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PRODUCTION AND MARKETING
OF TROPICAL CROPS

Title: The Influence of Perceived Food Attributes on Consumer Preferences for Organic and GMO Foods

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THE INFLUENCES OF PERCEIVED FOOD ATTRIBUTES ON CONSUMER PREFERENCES FOR ORGANIC AND GMO FOODS

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ABSTRACT

This paper uses a logistic regression model to examine consumer willingness to buy organic and/or GM food products in the context of food attributes that are considered important in the consumption decision. That model is chosen for its mathematical simplicity and because its asymptotic characteristic constrains the predicted probabilities to a range between zero and one. In particular, the model examines the process that shapes food preferences in the absence or presence of specific food attributes. The paper finds that food attributes related to health, naturalness, familiarity, vegetarian-vegan, production location, and availability are critical in the acceptance of the organic and/or GM foods. The results show that food naturalness is pivotal to the organic food purchasing decision, while the absence of allergenic causing ingredients increase GM purchases. The findings also suggest that although there are perceived differences between organic and/or GM foods, the presence or absence of an attribute becomes important only when a respondent claims ownership of the good through the purchase action.

Keywords: Organic food, Consumer willingness, Food naturalness. GMO. Food attributes

The influences of perceived food attributes on consumer preferences for Organic and GMO Foods

Public perceptions about food are multidimensional and are shaped by various forces, particularly, personal and cultural preferences. Overtime, these forces are likely to be driven by the benefits derived from the food more so than the nature of the product. Thus public benefits, such as longer shelf stability, or private benefits (enhanced sensory appeal, reduced allergenicity) are likely to have positive effects on consumer attitudes towards food products.

In deciding which product to buy and given constrained resources, a consumer may consider both public and private benefits. Some consumers may prefer a product delivering more private benefits, while others may emphasize public benefits in their purchasing decisions. For example, consumers conscious of environmental and health related impacts of farming technologies may weight heavily the public good benefit of a better environment.

Consumers of organic foods often pay a premium that may be interpreted as demand for environmental quality (public good), or they may be paying for perceived superior quality in terms of taste etc. (a private good) or they may be paying for both benefits. Studies based on both benefits and actual purchasing data suggest consumers prefer organic products primarily because of health, food quality and taste considerations (private goods) while others choose organic foods because of a concern for animal welfare and the environment (public goods). In the case of the GM food products, the biotech industry has expended substantial resources to deliver foods with a wide range of enhanced consumer benefits. However, consumers have reservations about the foods due to uncertainties relating to externality costs from unanticipated impacts on human health and environment. Distinct consumer benefits (private and public) of GM foods are likely to be a stimulus for broader consumer acceptance (Riley and Hoffman, 1999; House *et al*., 2001). As GM food products with enhanced and functional attributes appear in the marketplace, consumers will be faced with the choice between GM products and conventional and organic foods.

Preferences for public and private benefits may impact consumer's purchasing decisions differently. Yet, the literature on public attitudes towards food do not account for a consumer's consideration of private and public benefits in influencing purchasing decisions. To fill this void, we apply multivariate statistical analyses on 2003 U.S. survey data to test the hypothesis that preferences for organic products are influenced by the same set of factors as GM foods. The specific objectives of the study are to: (i) identify and estimate the importance of the various factors driving consumer perception and acceptance of organic and/or the GM food products; and (ii) identify and characterize distinct consumer segments in terms of their consumption or purchase of organic and/or GM food products.

Survey Methodology and Empirical Model

A survey instrument developed by the Food Policy Institute at Rutgers University was used to collect data for this study. The survey collected information on core questions related to Americans' awareness and knowledge of transgenic techniques, willingness to purchase labeled foods (organic and/or GM) and perceptions on food aspects considered important in consumption decisions. Also collected, were data on consumer's attitudes towards personal health and safety as well as environmental concerns relating to foods. Additional respondents' information on socio-economic characteristics, political, moral, and religious views was also collected.

The Food Policy Institute contracted the opinion polling firm, Shulman, Ronca, and Bucuvalas, Inc. to conduct 1201 telephone interviews using computer-assisted telephone interview (CATI) technology. Interviewers were consistently monitored throughout the field period. The interviews were conducted between February 27, 2003, and April 1, 2003[1]. To limit the length of the survey and minimize fatigue on the part of respondents, two versions of the survey were created and given to two identically drawn split samples. While the majority of the questions were administered to the entire sample, certain questions within each of the two versions were unique and only posed to half the sample. Version A had 600 respondents and an average interview length of 24.8 minutes, while Version B had 601 respondents and averaged 26.4 minutes.

All interviews were conducted in English. Potential respondents were selected using national random digit dialing across the entire United States. U.S. Census Bureau population estimates determined the distribution necessary for proportionate geographic coverage. Appropriate weighing of age, gender, and race was done to correct for disproportionate representation. The CATI program guided a random but balanced selection process to ensure that representative number of males and females were interviewed. The sampling design accounts for the possibility that people who answer the telephone immediately are different from those who are rarely at home. To maximize generalizability, a 12-call design was employed with attempts to contact an elusive individual made at different times and days throughout the week. Interviewers left a voice mail message on the second, fifth and ninth attempt, explaining the study and the purpose for calling. The CATI software maintained callback appointments and prompted the interviewers to leave an answering-machine message when necessary. Many of the telephone numbers originally selected as part of the sampling frame were excluded as non-residential or non-working numbers. Only 38% of the phone numbers selected at random yielded completed interviews. However, calls to 56% of the working residential numbers resulted in completed interviews. Moreover, 65% of those who were available and eligible to participate agreed to complete the study. These response rates did not significantly differ between the two versions of the questionnaire. The 1,201 completed interviews yield a sampling error rate of ±3%, with the split-ballot format yielding a sampling error rate of ±4%.

During the telephone interviews, respondents were asked to indicate their willingness to buy organic foods and those food products involving GM technology. In particular, respondents were asked to state their purchasing preferences for a GM and organic labeled food product through the following questions:

1. How often do you buy food products labeled specifically as "Organic?": The possible responses were: "never"; "rarely"; "sometimes"; "frequently"; "always"; "don't know" and the option of refusing to answer.
2. If you were shopping and saw that some products were labeled as containing

[1] Interviewing was not conducted on March 21 and 22 due to the start of "Operation Iraqi Freedom" and the coverage it was receiving on television

genetically modified ingredients, would you be any more willing or less willing to purchase them, or would it not make a difference? The possible responses were: "Much more willing"; "Somewhat more willing"; "Somewhat less willing"; "Much less willing"; "Would not make a difference;" "Don't know" and the option of refusing to answer.

A binary dependent variable was defined using consumers' responses to the above statements. In the case of *BUYORG,* a value of 1 was assigned if the respondent chose "*sometimes*"; "*frequently*"; or "*always*" and 0 if the response was either "*never*" or "*rarely*". A similar procedure was used to create binary dependent variable *BUYGM* by assigning a value of 1 if the respondent chose "*Much more willing*" or "*Somewhat more willing*; and 0 if the response was " *Somewhat less willing*" "*Much less willing*" or "*Would not make a difference*". The perceptions of respondents on the importance of specific food attributes considered important in consumption decisions (here defined as private and public benefits) were used as the explanatory variables of the empirical models.

Conceptual Framework

The objective of this study is to identify and estimate the influence of consumers' views on specific food aspects (attributes) on demand for organic and genetically modified foods. The Lancaster (1966a,b) model provides the framework within which consumers' food choices can be analyzed in terms of the product attributes. In this model, consumers derive utility (U) from product attributes (*z*), which he/she considers important in a consumption decision.

$$U = U(z_1, z_2, \ldots, z_m) \qquad (1)$$

Although Lancaster envisioned utility to depend on product attributes only, this framework can be viewed as one where utility depends on product attributes as well as on consumers' personal attributes. In the context of this study, it is assumed that presence/absence of private/public product benefits are relevant in a consumers' food choice, regardless of the production process (organic, trasgenic or otherwise).

We analyze consumers' willingness to buy organic and/or GM foods by integrating the above model within the random utility discrete choice model. Following the random utility framework, it is assumed that a consumer faces a choice between buying either an alternative[2] or the GM variety of the same product. Likewise, in the case organic food purchases, the consumer decides to buy an organic food compared to the alterative. Utilities derived from the conventional and GM product varieties are given by U_T and $U_{G\ (ORG)}$, respectively. However, these utility levels are not directly observable. The observable variables are the product attributes a (a = T, G) and a vector of consumer characteristics (x). The random utility model assumes that the utility derived by consumer i from the product with attribute a (a = T, G) can be expressed as:

$$U_{ai} = V_{ai} + \varepsilon_{ai} \qquad (2)$$

where U_{ai} is the latent utility level attained by the i^{th} consumer by choosing the product attribute a (*a = T, G(ORG)*), V_{ai} is the explainable part of the latent utility that depends on the product attribute and the consumer characteristics, and ε_{ai} is the 'unexplainable' random component in U_{ai}.

The utility maximizing consumer will choose to buy the GM variety of a product if and only if $V_{Gi} + \varepsilon_{Gi} > V_{Ti} + \varepsilon_{Ti}$ or equivalently if $\varepsilon_i = \varepsilon_{Ti} - \varepsilon_{Gi} < V_{Gi} - V_{Ti}$. Since ε is unobservable and stochastic in nature, the consumer's choice is not deterministic and can not be predicted exactly. Instead, the probability of any particular outcome can be derived. The probability that consumer *i* will buy the GM variety of the product is given by:

$$P_i = \text{Prob}(\varepsilon_{Ti} - \varepsilon_{Gi} < V_{Gi} - V_{Ti}) = \text{Prob}(\varepsilon < V_{Gi} - V_{Ti}) \qquad (3)$$

Describing the density function of ε by f(ε), the above probability is given by:

$$P_i = \int_{\varepsilon} Z_i(\varepsilon_i < V_{Gi} - V_{Ti}) f(\varepsilon_i) d\varepsilon_i \qquad (4)$$

where Z_i is an indicator variable that equals 1 when the term inside the parenthesis is true and 0 otherwise. In other words, the indicator variable Z_i is a binary variable that equals 1 when the utility from the GM product exceeds that from the alterantive product.

In order to empirically implement the above conceptual framework, it is assumed that ε_{ai} is

[2] T=alternative food product, the alternative the GM food could be either a conventional, or organic food product while in the case of Organic, the alternative could be a conventional or GM food product subsumed as alternative foods.

identically and independently distributed as type I extreme value in which case $\varepsilon_i = \varepsilon_{Ti} - \varepsilon_{Gi}$ follows the logistic distribution (Train, 2002). Under this distributional property of ε_i, the probability that consumer i chooses the GM food product is given by the standard logit model of discrete choice (McFadden 1974, 1984).

The relation between a consumer's willingness to buy the GM food variety and his/her views on a specific food attribute is explored by modeling the indicator variable Z_i for the i^{th} consumer as a function of his/her rating of the food attribute as follows:

$$Z_i = \mathbf{ßX}_i = \ _0 + \ _1 x_{i1} + \ _2 x_{i2} + \mathrm{K} + \ _k x_{ik} + \ _i, \quad i = 1, 2, \mathrm{K}\ , n \qquad (5)$$

where x_{ij} denotes the j^{th} attribute rating of the i^{th} respondent, $\ = (\ _0, \ _1, \ldots, \ _k)$ is the parameter vector to be estimated and $\ _i$ is the random error or disturbance term associated with the i^{th} consumer. Under the logistic distributional assumption for the random term, the probability P_i (that the i^{th} consumer will choose the GM food variety) can now be expressed as (Green, 2002):

$$P_i = F(Z_i) = F(\ _0 + \sum_{j=1}^{k} \ _j x_{ij}) = F(\mathbf{ßX}_i) = \frac{1}{1+\exp(-\mathbf{ßX}_i)} \qquad (6)$$

The estimated -coefficients of equation (6) do not directly represent the marginal effects of the independent variables on the probability P_i that the GM variety will be chosen. In the case of a continuous explanatory variable, the marginal effect of x_j on the probability P_i is given by:

$$\partial P_i / \partial x_{ij} = \left[\ _j \exp(-\mathbf{ßX}_i)\right] / \left[1+\exp(-\mathbf{ßX}_i)\right]^2 \qquad (7)$$

However, if the explanatory variable is qualitative or discrete in nature $\partial P_i / \partial x_{ij}$ does not exist. In such a case, the marginal effect is obtained by evaluating P_i at alternative values of x_{ij}. For example, in the case of a binary explanatory variable x_{ij} that takes values of 1 and 0, the marginal effect is determined as:

$$\partial P_i / \partial x_{ij} = P(x_{ij} = 1) - P(x_{ij} = 0) \qquad (8)$$

The model explanatory variables capture the potential influence the respondent's views on importance of specific food aspects on organic and/or GM food purchases. The following empirical model is specified to model organic and/or GM food purchases and consumer views on a food attribute in the consumption decision:

$$\begin{aligned} ORGBUY_i = &\ _0 + \ _1 HEALTEAT + \ _2 FAMIL\_S + \ _3 FAMIL\_I + \ _4 FAMIL\_VI + \\ &+ \ _5 FAMIL\_EI + \ _6 DULTRA\_S + \ _7 DULTRA\_I + \ _8 DULTRA\_VI + \ _9 DULTRA\_EI + \\ &\ _{10} VEGT\_SI + \ _{11} VEGT\_I + \ _{12} VEGT\_VI + \ _{13} VEGT\_EI + \ _{14} USPA\_I \\ &+ \ _{15} USPA\_VI + \ _{16} USPA\_EI + \ _{17} IMP\_AGI + \ _{18} IMP\_AGVI + \ _{19} IMP\_AGEI \\ &+ \ _{20} IMP\_ESYI + \ _{21} IMP\_ESYV + \ _{22} IMP\_ESYE + \varepsilon \end{aligned}$$

and

$$\begin{aligned} GMBUY_i = &\ _0 + \ _1 HEALTEAT + \ _2 FAMIL\_S + \ _3 FAMIL\_I + \ _4 FAMIL\_VI + \\ &+ \ _5 FAMIL\_EI + \ _6 DULTRA\_S + \ _7 DULTRA\_I + \ _8 DULTRA\_VI + \ _9 DULTRA\_EI + \\ &\ _{10} VEGT\_SI + \ _{11} VEGT\_I + \ _{12} VEGT\_VI + \ _{13} VEGT\_EI + \ _{14} USPA\_I \\ &+ \ _{15} USPA\_VI + \ _{16} USPA\_EI + \ _{17} IMP\_AGI + \ _{18} IMP\_AGVI + \ _{19} IMP\_AGEI \\ &+ \ _{20} IMP\_ESYI + \ _{21} IMP\_ESYV + \ _{22} IMP\_ESYE + \varepsilon \end{aligned}$$

where the variables are defined and listed in Table 1.

The two logistic models on each of the food products (organic and/or GM) are estimated to explain and predict consumer willingness to buy the respective foods. The maximum likelihood (ML) estimation procedure was used to obtain the model parameters. The model summary statistics, -coefficients (along with their t-ratios) and the marginal effects were obtained by using the software package LIMDEP (Econometric Software, 2002).

Empirical Results

The maximum likelihood estimates of the model coefficients and the associated t-ratios are reported in Table 2. This table also reports the estimated values of the log-likelihood functions of the unrestricted and the restricted (i.e., all slope coefficients are zero) models. The reported values of the McFadden's R^2 are measures of goodness of model fit. The marginal effects of the independent variables on the dependent variable (i.e., willingness to buy organic and/or the GM food products) are reported in Table 3. Table 3 also provides information on model prediction success.

Among the 1143 respondents included in this study, 771 (67 percent) respondents were categorized as *to much more willing, somewhat willing and averagely willing to buy* GM labeled food and the remaining 372 (33 percent) respondents were classified as *somewhat less willing* to *much less willing* buy GM labeled food. In the case of the organic food, 521 (44 percent) respondents were identified as *sometimes, frequently* to *regular* buyers of organically labeled foods, while 664(56 percent) respondents were characterized as *never* or *rarely* buying such foods.

According to Table 2 that the coefficients of *HEALTHEAT*, *IMP_AGI*, and *IMP_ESYV* are positive, while *FAMIL_SI*, *DULTRA_I, DULTRA_V* and *DULTRA_EI* are negative, respectively and statistically significant at 5 the percent level in influencing GM food purchases. The estimated coefficients suggest that respondents' perceptions about the absence of allergic ingredients in foods, foods that are easily available and respondents who perceive the role of eating primarily to stay healthy relative to those who hold the opposite perceptions, are more likely to buy GM labeled food products. In contrast, respondents who view a food's familiarly (i.e., familiar brand or naturalness (non-adulteration) as important relative to those who view these food attributes as not important are less willing to buy GM labeled foods. The results suggest healthy benefits (including absence of allergic causing ingredients in foods); food naturalness aspect (i.e., absence of artificial nor flavors) will enhance GM foods purchases.

In the case of organic food purchases, *DULTRA_V, DULTRA_EI, VEGT_VI, VEGT_I, VEGT*_EI, and *USPA_V*I are positive, while *FAMIL_SI*, *FAMIL_I*, *FAMIL_VI FAMIL_EI*, and *USPA_VI* are negative, respectively and statistically significant at the 5 percent level in influencing organic food purchases. The estimates suggest that respondents' perceptions of food naturalness, importance that the food be vegetarian and vegan, and that the food be locally produced (produced in U.S.A) compared to those placing no importance on food naturalness, vegetarian-vegan foods, and local production are more likely to buy organic products. Conversely, respondents who place importance on food familiarly (i.e., familiar brands or food you had eaten before)

Table 2: Maximum Likelihood Estimates of Model Coefficients

	Buy Organic Foods			Buy GM Foods		
	Coefficient	t-ratio	p-value	Coefficient	t-ratio	p-value
Constant	-3.1132	-7.31	0.00	1.9841	7.99	0.00
HEALTEAT	0.0001	0.11	0.91	0.0021	2.39	0.02
FAMIL_SI	-0.6239	-1.93	0.05	-0.4915	-2.10	0.04
FAMIL_I	-1.0224	-3.13	0.00	-0.1703	-0.73	0.47
FAMIL_VI	-1.1216	-3.58	0.00	-0.0438	-0.19	0.85
FAMIL_EI	-1.4339	-4.40	0.00	0.0584	0.24	0.81
DULTRA_S	0.6112	1.27	0.20	-0.3130	-1.20	0.23
DULTRA_I	0.6353	1.40	0.16	-0.9021	-3.74	0.00
DULTRA_V	1.5348	3.49	0.00	-0.9484	-3.73	0.00
DULTRA_E	2.4180	5.58	0.00	-1.5588	-6.10	0.00
VEGT_SI	0.2652	0.63	0.53	-0.1612	-0.68	0.50
VEGT_I	0.7129	2.14	0.03	-0.2393	-1.15	0.25
VEGT_VI	1.1434	3.59	0.00	-0.0214	-0.10	0.92
VEGT_EI	1.5583	4.74	0.00	-0.5110	-2.29	0.02
USPA_I	0.2705	1.55	0.12	0.0475	0.38	0.71
USPA_VI	0.2620	1.81	0.07	0.0007	0.01	0.99
USPA_EI	-0.5257	-3.20	0.00	-0.0477	-0.42	0.67
IMP_AGI	0.1756	0.73	0.47	0.3709	1.98	0.05
IMP_AGVI	-0.0012	0.00	1.00	-0.1857	-0.98	0.32
IMP_AGEI	-0.1758	-1.04	0.30	-0.1842	-1.53	0.13
IMP_ESYI	0.1015	0.65	0.51	-0.1744	-1.58	0.11
IMP_ESYV	-0.0679	-0.47	0.64	0.3055	2.99	0.00
IMP_ESYE	-0.0268	-0.18	0.86	-0.1311	-1.26	0.21
LL	-375.68			-660.68		
Restricted LL	-450.11			-721.14		
Chi-Square	148.86			120.91		
DF	22			22		
McFadden's R^2	0.17			0.08		
% Correct prediction	88%			70%		

compared those who view this aspect as not important, and also respondents who view importance of local food production as extremely important compared to those who do not, are not likely to buy organic foods. The results suggest that the presence of food vegan-vegetarian and naturalness attributes contribute to increasing the regularity of organic food purchases.

The estimated marginal effects of the independent variables (Table 3) show that respondents' perceptions on food naturalness, availability, and production location impact organic and/or GM food purchases differently. Similarly, health and vegetarian-vegan food attributes also influence respondents' purchasing behavior of the organic and/or GM food products. Therefore, respondents who view food naturalness as *important* to *extremely important* in deciding what foods to eat are between 21 to 36 percent less likely to buy GM foods compared to those who do not consider this attribute important. Respondents who view *familiarity* of the product to be *somewhat important*, and those who prefer the food to be *vegetarian-vegan* are compared to those who do not, are 11 percent less likely to buy GM foods. With relatively smaller magnitudes though statistically significant, are respondents' perceptions on the importance of food availability (very important to extremely important); such respondents are 4 to 7 percent less likely to buy GM foods. On the other hand, respondents who place importance on the absence of allergic causing ingredients in foods relative to those who do not are 8 percent more likely to buy GM foods. We note that although the role of eating to stay healthy is significant, there is no difference between respondents in terms of GM food purchases.

The results further show that respondents who place importance (important to extremely important) in food naturalness in their eating decisions compared to those who do not are between 6 to 32 percent more likely to buy organic foods. While, respondents who place importance in vegetarian and vegan (no meat or meat by products) food attribute (important to extremely important) compared to those who do not are between 7

Table 3: Estimated Marginal Effects of Independent Variables on Willingness to Buy/Regularity of Purchases

	Buy Organic Foods			*Buy GM Foods*		
	ME	t-ratio	p-value	ME	t-ratio	p-value
Constant	-	-	-	-	-	-
HEALTEAT	0.00	0.11	0.91	0.00	2.39	0.02
FAMIL_SI	-0.04	-1.93	0.05	-0.11	-2.10	0.04
FAMIL_I	-0.06	-3.13	0.00	-0.04	-0.73	0.47
FAMIL_VI	-0.07	-3.58	0.00	-0.01	-0.19	0.85
FAMIL_EI	-0.08	-4.40	0.00	0.01	0.24	0.81
DULTRA_S	0.05	1.27	0.20	-0.07	-1.20	0.23
DULTRA_I	0.06	1.40	0.16	-0.21	-3.74	0.00
DULTRA_V	0.17	3.49	0.00	-0.22	-3.73	0.00
DULTRA_E	0.32	5.58	0.00	-0.36	-6.10	0.00
VEGT_SI	0.02	0.63	0.53	-0.04	-0.68	0.50
VEGT_I	0.07	2.14	0.03	-0.05	-1.15	0.25
VEGT_VI	0.12	3.59	0.00	0.00	-0.10	0.92
VEGT_EI	0.18	4.74	0.00	-0.11	-2.29	0.02
USPA_I	0.02	1.55	0.12	0.01	0.38	0.71
USPA_VI	0.02	1.81	0.07	0.00	0.01	0.99
USPA_EI	-0.04	-3.20	0.00	-0.01	-0.42	0.67
IMP_AGI	0.01	0.73	0.47	0.08	1.98	0.05
IMP_AGVI	0.00	0.00	1.00	-0.04	-0.98	0.32
IMP_AGEI	-0.01	-1.04	0.30	-0.04	-1.53	0.13
IMP_ESYI	0.01	0.65	0.51	-0.04	-1.58	0.11
IMP_ESYV	-0.01	-0.47	0.64	0.07	2.99	0.00
IMP_ESYE	0.00	-0.18	0.86	-0.03	-1.26	0.21

	Predicted					Predicted		
	0	**1**	*Total*			**0**	**1**	*Total*
0	1025	10	1035	*Actual*	**0**	95	277	372
1	129	21	150		**1**	65	706	771
	1154	31	1185			160	983	1143

to 18 percent more likely to buy organic foods. Conversely, those who place importance in food familiarity (somewhat important to extremely important) compared to those who do not are 4 to 8 percent less likely to buy organic foods on a regular basis.

Overall, these results suggest that consumer purchases of organic and/or GM foods are driven by presence or absence of particular food benefits the respondent deems important in the consumption decision. Such benefits include food naturalness, absence of allergic ingredients (health), production location (public) and availability (access). These attributes are characterized as public and private benefits in this paper. However, the presence or absence of an attribute becomes meaningful only when a respondent claims ownership of the good through a purchase action, given that there is a narrow line between excludability and non-triviality in the definition of a private or public good, in the context of consumption.

Model summary statistics presented, in the lower panels of Tables 2 and 3, indicate that the two models have significant explanatory power. McFadden's R^2 estimates are between 0.08 and 0.17, which are quite reasonable for a cross-section data. The estimated models successfully predicted between 70 percent and 88 percent of responses, for GM and/or organic food purchases, respectively.

Conclusions

This paper examined consumer willingness to buy an organic and/or GM food product in the context of food attributes considered important in the consumption decision. Food attributes related to health, naturalness, familiarity, vegetarian-vegan, production location, and availability are found to be critical in the acceptance of the organic and/or GM foods. The results show that food naturalness is pivotal in organic food purchasing decisions, while the absence of allergenic causing ingredients enhances GM purchases. These findings suggest that although there are perceived differences between organic and/or GM foods, when placed with in the context of similar food attributes, a consumer's selection of a food may not consider the production process. The results show in case of benefits, the direction of influence is similar and very significant.

This study contributes to the emerging literature on consumer perceptions about food by identifying the drivers of organic and/or GM food consumption. The information generated may inform policy decision-making debate on organic farming juxtaposed with GM and may be useful to the marketers of both foods.

The study has shown that instead of taking consumers' perceptions and attitudes as exogenous variables, future research may need to explicitly model consumers' latent psychological variables (e.g., attitudes and perceptions) as well as their perceptions about risks and benefits of foods including genetically modified products in analyzing public acceptance.

References

Econometric Software. Limdep Version 8.0. Plainview, NY: Econometric Software Inc., 2002.

House, L., B. Morrow, J. Lusk, and M. Moore. (2001). Modeling Consumer Acceptance and Willingness to Pay for Genetically Modified Foods in the U.S. and the European Union. Paper presented at the International Food and Agribusiness Symposium, Sydney.

Lancaster, K. J. (1966a). A New Approach to Consumer Theory. Journal of Political Economy, 74:132-157.

Lancaster, K. J. (1966b). Change and Innovation in the Technology of Consumption. American Economic Review, 56:14-23.

McFadden, D. (1974). Conditional Logit Analysis of Qualitative Choice Behavior. In Zarembka, P. Ed. Frontiers in Econometrics. New York: Academic Press.

McFadden, D. (1984). Econometric Analysis of Qualitative Response Models. In Grilliches, Z., & Intrilligator, M. Eds. Handbook of Econometrics, Vol. 2. Amsterdam: North Holland.

Train, K. (2002). Discrete Choice Methods with Simulation, Cambridge University Press.

Riley, P. and L. Hoffman. (1999). Value-Enhanced Crops: Biotechnology's Next Stage. *Ag. Outlook* (March Issue), pp. 18-23.

Table 1: Descriptive Variables used in the models

Variable	Description of Variable	Mean	Std. Dev
HEALTEAT	1=if respondent eats to primarily to stay healthy;0=otherwise	0.73	0.44
FAMILA	Importance of familiarity in an eating decision (food you had before, familiar brand & kosha-halal)	3.17	1.41
FAMIL_NI	1 = if familiarity of the food is not important ;0 otherwise	0.17	0.38
FAMIL_SI	1 = if familiarity of the food is somewhat important ;0 otherwise	0.17	0.38
FAMIL_I	1 = if familiarity of the food is important ;0 otherwise	0.19	0.40
FAMIL_VI	1 = if familiarity of the food is very important ;0 otherwise	0.23	0.42
FAMIL_EI	1 = if familiarity of the food is extremely important ;0 otherwise	0.23	0.42
DULTRATI	Importance of food non-adulteration in an eating decisions (no artificial colors, no artificial flavors, and not processed)	3.08	1.41
DULTRA_N	1 = if food Non-adulteration of the food is not important ;0 otherwise	0.18	0.39
DULTRA_S	1 = if food Non-adulteration of the food is somewhat important ;0 otherwise	0.18	0.38
DULTRA_I	1 = if food Non-adulteration of the food is important ;0 otherwise	0.22	0.42
DULTRA_V	1 = if food Non-adulteration of the food is very important ;0 otherwise	0.19	0.40
DULTRA_EI	1 = if food Non-adulteration of the food is extremely important ;0 otherwise	0.22	0.41
VEGET	Importance of vegetarian or vegan food in an eating decision	2.81	1.51
VEGT_NI	1 = if vegetarian or Vegan food is not important ;0 otherwise	0.32	0.47
VEGT_SI	1 = if vegetarian or Vegan food is somewhat important ;0 otherwise	0.12	0.32
VEGT_I	1 = if vegetarian or Vegan food is important ;0 otherwise	0.18	0.38
VEGT_VI	1 = if vegetarian or Vegan food is very important ;0 otherwise	0.21	0.41
VEGT_EI	1 = if vegetarian or Vegan food is extremely important ;0 otherwise	0.18	0.38
USPAT	Importance of the food being produced in the U.S (local production) in eating decisions	2.68	1.11
USPA_NI	1 = if food is U.S produced is not important ;0 otherwise	0.22	0.41
USPA_I	1 = if food is U.S produced is important ;0 otherwise	0.18	0.38
USPA_VI	1 = if food is U.S produced is very important ;0 otherwise	0.32	0.46
USPA_EI	1 = if food is U.S produced extremely important ;0 otherwise	0.29	0.45
IMP_ALLG	Importance no food allergy causing ingredients in eating decisions	3.28	1.15
IMP_AGNI	1 = if food allergy causing ingredients is not important; 0 = otherwise	0.16	0.36
IMP_AGI	1 = if food allergy causing ingredients is important; 0 = otherwise	0.09	0.29
IMP_AGVI	1 = if food allergy causing ingredients is very important; 0 = otherwise	0.07	0.25
IMP_AGEI	1 = if food allergy causing ingredients is extremely important; 0 = otherwise	0.68	0.47
IMP_ESYG	Importance of availability (easy to get) of the food in eating decisions; 0 = otherwise	2.89	0.96
IMP_ESYN	1 = Food availability is not important; 0 = otherwise	0.09	0.29
IMP_ESYI	1 = Food availability is important; 0 = otherwise	0.24	0.43
IMP_ESYV	1 = Food availability is very important; 0 = otherwise	0.35	0.48
IMP_ESYE	1 = Food availability is extremely important; 0 = otherwise	0.32	0.47