surveys" and are increasingly used in exploring various aspects of consumer behavior for academic or commercial purposes (Moon and Balasubramanian, 2001). Questionnaires were distributed to 5,200 households (a subsample of NPD panel), selected across the United States by random sampling. The US sample was stratified by geographic regions, head of household age, education, and income, consistent with the US census for adults. There were 3,060 usable observations providing an effective return rate of 59%.

The data were analyzed in two ways. First, a descriptive analysis of important variables was conducted using frequency analysis and mean tests. Second, the association of organic food purchase with perceived risks and benefits of agro-biotechnology was analyzed using a regression analysis. Estimated parameters were used to simulate organic food purchase pattern.

Results

Purchase of Organic Food

Respondents were asked, "How often do you purchase organically grown produce or other organic food products?" Responses were recorded in a scale variable ranging from "1=Never" to "6=All the time". Figure 1 shows that only 2% of the respondents purchased organic foods all the time, while 33% never purchased. Responses were regrouped into two categories with the first category comprising 1 to 3 values, and the

second category comprising the remaining. The first group represented those consumers who were generally unlikely to purchase organic food, while the second group represented those consumers who were likely to purchase. Only about 23% of the respondents fell in the group of likely purchasers of organic food.

Summary statistics including the description of the variables and sample means are given in Table 1. The respondents were regrouped into male and female categories. The female respondents were 53% of the total respondents. Mean tests to determine mean differences between the male and female groups using GLM procedures (SAS, 2004) showed that female respondents were younger and had lower average household income than the male respondents. Interestingly, a larger percentage of female respondents had college degree than the male respondents (51% vs. 41%).

Respondents generally agreed that the foods available at the grocery stores were safe to eat (4.48 compared to 6=completely agreed). Female respondents were less agreeable than male respondents in this regard (4.43 vs. 4.55). The mean difference was statistically significant (P. value<0.0024). Although both male and female respondents generally agreed that food safety was an important consideration while making food selection decisions, female respondents were more concerned about food safety compared to male respondents (5.13 vs. 4.88; P. value< 0.0001). Food prices were equally critical while making food selection decisions among US consumers. However, female respondents were more concerned about prices compared to male respondents (5.09 vs. 4.93; P. value=< 0.0001).

Respondents had “some what” heard or read about Genetically Modified (GM) Organisms (3.05 compared to 6 = a great deal). Despite a higher percentage of college

education, female respondents were less aware of GM issues than male respondents (2.32 vs. 2.61; P-value<0.0001). Consumers' general concern regarding GM products available in the stores was measured in terms of their attitude toward existing labeling practices. Consumers were generally indifferent about the fact that conventional foods were currently not labeled differently than GM foods in the grocery stores (3.05 vs. 6=extremely bothered). Nevertheless, female respondents seemed to be more bothered than the male respondents (3.20 vs. 2.88; P-value<0.0001). This finding suggested that concerns regarding GM foods were not the function specific awareness about GM issues (note that female respondents were less aware of GM issues than males) but perhaps general education level.

Risks and Benefits of Agro-biotechnology

Thos who oppose the application of biotechnology in food production argue that using this technology in crop production has significant negative consequences. They fear that inserted genes could be allergenic or harmful to human health (Moon and Balasubramanian, 2003; Hansen, 2001;Vogt and Parish, 1999). Examples of such fear included a possibility of new genes inadvertently causing plants to produce toxins at higher levels than are present naturally, which could create long-term negative health consequences. Further, genes from genetically modified plants may escape into the environment through cross-fertilization, posing risks to the natural ecosystem (Caplan, 2001). Moral issues surrounding biotechnology has manifested in the form of a believe that it was immoral to alter God's creations using genetic engineering techniques. Others have pointed to the inequitable distribution of the economic benefits of agro-

biotechnology (Wohl, 1999). For example, many believe that multinational biotech corporations are the main beneficiaries of agro-biotechnology while consumers assume most of the risks involved. Further, increasing control of multinational corporations over small-scale family farming and gradual disappearance of small farms (e.g. dairy industry) are some of the negative attributes of agro-biotechnology.

Supporter of agro-biotechnology argue that the application of biotechnology to crop production will bring substantial benefits to societies while revolutionizing the way crops are produced (Moon and Balasubramanian, 2003). Some of the specific benefits of agro-biotechnology include improved environmental quality (e.g., less soil erosion and infertility) by reducing the use of pesticides and herbicides in crop production (Magnusson and Hursti, 2002; Pinstrup-Andersen and Schioler, 2000) and improved nutritional value of foods (e.g., rice with improved quantities of Vitamin A; soybean with fatty acid; soybean with reduced phytate content). More importantly, supporters of biotechnology believed that biotechnology will mitigate food shortages in developing nations by increasing yields with crops resistant to various pests, insects or drought (Moon and Balasubramanian, 2003).

Based on the above discussions respondents were asked eight questions dealing with perceived risks and benefits of application of biotechnology in crop production (Table 2). The five questions related to perceived risks of GM technology dealt with: (1) health risks; (2) environmental risks; (3) moral considerations; (4) image of multinational corporations as the primary beneficiaries of biotechnology; and (5) growing control of multinational corporations over farming. The three questions relating to benefits dealt

with: (1) reduced use of chemicals in crop production; (2) improved nutritional content; (3) increased yields.

Table 2 presents the distribution of responses to the eight questions. Overall, respondents showed a greater level of certainties in responses about the risks of agro-biotechnology compared to the benefits. The percentages of "Don't know" responses for perceived risks ranged from 24.4 (MORALLY WRONG) to 43.9 (ECO HAZARDS) compared to 37.8 (REDUCE SHORTAGE) to 48.8 (NUTRITION) for perceived benefits. It seems consumers were more certain about moral issues than the other risks of agro-biotechnology. Only 24.4% reported "Don't Know" about the moral issues related to agro-biotechnology. However, more consumers disagreed that agro-biotechnology was morally wrong (43%) than agreed (31.4%).

A majority of the consumers agreed that corporations were the main beneficiaries of the agro-biotechnology (51.6%) and that the development and use of genetically modified seeds will negatively impact family farms by putting more control of the food supply into the hands of multinational corporations (51.6%). Consumer acceptance of agro-biotechnology is determined by several factor including the distribution of benefits from the technology. If consumers' perceive that there were only commercial interests but no obvious benefits to them, the acceptability will be low as found among the European consumers (Moon and Balasubramanian, 2001; Grov-White et al., 1997). The next important risks of agro-biotechnology were potential hazards to natural ecosystem and health hazards posed by genetically modified crops. Again, more consumers disagreed that agro-biotechnology posed health hazards (30.5%) than agreed (25.6%). However, the percentages reversed when it came to eco-hazards. That is more consumers

agreed that agro-biotechnology posed ecological hazards (30.3%) than disagreed (22.7%).

The main perceived benefit of agro-biotechnology was its ability to potentially reduce world food shortages by increasing yields (47.4%) followed by its ability to improve environmental quality by reducing the use of chemicals in agricultural production (42.2%). Almost half of the respondents expressed "don't know" when asked about contribution of agro-biotechnology in improving nutritional value of food (48.8%). Only 29% agreed compared to 21.5% who disagreed that agro-biotechnology enhances the value of foods by improving the nutritional composition.

A regression analysis to evaluate the factors influencing organic food purchasing decisions

An ordered probit regression model was selected as the appropriate regression model to analyze the factors influencing organic food purchase decisions. The choice of the model was based on the nature of dependent variable. The purchase history was measured using a scale (1 to 6) that allowed for the ranking of the outcomes. The empirical model was defined as

(1) $$Y^*_t = \$ X_t + ,_t$$

where Y^*_t was an unobserved purchase pattern for organic food; X_t was a vector of variables related to risks and benefits of agro-biotechnology, general food related attitude and purchase behavior, and socio-demographics (Table 1); $\$$ was the vector of unknown parameters and $,_t$ was the independently and identically normally distributed error term. While Y^*_t was unobserved, respondents actually reported purchase history by selecting one of the six categories (Y_t) representing consumers' likelihood of buying organic food. Values for Y_t were 1,2,3,4,5 and 6 where 1 represented "Never" bought organic food

(NB) to the statement, “How often do you purchase organically grown produce or other organic food products to reduce potential health risks?” and 6 represented “All the time (AT). The unknown parameter vector,**$**, in equation (1) were estimated using LIMDEP software.

The estimated parameters of ordered probit models were used to simulate purchase pattern over the range of the values of statistically significant independent variables. In doing so, the independent variables other than the one being examined were held constant at their mean value.

Independent Variables

The first group of independent variables included consumers’ general food related attitude and purchase behavior (Table 1). The organic food purchase pattern is likely to be influenced by consumers’ general food related attitude and purchase behavior. In this section, consumers were asked questions relating to their perception about the safety of food supply and the influence of food prices and food safety in their food purchase decisions. This set of independent variables included perceived safety of food available in the grocery stores (SAFE_FOOD), attitude toward the government role in safety of the food supply (FOOD_SUPPLY), and the importance of food safety (FOOD_SAFETY) and prices of food (FOOD_PRICE) in food purchasing decisions.

High correlations were found among the variables measuring consumers’ perceptions of perceived risks and benefits of agro-biotechnology (Table 2). The correlation coefficients ranged from 0.43 to 0.66 among the perceived risks and 0.42 to 0.56 among perceived benefits. Hence, it would be difficult to isolate the impact of each of the factors on organic food purchase pattern in the regression model. To cope with

potential multi-collenearity problems in estimating the empirical models, an index of perceived risks (RISKS) was constructed by adding consumer responses to the five questions describing the negative attributes and dividing by the number of questions. Theoretically, the index could range from 1 (representing complete disagreement with the risk aspects of agro-biotechnology) to 6 (representing complete agreement). Similarly, a benefit index (BENEFIT) was created using consumer responses to three questions relating to the benefits of agro-biotechnology. The benefit index could range from 1 (representing complete disagreement with the positive aspects of agro-biotechnology) to 6 (representing complete agreement). It is anticipated that perceived benefits of agro-biotechnology will have negative impact on the likelihood of purchasing of organic food. Consumers who perceived that GM food products were beneficial were less likely to purchase organic food. Similarly, consumers who strongly agreed that applications of biotechnology in food production had many risks were likely to buy organic food more often.

As discussed above, consumers' level of awareness and concern about biotechnology was measured by asking how much have they read or heard about GMOs (HEAR_GM) and whether they were upset about the existing practices of labeling GM food (UPSET). Previous studies have shown that a higher level of awareness about GM issues have translated into negative attitude towards GM food (Hurst and Magnusson, 2003; Nature, 1997). Hurst and Magnusson (2003) showed that higher level of knowledge about gene technology among Swedish consumers translated into negative attitude toward GM foods and positive attitude towards organic foods. Similarly, it is

expected that consumers who are generally upset of existing labeling practices are likely to purchase organic food more often.

Demographic characteristics of consumers were likely to influence consumers' organic food purchase pattern in two ways: 1) through their perceptions and attitudes about biotechnology, 2) directly. Surveys showed that the levels of education and gender have made a significant difference in explaining public acceptance of biotech foods: males and respondents with higher education were more likely to accept biotech foods (Moon and S, 2003; Nature of Science, 2000). Heiman, Just, and Zilberman (2000) also showed that education had a significant role in explaining consumers' attitudes toward biotech foods. Hence, gender, age, income, and education were included in the set of independent variables. Education variable represented those with college degree or otherwise.

Discussion of Regression Results

Results from the ordered probit model for consumers' purchase pattern of organic food are reported in Table 3. The chi-square statistics for the model indicated that the null hypothesis that all parameters were jointly zero was rejected at 0.01 level. Based on the collinearity diagnostic tests (Belsley, et al., 1980), no collinearity problems were detected in the analyses.

Consumers' purchase of organic food was influenced by perceived risks of agro-biotechnology, variables representing general food purchase behavior, level of awareness of GM technology and concern that GM foods are not differently labeled than traditional foods, and age of the respondents.

Perceived risks and benefits of agro-biotechnology: Perceptions about the risks of agro-biotechnology as represented by RISK were statistically significant (**$**=0.0530; P-value=0.0375) in determining overall purchase pattern of organic food. Perceived risks of agro-biotechnology caused consumers to buy organic food more often. The impact of perceived risks of biotechnology on the likelihood that a consumer would "never" purchase organic food is simulated in figure 2. If a consumer completely disagreed about all the potential risks of agro-biotechnology (RISK=1) then his/her probability of "never" purchasing organic food was about 40%. That is, if you perceive agro-biotechnology generally possesses zero risk, then consumers would not be inclined to buy organic food. The probability, however, gradually declined as the perceived risk increased. At the highest level of perceived risks (RISK=6), the probability was only about 12%. That is, as a consumer perceived more risks of agro-biotechnology he/she was less likely to "never" buy organic food or inclined to buy more often. Perception of benefits did not have statistically significant impact on the likelihood of purchasing organic food. The dominant influence of perceived risks of agro-biotechnology may have been the result of persistent flow of information dealing with negative aspect of biotechnology. A few GMO foods present direct and tangible benefits (e.g., improved nutrition or taste) to consumers (Moon and Balasubramanian, 2003). In addition to that, there is a general lack of effective information/education programs that promote positive attributes of agro-biotechnology.

General opinions and purchase behavior: A consumer who perceived that the foods available at the grocery stores were generally safe to eat was likely to buy organic food less often (**$**=-0.1504; P-value<0.0001). However, those who were concerned about

the safety of food while making food purchase decisions were likely to buy organic food more often (**$**=0.2002; P-value<0.0001). Interestingly, price consideration while purchasing food did not have any effect on the likelihood of purchasing organic food. Magnusson et al., (2001) reported that although consumers were concerned about organic food being more expensive than the conventional food, many organic consumers never refrained from buying organic foods because of the price. Kuchler et al. (2000) reported that the perceived benefits of organic food products are sufficiently high to cover the existing price premium for organic foods. Results in the current study are consistent with the fact that organic food consumers are least susceptive to price premium. Figure 3 presents simulated effects of all three purchase behavior variables on the purchase pattern for organic food. A consumer who completely disagreed that food safety was an important consideration in food purchase decisions was more than 60% likely to "never" purchase organic food. The probability declined to less than 30% when he/she completely agreed that food safety consideration was critical in food purchase decisions. Hence, a difference of nearly 40 percentage points within the possible values of the variable. Consumers who completely disagreed that foods available at grocery stores were safe to eat (SAFE=1) were less than 20% likely to "never" buy organic food. That is a general distrust of safety of foods at grocery stores will increase their inclination to purchase organic food more often. Impact of prices was the least in terms of magnitude and statistical significance among several variables dealing with food purchase behavior (Figure 3). In the current study, the results clearly showed that consumers' concern of food safety in general and food safety at the grocery stores in particular were the most influential factors in determining organic food purchase pattern.

Consumers who had read or heard a great deal about the GM technology were likely to buy organic food more often. This result reinforces the earlier discussions about the role of information/education in shaping perception of risks and benefits of agro-biotechnology. Since much of the available information to public dealt with the negative aspects of agro-biotechnology, it was not surprising that consumers who had acquired a greater amount of such information were likely to buy more organic food. Those consumers were upset that labeling of GM foods was not different from the traditional foods (**$**=0.0917; P-value<0.0001) were likely purchase organic foods more often. Trijp et al. (1997) demonstrated the importance of clear and unmistakable labeling as an important condition for buying food items including organic food.

Socio-demographic characteristics: Among the socio demographic variables age of the respondents was the only variable which had statistically significant impact on the organic food purchase pattern (**$**=-0.0038; P-value=0.0215). Older respondents were less likely to buy organic foods compared to younger respondents. This result is different from several other health related studies, which showed a positive relationship between age and general health concern. Older meal planners are more likely to be concerned about food safety (Lin,1995) and more likely to use nutritional information about health benefits, fat, and cholesterol content on food packages than younger meal planners(Nayga, 1996.). In this study, budget constraints may have been indirectly influencing organic food purchase decisions through age variables. Many older consumers have limited disposable income. Davies et al., (1995) found some relationship between the amount of disposable income available and the corresponding extent of

purchase of organic food. In this context, the results regarding the relationship between age and organic food purchase were found to be consistent.

Summary and Conclusions

Perception of risks and benefits are key determinants of consumer acceptance of food products including GM foods. This study explored the role of perceived risks and benefits of agro-biotechnology in shaping consumers' purchase pattern for organic products. The sample data indicated that about one fourth of the consumers bought organic products at least sometimes. Only 2% of the consumers bought organic food very often. However, as perceived risks of GM technology dominated the perceived benefits, consumers were likely to look for alternative food sources including organic foods. The results suggest that, as consumers' perceived risks of agro-biotechnology increase they are more likely to be participants in the organic food market. Consumers who are concerned about negative attributes of agro-biotechnology including long term health and environmental hazards, inequity in the distribution of benefits from the technology, and adverse effects to small and medium farms were the potential organic food consumers. Due to high correlations among these attributes, the study was unable to delineate the effect of each individual attribute.

Importance of food safety while making food purchase decisions and consumers' trust in the ability of grocery stores to supply safe food were other important factors in determining purchase pattern for organic foods. Importance of food safety tended to overwhelm the potential budget constraint caused by price premium. In this study, prices of food products did not play important role in determining purchase pattern for organic

foods. As long as organic food marketers are successful in assuring food safety, consumers are willing to pay premium price. Growth in organic food market is largely dependent on continued reinforcement of consumers' belief that organic foods are safer than conventional foods.

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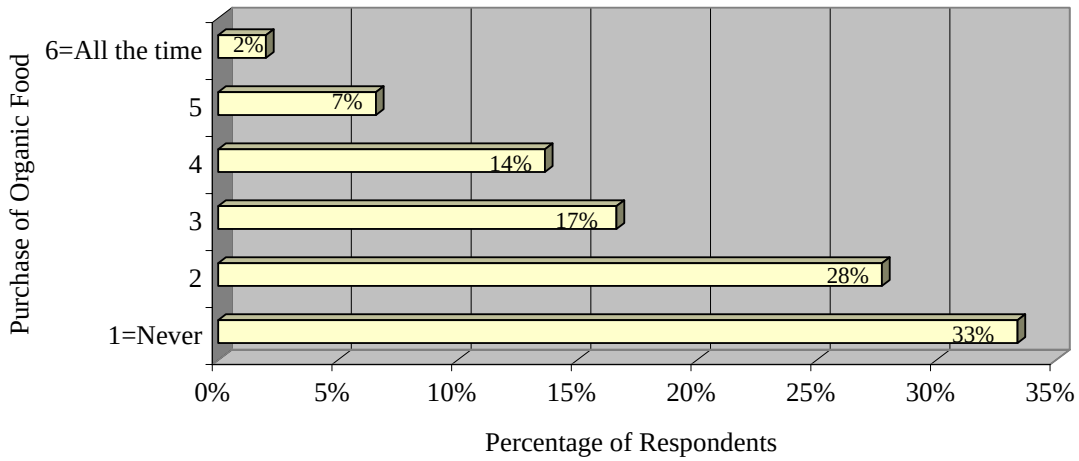

Figure 1: Distribution of organic food purchase pattern in the United States**.**

Table 1: Descriptive statistics of the variables used in the analysis.

Variable	Explanation	All	Female	Male	P-value
Organic	How often do you purchase organically grown produce or other organic food products to reduce potential health risks associated with pesticides residues 1=Never oppose;6=All the time	2.38	2.40	2.36	0.4067
Index of perceived risks and benefits of application of bio-technology:					
RISKS	Index of perceived risks of agro-biotechnology (1 to 6)	3.71	3.83	3.56	<0.0001
BENEFITS	Index of perceived benefits of agro- biotechnology (1 to 6)	3.76	3.69	3.84	<0.0001
General Food Related Attitude and Purchase Behavior:					
SAFE_FOOD	I feel that foods available at grocery stores are safe to eat. 1=Disagree completely; 6=Agree completely	4.48	4.43	4.55	0.0024
FOOD_SUPPLY	The government ensures safety of the food supply 1=disagree completely; 6=agree completely	4.29	4.28	4.30	0.6389
FOOD_SAFETY	Safety is an important consideration in food purchasing 1=disagree completely; 6=agree completely	5.01	5.13	4.88	<0.0001
FOOD_PRICE	Price is an important consideration in food purchasing 1=disagree completely; 6=agree completely	5.02	5.09	4.93	<0.0001
Awareness about GM and Concern among the respondents:					
HEAR_GM	How much heard about genetically modified organism (GMOs) 1=Nothing; 6=A great deal	2.46	2.32	2.61	<0.0001
UPSET	How do you feel about the fact that conventional foods are currently not labeled differently than the genetically modified foods in the grocery stores? 1=Not bothered; 6=Extremely bothered	3.05	3.20	2.88	<0.0001
Demographic Characteristics of the Respondents:					
GENDER	Female =1; Male=0	0.53	-	-	-
AGE	Actual age of the respondents	46	45	47	<0.0001
INCOME	Household income in ‘000 U.S. dollars	52.36	51.07	53.84	0.0600
COLLEGE	1=college education; 0 otherwise	0.47	0.51	0.41	<0.0001
WHITE	1=If white; 0=otherwise	0.85	0.84	0.86	0.3123

Table 2 Perceived risks and benefits of agro-biotechnology.[1]

	Disagree	Agree	Don't Know
Perceived risks of agro-biotechnology: (Percent)			
HEALTH RISKS: Foods based on genetically modified crops pose health hazards to consumers 1=disagree completely; 6=agree completely	30.5	25.6	43.9
ECO HAZARDS: Use of biotechnology in crop production pose hazards to natural ecosystem. 1=disagree completely; 6=agree completely	22.7	30.3	47.0
MORALLY WRONG: I believe it is morally and ethically wrong to use genetically modified ingredients to make food products. 1=disagree completely; 6=agree completely	43.0	31.4	24.4
CORPORATION: Corporations are the main beneficiaries from agricultural biotechnology, while consumers assume most risk. 1=disagree completely; 6=agree completely	22.1	53.3	24.6
CONTROL: The development and use of genetically modified seeds will negatively impact family farms by putting more control of the food supply into the hands of multinational corporations. 1=disagree completely; 6=agree completely	17.7	51.6	29.7
Perceived benefits of agro-biotechnology: (Percent)			
REDUCE SHORTAGE: The application of biotechnology to crop production will potentially reduce world food shortages by increasing yields. 1=disagree completely; 6=agree completely	14.8	47.4	37.8
IMPROVE ENVIRONMENT: The application of biotechnology to crop production will contribute to improving environmental quality by reducing the use of chemicals in agricultural production. 1=disagree completely; 6=agree completely	16.2	42.2	40.6
NUTRITION: Agricultural biotechnology enhances the value of foods by improving the nutritional composition. 1=disagree completely; 6=agree completely	21.2	29.0	48.8

[1]Six-point scale ranging from "Disagree completely" to "Agree completely" was used. In the table "Disagree" is an aggregation of the first three categories while "Agree" is for the last three categories.

Table 3: Organic Food Consumption: Maximum Likelihood Estimates of Ordered Probit Model

Variables	Estimated Parameter	P-value
Constant	-0.4801*	0.0278
RISKS	0.0530*	0.0375
BENEFITS	0.0336	0.1814
GROCERY_SAFE	-0.1504*	0.0000
GOVT_ROLE	-0.0167	0.4206
FOOD_SAFETY	0.2002*	0.0000
FOOD_PRICE	-0.0252	0.1722
HEAR_ALL	0.1797*	0.0000
UPSET	0.0917*	0.0000
FEMALE	-0.0231	0.5741
AGE	-0.0038*	0.0215
INCOME	-0.0005	0.3715
COLLEGE	-0.0524	0.2165
WHITE	0.0166	0.7576
Threshold parameters for Index		
Mu(1)	0.77728*	0.0000
Mu(2)	1.31111*	0.0000
Mu(3)	1.99304*	0.0000
Mu(4)	2.76484*	0.0000
Log likelihood Restricted	-4297.04	
Log likelihood Unrestricted	-4543.24	
Chi-squared (degree of freedom=13)	492.40*	

*Significant at < 5%

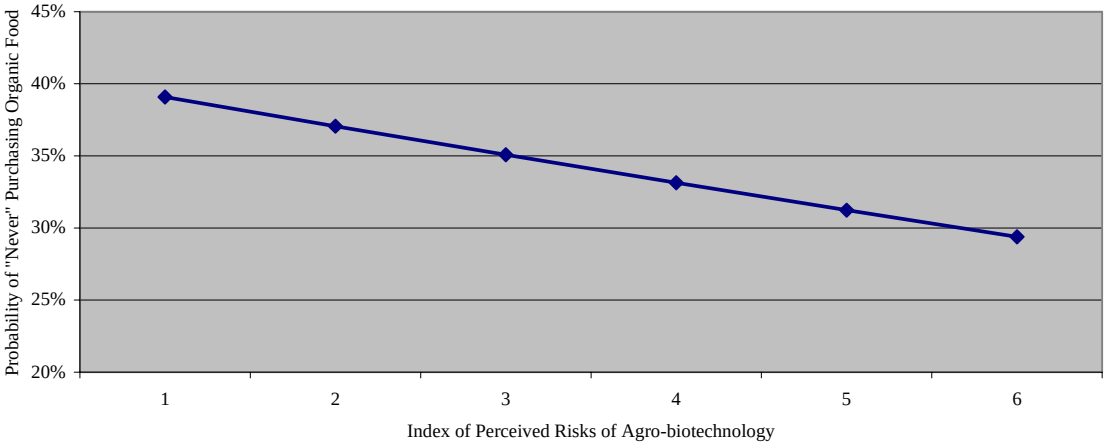

Figure 2: Simulated impact of perceived risks of agro-biotechnology and organic food purchase

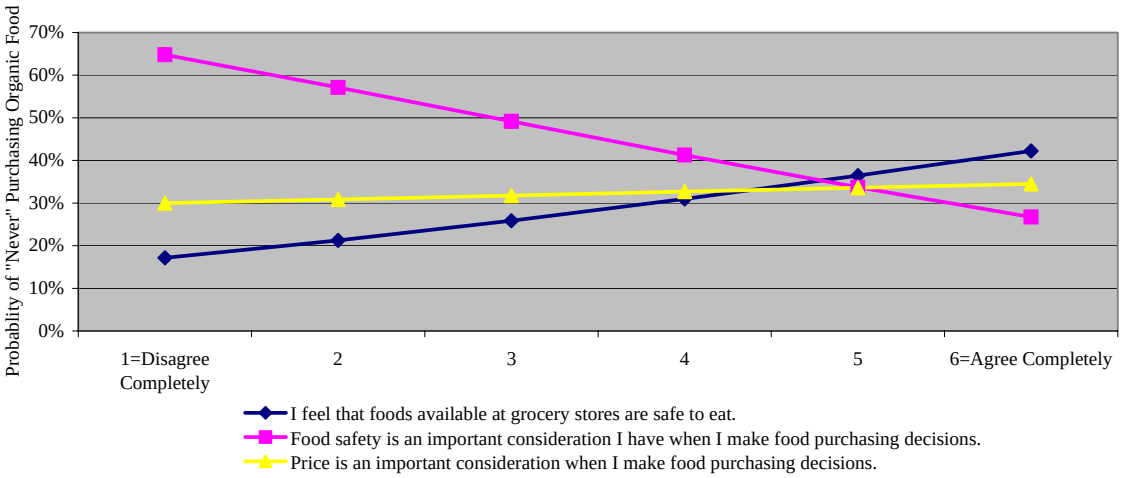

Figure 3: Important considerations and organic food purchase