Italian Consumer Acceptance of Nutritionally Enhanced GM Food

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Abstract

The aim of this article is to evaluate Italian consumers' acceptance and willingness to purchase GM foods based on the type of benefit (input vs output trait) and product (plant based vs animal based). Two surveys were administered in two consecutive years (2004 and 2005) and the data used to test for possible changes in consumer acceptance. The results of a multinomial logit analysis suggest that on average consumer acceptance for plant-based GM food was higher in 2005. This study confirmed the key role of information strategies to consumers, with the most relevant results being the role distorted information play in raising the consumer's level of fear and perceived risk. Respondents also place a higher level of confidence on scientists who are generally seen as independent of the industry. Consumers that usually consume and buy enhanced food products have a higher probability to buy a GM product providing an increased vitamin content.

Key words: Food, Genetically modified organisms, consumer acceptance, willingness to buy, nutritionally enhanced food products.

JEL classification: Q13

1. Introduction

The diffusion of nutrient enriched products and foods conducive to good health is growing. These are commonly termed ‘nutraceuticals,’ ‘functional foods’, or ‘nutritionally enhanced foods’. The causes of the observed increase in consumer interest lay in several factors, many of which are common socio-economic trends in industrialized countries. These include a rise in income, an increased interest in pursuing the wellbeing beneath the satisfaction of basic needs, changes in lifestyle and eating habits, strong linkages discovered between good health and correct nutrition, an increase in average life expectancy and the consequent rise in the proportion of elderly people in the population, and an increased tendency to avoid chemical pharmaceuticals (Canavari *et al.*, 2007).

Another related and recent issue in food industry is represented by the diffusion of transgenic and genetically engineered organisms in agriculture. Technically, the design of transgenic organisms is one of the possible means to introduce changes in food characteristics to enhance their nutritional performance. However, the introduction of genetically modified (GM) foods gave rise to a strong movement against this innovation.

Consumer acceptance of GM foods in Europe is a key factor that will influence the future of biotechnology in agriculture and food systems. Several studies take into consideration consumer acceptance of GM food and the related factors. Lusk *et al.* (2004) performed a meta-analysis of GM food valuation studies, analyzing 25 studies that have reported consumer willingness-to-pay (WTP) or willingness-to-accept (WTA) values. In Italy, the survey conducted by Boccaletti and Moro (2000) found that the Italian consumers are far less willing to buy genetically modified food and hold a much stronger belief when compared to their United States counter-parts that it is important to indicate GM food products with adequate labeling. These outcomes are confirmed by McGarry Wolf *et al.* (2004) and other related studies are discussed in Canavari and Nayga (2009) who note that most of the studies on GM food take into consideration input trait benefits, such as resistance to plant diseases or herbicides in common crops (Traxler et al., 2004).

Some proponents of biotechnology view the current consumer resistance to GM foods as

due—at least in part—to the lack of tangible consumer benefits from this technology. These proponents believe that the next wave of food biotechnology innovations will have greater public acceptance, because of expected new and improved products with enhanced nutritional benefits (Feldmann *et al.*, 2000; Gamble *et al.*, 2002). This issue was previously explored by Onyango and Nayga (2004) in the United States. In Italy, we performed a survey study in 2004 (Canavari *et al.*, 2005; Canavari and Nayga, 2009). Drawing on the results from the 2004 survey, a further survey was performed in 2005 using an enhanced data collection tool. Both surveys were aimed at evaluating Italian consumer acceptance and willingness-to-pay for second generation GM foods, which are characterized by at least an *output* trait benefit, (i.e. nutritionally enhanced foods). These differ from first generation GM foods which were characterized by *input* trait benefit (i.e., reduced pesticides). The 2005 survey results are compared with the results of the previous study performed in 2004 to highlight possible changes in consumers' attitudes and preferences. Multinomial logit models are estimated to examine the effect of various factors on consumers' willingness to buy GM foods with or without nutritionally enhanced attributes.

The paper is organized as follows: first, we describe the survey instrument and the data we use; then, we describe the results; finally, we draw some conclusions.

2. Materials and Methods

The theoretical framework is the Lancaster (1966) model for consumers' food choices based on the product attributes and its further developments. A random utility discrete choice model (Marschak, 1960) is adopted to analyze the willingness to buy GM foods. The 2004 survey was conducted in late spring-early summer and was based on a telephone interview of a sample of Italian households (Canavari *et al.*, 2005). The 2005 survey data collection was performed in the period February-June and aimed at detecting changes in consumer attitudes from 2004 as well as improving the choice-task. In this last version of the survey a double bounded question was introduced to evaluate purchase intentions conditional to choosing a GM or a non-GM alternative.

Both questionnaires were divided into two sections and aimed at collecting information on

consumer choice, behaviour and characteristics (see Table 1 for the complete list of variables):

Section I

This section of the survey instrument contained the following components:

a. When respondents were found to be unaware of the use of biotechnology in food production a short explanation of this issue was given to them using the following statements:

   "Transgenic foods are products where, to improve food characteristics, parts of the natural genetic code are replaced with those of others living beings. These organisms are also called genetically modified organism or GMO.";

b. We explored the respondent's willingness to buy hypothetical first (input-traits) and second (input and output-traits) generation GM foods in place of conventional foods. The food products were exemplified by breakfast cookies and eggs to represent both plant-derived and animal-derived products, presented in random alternate order, at an equal starting bid price for both GM and non-GM food. We asked for respondent's willingness to buy a hypothetical second generation GM food in place of the conventional food. In the case of cookies these were proposed to be vitamin E enhanced believed to slow down the negative effects of aging. In the case of eggs these were proposed as low cholesterol. Cookies and eggs are among the most popular food products regularly purchased and consumed by Italians and everybody is familiar with them. The two key questions posed in the survey are based on the following information:

   - willingness to buy breakfast cookies (and eggs) that are derived from genetically modified wheat (or eggs laid from hens fed on transgenic corn), provide the input trait benefits that society at large can enjoy because of a reduced usage of pesticides (respectively, GMCOOKIE and GMEGGS);
   - willingness to buy nutritionally enhanced breakfast cookies (or eggs) derived from wheat genetically modified to provide additional private benefits derived from the added vitamin E/antioxidant content, (or eggs from hens fed with transgenic corn and genetically modified to

produce low-cholesterol eggs). This therefore introduces nutritional health related benefits mainly of a private nature (respectively, GMVIT_Y0 and GMCHO_Y0);

- the starting bid prices for the two products were set to two different levels randomly distributed across the sample: (GMVIT_B0 and GMCHO_B0 for cookies and eggs, respectively);

c. According to the respondent's answer to the first bid question, a follow-up question was asked at a second bid value as follows:

- 1st step: for those who choose to buy the regular food at the initial price, choice between GM nutritionally enhanced food and regular food, the former at a price 30% lower than the starting bid price (higher for those who choose the transgenic one);
- 2nd step: according to the previous answer, choice between GM nutritionally enhanced food and regular food, the latter at a price 10% or 50% lower than the starting bid price (vice versa for those who choose the transgenic one);

The choices in b. and c. are all made with respect to a regular non-GM food that is not strictly a GM-free food, since a 0.9% level of GM residuals for each ingredient is allowed without the need of labelling the food as GM by current law.

Section II

d. 5 questions asking if statements related to biotechnology and GM foods are true or false; the five statements were: (1) ordinary tomatoes do not contain genes, while genetically modified tomatoes do; (2) if a person eats a genetically modified fruit, his/her genes could be modified as a result; (3) genetically modified animals are always larger than ordinary animals; (4) it is possible to transfer animal genes to plants; (5) tomatoes, genetically modified with genes from catfish, would probably taste 'fishy'. From the number of right answers the variable GMQUIZ was derived, while from the number of wrong responses to the 2nd, 3rd and 5th statements, which

are specifically related to common fears about the so called "Frankenstein Food", the variable GMFRANK was derived.

e. public trust about private and public institutions associated with biotechnology research and product development (researchers, public bodies, multinationals companies),
f. frequency of consumption of organic and nutritionally enhanced (i.e. high vitamins and low cholesterol) food;
g. a simple yes/no proxy for time preferences (stated preference for spending today or save for the future) and two proxies for risk attitudes both general (willingness to bet 50 Euros, having 1% likelihood to win 5,000 Euros) and health related (average daily number of cigarettes smoked);
h. respondent's and household's socio-economic and demographic characteristics.

The target group for the survey is the Italian adult aged 18 years or older. A random stratified proportional probability sample of 400 respondents was drawn from a directory of approximately 20 million households in Italy. The objective was to achieve a sampling error rate of +/-4.9 percent at a 95% confidence interval for the yes/no answers. Quotas were set to ensure a balanced representation of geographical areas within the country and among small, medium and large size towns. A working list of 2,000 telephone numbers was compiled in order to obtain clusters of 5 potential numbers for each foreseen respondent. Each number was dialled a maximum of 3 times. In the case of no response or a refusal, the following number in the cluster was used. If available, the respondent responsible for purchasing food for the household was asked to participate in the survey.

Since we are using the telephone survey methodology, there is a possibility that participants of the survey will provide responses that reflect a hypothetical bias, that is when people respond to hypothetical questions in a different way compared to real situations. Consequently, we used a cheap talk script that was prepared before conducting the telephone survey, since it has been found by Lusk (2003) that it can effectively address the hypothetical bias issue.

Several models (probit, bivariate probit, ordered probit and multinomial logit models) were tested to examine the effect of various factors on consumers' willingness to buy GM foods with or without nutritionally enhanced attributes and on the related WTP answers to discrete choice bid amounts.

3. Results and Discussion

At the end of the survey, 1301 working telephone numbers were dialled. Each number was dialled at different times of the week and at different times of the day from 11.00-20.00, in order to reduce the risk of an unequal selection of categories and to reach people who were infrequently at home. In any case, 322 listed numbers were not reached after 3 tries, while 403 respondents completed the survey and 576 individuals refused to participate. This gave us a response/cooperation rate of about 41 percent. The length of the interview resulted between 5 and 17 minutes.

The description of the variables used in the analysis are exhibited in Table 1. The four variables of interest for the dependent variable are GMCOOKIE, GMVIT_Y0, GMEGGS, and GMECHO_Y0. In Table 2, the descriptive statistics of the variables obtained in 2005 are compared with those obtained in the 2004 survey. Both surveys used the same sampling procedure. The share of respondents stating they would buy GM food increased for both GM cookie and GM eggs from 2004 to 2005. Specifically, 44.4 percent of the respondents in the 2005 survey indicated that they would buy cookie obtained from GM flour with less pesticides and 46 percent indicated that they would buy cookie from GM flour enhanced with vitamin E. In 2004, the percentages of respondents indicating that they would buy cookie obtained from GM flour with less pesticides and GM flour with enhanced vitamin E are 32 and 38.4 percent, respectively. The percentage of individuals indicating that they would buy GM eggs also increased slightly from 2004 to 2005 with 34.3 percent of the respondent indicating that they would buy package of 6 eggs obtained from hens that eat GM maize with less pesticide and package of 6 eggs obtained from GM hens that lay eggs with less cholesterol. Hence, there seems to be a difference in the acceptance levels between GM cookies (GM plant-based product) and GM eggs (GM animal-based food).

Most of the socio-demographic characteristics are consistent between the two samples,

remaining within the range of +/- 4 percent. The average for the variable GMQUIZ decreases slightly in the 2005 sample, while the GMFRANK mean has a lower value than in the 2004 sample. In this survey, the distribution of GMQUIZ score is very close to a random distribution of the answers. This is due to the fact that the score is calculated by summing the correct answers, while both the wrong and no answers take the 0 value. Since a relatively high percentage of people did not answer some questions, we considered this score not really as reliable as in the previous survey. On the other hand, since three of the GMQUIZ questions were specifically addressed to highlight unjustified fears on GM foods and the score is obtained by summing only the wrong answers, the GMFRANK score is then considered more suitable in indicating the presence of negative opinions and incorrect information on the effects of GM food, showing the grade of association of this food with the image of "Frankenstein food".

We used a multinomial logit (MNL) model to analyze the willingness to purchase data based on a dependent variable that was developed using the two binary (0;1) choices. This variable is interpreted as follows:

0 = Unwilling to buy GM food (N-N)

1 = Willing to buy nutritionally enhanced GM food but not input trait (N-Y)

2 = Willing to buy input trait GM food but not nutritionally enhanced (Y-N)

3 = Willing to buy both input trait and nutritionally enhanced GM food (Y-Y)

The estimates of the MNL model for cookies and for eggs are exhibited respectively in Table 3 and Table 4, which, for the sake of brevity, show only the marginal effects for the choices 0 and 3.

The overall Pseudo R-squared is 23,78% in the MNL for cookies and 25,83% in the MNL for eggs. The performance of the model is in line with the usual levels for this type of cross-sectional data (Louviere *et al.*, 2000, p.54).

The variable EGGFIRST was introduced to test if the order in which the two product alternatives (cookies/eggs) was proposed to the respondent mattered. Since in all the models this variable showed no significance, it may be concluded that the respondent was not influenced by the order of

questions on cookies and eggs.

Considering the Cookies model for the choice between regular cookies and GM cookies, the three variables that are significant at the 0.01 level are HEARD, GMFRANK and TR_SCIEN. The first variable shows that people who were previously informed about the existence of GM Food are about 38% less likely to buy second generation GM cookies. The result may be explained by the difference between the short explanation given to the people who stated they have not heard about GM before (which was neutral, not introducing problematic issues in the topic) and the orientation of the mainstream information that is rather negative instead. In fact, Italian consumers seem to be exposed to a great deal of information about GM foods in the media and they seem to be more influenced by information that comes from consumer and environmental-oriented action groups, that usually tend to frame agricultural biotechnology in a negative way (Govindasamy et al., 2008). The role of this type of information is consistent with what Hu and Chen (2004) found in China.

As expected, the variable GMFRANK acts as a deterrent to the purchase of GM food, confirming the significant effect of distorted information on the choice. It is important to note that most of consumers receive information about such complex scientific concepts through the media (Hoban & Kendall, 1993). When these topics are treated by the media, consumers seem to be involved mainly into the political-ideological debate, while the scientific arguments seem to not reach the majority of them. This is due mainly to the use of specific technical terms linked to the scientific aspects that requires a high-medium level of education to be understood (Basile and Russo, 2005). The lack of clarity into the treatment of scientific topics by the media and the influence of consumers and environmental-oriented action groups probably are at the base of the spread of common fears about the "Frankenstein Food".

The significance of variable TR_SCIEN is consistent with the findings of Todt et al. (2009) in Spain, where consumers stated that their preferences and demand decisions are based primarily on scientific opinion

Other variables are less significant, but also interesting. The variable VIT (a transformation of the

FREQ_VIT variable, assuming the value 1 if the consumption of food with less cholesterol is at least twice a week and 0 elsewhere) is consistent with expectations for GM cookies derived from wheat genetically modified to provide added vitamin E. Also the sign is as expected, and the marginal effect, as showed in the Table 3, is quite relevant, reaching about 20%.

The variable SMOKE, taken as a proxy for the adoption of behaviours entailing long term risks on health, increases the probability to buy GM food of about 22%. Finally, the variable GAMBLE is able to increase the probability to buy GM by 28% in the MNL model. The marginal effects of these two variables confirm the high risk perception of the consumer toward GM Food (Moon & Balasubramanian, 2004). Also, the high number of household members has a positive significant influence with the probability that they will purchase nutritionally enhanced GM cookies. Respondents from North-east are less likely to buy cookies obtained from GM flour enhanced with vitamin.

There are no significant variables for the choice Y = 1 (willing to buy nutritionally enhanced GM food but not input trait (N-Y).

4. Conclusion

This paper investigated consumers' purchase intentions of nutritionally enhanced genetically modified foods in Italy. These intentions have been found to be slightly higher than in other surveys conducted in the past, but there is still a strong resistance against GM food.

However, the purchase intentions do increase in the case of the gene transfer being plant based, while it remains lower and do not increase in the case that it is animal-based.

The interest for the specific benefit appears to be relevant, in fact in the case of individuals that usually consume vitamin-enhanced food a higher probability to buy GM cookies derived from wheat genetically modified to provide added vitamin E can be highlighted

The key role of information strategies to the consumer is partially confirmed in this study. The role of distorting information resulted in raising the level of fear and the perception of risk by the consumer. The effect of different types of information is not addressed in this study, but may be an

important future issue. The involved subjects which seem to be granted with the higher level of confidence are the Italian scientists, who are traditionally seen as independent from the industry. This suggests that information channelled through the direct interventions of scientists in the public debate may be more effective and able to help the consumers to forming a more stable and competent opinion. During the interviews, many consumers complained about the confusion and the incomplete information on the issue of GM food, and claimed that their answers were not motivated by an absolute refusal of research on biotechnology, but by a conservative approach under an uncertain decision framework.

It is also interesting to highlight that education level seems not to be directly related with higher purchase intentions. This holds with the previous survey conducted in 2004, in which only the lower education level was significant. This may be associated with the role of information, assuming that the less educated people may have been less exposed to information linked to scientific topics, including genetically engineering and the related risks and benefits.

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Table 1. Description of the variables used in the Multinomial Logit Model (2005 survey)

Dep. Variables	Description
GMCOOKIE	1 if respondent would choose to buy 500g cookie obtained from GM flour with less pesticide, rather than 500g non-GM traditional cookie at the same price; 0 otherwise
GMVIT_Y0	1 if respondent would choose to buy 500g cookie obtained from GM flour enhanced with vitamin E rather than 500g non-GM traditional cookie at the same price; 0 otherwise
GMEGGS	1 if respondent would choose to buy a package of 6 eggs obtained from hens that eat GM maize with less pesticide rather than a package of 6 non-GM regular eggs at the same price; 0 otherwise
GMCHO_Y0	1 if respondent would choose to buy a package of 6 eggs obtained from GM hens (and fed with GM maize) that lay eggs with less cholesterol rather than a package of 6 eggs from non-GM regular eggs at the same price; 0 otherwise
Covariates	**Description**
NORTHEAST	1 if live in North-east: Trentino-Alto Adige, Veneto, Emilia-Romagna, Friuli-Venezia Giulia; 0 otherwise
CENTER	1 if live in Center: Toscana, Marche, Umbria, Lazio; 0 otherwise
SOUTH	1 if live in South: Abruzzi, Molise, Puglia, Campania, Basilicata, Calabria; 0 otherwise
ISLANDS	1 if live in Islands: Sicilia, Sardegna; 0 otherwise
TOWNMEDI	1 if from a medium sized town (>20.000, <=100.000 inh.); 0 otherwise
TOWNLARG	1 if from a large sized town (>100.000 inh.); 0 otherwise
HEARD	1 if respondent claims he was previously informed by any means about the existence of GM food; 0 otherwise
GMQUIZ	number of correct responses to 5 "scientific" questions
GMFRANK	number of wrong responses to 3 "scientific" questions related to common fears about the "Frankenstein Food"
BUY_FOOD	1 if respondent is in charge for household's food purchases; 0 otherwise
AGE	Age of the respondent (also recoded in 3 classes)
EDUCAT	School qualification of the respondent (1=basic school (up to 5 yrs); 2= middle school (at least 8 yrs); 3= high school (at least 13 yrs);4= laurea degree or higher (over 17 yrs)
TR_SCIEN	1 if respondent express trust in self-regulating capacity of scientists; 0 otherwise
TR_PUBL	1 if respondent express trust in capacity of government to set and enforce suitable rules for GM food; 0 otherwise
TR_MULT	1 if respondent express trust in multinational companies working on GM; 0 otherwise
POS_GM	1 if respondent express a positive attitude towards genetically engineering applied in medicine; 0 otherwise
FREQ_ORG*	Frequency consumption of organic food (5=1/d; 4=2-3/w; 3=1/w; 2=1/m; 1=never)
FREQ_VIT*	Frequency consumption of vitamin enhanced food (5=1/d; 4=2-3/w; 3=1/w; 2=1/m; 1=never)
FREQ_CHO*	Frequency consumption of low cholesterol food (5=1/d; 4=2-3/w; 3=1/w; 2=1/m; 1=never)
SMOKE	Respondent’s average daily number of cigarettes smoked
GAMBLE	1 if respondent express willingness to bet 50 Euros with 1% odds to win 5000 Euros; 0 otherwise
SP_TODAY	1 if respondent prefers to spend today instead of saving for tomorrow; 0 otherwise
ADULMEMB	Household's members older than 14, expressed in number of persons
KIDSMEMB	Household's members younger than or equal 14, expressed in number of persons
INCOME1	1 if household's total net income is lower than 1,000 EUR; 0 otherwise
INCOME2	1 if household's total net income is between 1,000 and 1,999 EUR; 0 otherwise
INCOME3	1 if household's total net income is between 2,000 and 2,999 EUR; 0 otherwise
FEMALE	1 if respondent is female; 0 otherwise

Note: Baseline profile: small town; male, older than 54, university degree education; region of Valle D'Aosta, Piemonte, Liguria, and Lombardia; household's income of at least 3,000 Euros/month.
* FREQ_ORG, FREQ_VIT, FREQ_CHO have also been transformed in the dichotomous variables ORG, VIT, CHO, equal to 1 if the frequence of consumption is at least once a week, 0 otherwise.

Table 2. Descriptive Statistics for the 2004 and 2005 samples.

Variables	2004			2005				
Dependent Variables	**Mean**	**Std. Dev.**	**Count**	**Mean**	**Std. Dev.**	**Count**	**Min.**	**Max.**
GMCOOKIE	0.320		419	0.444		390	0	1
GMVIT_Y0	0.384		425	0.460		391	0	1
GMEGGS	0.282		422	0.343		396	0	1
GMCHO_Y0	0.283		427	0.343		397	0	1
Covariates	**Mean**	**Std. Dev.**	**Count**	**Mean**	**Std. Dev.**	**Count**	**Min.**	**Max.**
HEARD	0.901		433	0.792		403	0	1
GMQUIZ	2.762	1.306	433	2.484	1.379	403	0	5
GMFRANK	0.691	0.840	433	0.888	0.928	403	0	3
BUY_FOOD	0.838		433	0.746		402	0	1
AGE	46.06	14.66	421	47.16	16.17	389	18	85
EDUCAT	2.684	0.838	430	2.658	0.894	398	1	4
TR_SCIEN	0.827		411	0.799		389	0	1
TR_PUBL	0.445		429	0.503		394	0	1
TR_MULT	-	-	-	0.409		391	0	1
POS_GM	-	-	-	0.777		341	0	1
FREQ_ORG	-	-	-	1.508	1.438	396	0	4
FREQ_VIT	-	-	-	0.906	1.296	395	0	4
FREQ_CHO	-	-	-	0.905	1.356	391	0	4
SMOKE	-	-	-	0.281		402	0	1
GAMBLE	-	-	-	0.187		391	0	1
SP_TODAY	-	-	-	0.361		380	0	1
ADULMEMB	2.831	1.117	433	2.722	1.023	403	1	8
KIDSMEMB	0.577	0.866	433	0.531	0.783	403	0	3
INCOME1	0.098		398	0.170		376	0	1
INCOME2	0.389		398	0.378		376	0	1
INCOME3	0.309		398	0.295		376	0	1
FEMALE	0.718		433	0.695		403	0	1

Table 3 MNL Model for Cookies. Marginal Effects [a] (2005 survey).

	Marg. effects on Prob[Y = 0]			Marg. effects on Prob[Y = 1]			Marg. effects on Prob[Y = 2]			Marg. effects on Prob[Y = 3]		
Variable	Coefficient	Elasticity	P[|Z|>z]	Coefficient	Elasticity	P[|Z|>z]	Coefficient	Elasticity	P[|Z|>z]	Coefficient	Elasticity	P[|Z|>z]
Constant	0.604		**	-.057			-.068			-0.479		*
HEARD	0.351	.580	***							-0.376	-.677	***
GMFRANK	0.140	.257	***							-0.131	-.263	***
BUY_FOOD												
YOUNG	-0.194	-.104	*				.055	.354	*			
MATAGE												
EDUC1												
EDUC2												
EDUC4												
TR_SCIEN	-0.442	-.722	***							0.442	.787	***
TR_PUBL												
TR_MULT												
ORG												
VIT	-0.167	-.143	**							0.180	.168	**
CHO												
ADULMEMB	-0.089	-.500	**							0.087	.532	**
CHILDR												
SMOKE	-0.217	-.122	**							0.225	.138	**
SP_TODAY												
GAMBLE	-0.257	-.088	**							0.282	.105	**
INCOME1										0.253	0.077	*
INCOME2												
NORTHEAST	0.244	.096	**							-0.194	-.090	*
CENTER												
SOUTH												
ISLANDS												
TOWNSMAL												
TOWNLARG												

[a] Estimation based on 287 observations, Chi squared 139.09 with 81 Degrees of freedom. Partial derivatives of probabilities with respect to the vector of characteristics, computed at the means of the Xs. Probabilities at the mean vector are 0= .489, 1= .022, 2= .041, 3= .448. Pseudo R-squared 0.238. P[|Z|>z]: *** < 0.01, ** <0.05, * < 0.10.

Table 4 MNL Model for Eggs. Marginal Effects [b] (2005 survey).

	Marg. effects on Prob[Y = 0]			Marg. effects on Prob[Y = 1]			Marg. Effects on Prob[Y = 2]			Marg. Effects on Prob[Y = 3]		
Variable	Coefficient	Elasticity	P[|Z|>z]	Coefficient	Elasticity	P[|Z|>z]	Coefficient	Elasticity	P[|Z|>z]	Coefficient	Elasticity	P[|Z|>z]
Constant	.597		**	-.314		***	-0.143		*	-0.140		
HEARD	.365	.502	***							-0.371	-1.040	***
GMFRANK	0.083	0.111	*									
BUY_FOOD				0.069	0.719	*						
YOUNG	-0.195	-0.087	*	0.092	0.361	**						
MATAGE												
EDUC1							0.086	0.152	*			
EDUC2												
EDUC4												
TR_SCIEN	-0.413	-0.562	***							0.357	0.990	***
TR_PUBL												
TR_MULT							0.078	0.696	**			
ORG				0.095	0.959	**						
VIT												
CHO				0.062	0.334	*						
ADULMEMB							0.028	1.673	**			
CHILDR												
SMOKE				0.102	0.434	***	-0.083	-0.500	**			
SP_TODAY												
GAMBLE												
INCOME1				-0.141	-0.258	*						
INCOME2				-0.081	-0.438	**						
NORTHEAST	0.208	0.075	*							-0.244	-0.180	**
CENTER												
SOUTH												
ISLANDS										-0.237	-0.103	*
TOWNSMAL												
TOWNLARG												

[b] Estimation based on 260 observations, Chi squared 156.83 with 81 Degrees of freedom. Partial derivatives of probabilities with respect to the vector of characteristics, computed at the means of the Xs. Probabilities at the mean vector are 0= .594 1= .068 2= .048 3= .291. Pseudo R-squared 0.258
P[|Z|>z]: *** < 0.01, ** <0.05, * < 0.10.