Consumers' Perceptions about Genetically Modified Foods and Their Stated

Willingness-to-Pay for Genetically Modified Food Labeling: Evidences from Turkey

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Abstract

We applied a multinomial logit model to determine consumer characteristics affecting three possible policy regulations that wanted to be implemented for genetically modified foods in Turkey. The study reveals that many household characteristics including food spending amount, education, gender, marital status, knowledge about food related policies and regional variables are key policy factors to choose regulation programs on GMO foods. People are more prone to implement compulsory policy on GMO foods than that of voluntary policy.

1. Introduction

Genetically modified crops of agriculture for whom so called 'Frankenstein food' and for whom so called 'Green golden food' are becoming increasingly important nowadays in the world. The application of transgenic or in other words, genetically modified (GM) technology on agricultural products and the resulting genetically modified organisms (GMO) are considered to be one of the most effective yet controversial achievements in science and technology (Lusk et al., 2002; Kaneko and Chern, 2005). Despite all promises and benefits proclaimed by many biotech agricultural based companies and the governments such as create its own pesticide usage and persistence, higher crop yields, enhanced nourishing values and many more, the controversy surrounding its use to food production widespread to many countries (Loureiro and Hine, 2002; Chern et al., 2003; Huffman, 2003; Kaneko and Chern, 2005).

To determine pervasive effects of GM foods on consumers' perceptions attract

scientist especially agricultural economists and literature in the topic of consumer reactions to GM foods devotes considerable applications to determine factors beyond this food. The studies applied to consumer attitudes and perceptions towards GM foods include stated preference methods of contingent valuation (CV) under random utility demand model framework. The effects of consumer socio-demographic factors and as well as food related characteristics including the bid for willingness-to-pay were then becomingly increasingly analyzed. Many consumers probably want to avoid GM foods until the uncertain effects of GM foods on human health become obvious and clear (Loureiro and Hine, 2002; Lusk et al., 2002; Chern et al., 2003; Huffman, 2003; Rousu et al., 2004; Kaneko and Chern, 2005).

GM and non-GM food labeling helps reducing the asymmetric information problem between producers of GM foods and consumers. The problem of asymmetric information is that the agricultural biotech industries know what exactly inherited in goods they produce in comparison to consumers who do not really have such information. However, GM food labeling policies differ from country to country perhaps due in large part to the greatest challenges for agricultural trade, the World Trade Organization regulation (WTO), and for the producers. There are mainly three types of labeling schemes: labeling ban, voluntary labeling and mandatory labeling (Loureiro and Hine, 2002; Lusk et al., 2002; Chern et al., 2003; Huffman, 2003; Morgan and Goh, 2004; Rousu et al., 2004; Kaneko and Chern, 2005; Terawaki, 2005).

Despite GMO foods so called monster foods or Frankenstein foods take a nationwide market place in Turkey, Turkish consumers do not yet enough have information about these types of products. This study is aimed to determine the

consumers' perceptions about GM food policy to be implemented and their stated willingness-to-pay for GM foods labeling using contingent valuation method under random utility demand model. The effects of consumers' characteristics on the possible policy programs for food labeling is then determined. On the other hand, to determine if the perceived knowledge about food related policy that are implemented by many developed and developing countries affect the choice to prone and against the GMO regulation programs.

Nowadays, food safety issue is one of the greatest topic ever for WTO and to our knowledge there is no any pervasive study contacted on Turkish consumers regarding the effects of their characteristics on GM foods for labeling issue and thus the results obtained from this study are aimed to serve as a political means for solving problems of Turkey, which faces to adapt the EU regulations for membership under dual negotiation. In addition, the study helps domestic supermarkets, wholesales and as well as international exporter of GM foods to Turkey to renovate their policy for better understanding of consumer preferences in the country.

This study applied data collected from nationwide survey including three metropolitan cities of seven regions where collected information from about 3,200 Turkish households about their perception on food safety and security including different food labeling scenarios presented to them. This project was supported by The Scientific and Technological Research Council of Turkey.

The model used in this study was based on a choice experiment estimating the three laws (e.g., compulsory GMO, voluntary GMO and non). In the survey, respondents were asked several questions. In each question, respondents were asked to select a choice

between three alternatives that the government should take into account. Respondents are faced three choices: either pick up a card indicating compulsory GMO regulation with European Union, or food with voluntary GMO regulation or none.

2. The Model

We assume that the analyst can not completely observe the household conditional indirect utility function. As such, the conditional indirect utility model decomposes into two parts: a deterministic portion and a random portion. This can be illustrated as:

$$U_j = V_j + \varepsilon_j \qquad j = 1, 2, 3$$

The consumer or household will choose GMO policy alternative j if

$$U_j \left(V_j + \varepsilon_j \right) > U_k \left(V_k + \varepsilon_k \right) \ \ for \ all \ other \ k \neq j$$

The probability that the household chooses the GMO policy alternative j will be

$$\vartheta_j = \Pr \left(V_j - V_k > \theta_{jk}, \ \forall_{k \neq j} \right)$$
$$where \ \ \theta_{jk} = \varepsilon_k - \varepsilon_j$$

V_j is not directly observable but we can instead observe which the GMO policy alternative the household are willing. Define an indicator variable δ_j such that $\delta_j = 1$ if the household chooses alternative j and 0 otherwise. Then $\delta_j = 1$ if $V_j + \varepsilon_j > V_k + \varepsilon_k \ \forall k \neq j$. This can be written as

$$\theta_j = \Pr \left(V_j - V_k > \theta_{jk} \ \forall_{k \neq j} \right)$$
$$= \Pr \left(\delta_j = 1 \right)$$

If random errors are independently and identically distributed across specified choices and number of households with a type *I* extreme value distribution, then the resulting probability of household *i* choosing one of given alternatives is simply a multinomial

logit model (Greene, 2003). This can be shown as

$$\Pr\left(\delta_j = 1\right) = \frac{e^{V_j}}{\sum_{k=0}^{2} e^{V_k}}$$

Following the standard convention, if we set the parameter estimates for choosing the alternative that the consumer is not interested in GMO policy at all, the probability in above equation can be written as

$$\Pr\left(\delta_j = 1\right) = \frac{e^{V_j}}{1 + \sum_{k=1}^{2} e^{V_k}} \quad for \; j = 2,3$$

$$\Pr\left(\delta_j = 1\right) = \frac{1}{1 + \sum_{k=1}^{2} e^{V_k}} \quad for \; j = 1$$

Marginal effects in this model are

$$\gamma_j = \frac{\partial \Pr_j}{\partial \mathbf{x}} \quad j = 1,2,3$$

$$= \Pr_j \left(\;_j - ^- \right)$$

$$where \; ^- = \sum_{k=0}^{2} \Pr_j \;_j$$

where $\;_j$ are a set of parameter estimates correspondence to the specified alternatives. Asympotitc variance-covariance of parameter estimates of marginal effects can be constructed using the delta method (Greene, 2003).

3. Data

The survey was conducted to examine Turkish people perceptions about genetically modified foods and their stated willingness-to-pay to avoid risk perceptions. Therefore, data were collected on risk perceptions on GMO foods, knowledge about these products consumptions, satisfaction with these foods, and demographic variables. In addition to

several willingness-to-pay questions related to corn flakes and oil, respondents were asked to choose three alternative GMO food policy implications to make sure that their foods are safe and secure. In essence, the respondents were asked to specifically choose the policy alternative they want to see at regulation.

Data were collected from nationwide survey in 2007 including three metropolitan cities of 14 provinces where collected information from about 3,200 Turkish households about their perception on food safety and security including different food labeling scenarios presented to them. This project was supported by The Scientific and Technological Research Council of Turkey. In the current study, the final sample includes 2,411 household observations after the deletion of records with the missing observations, outliers, or other information relevant to the study. Descriptive statistics of variables are presented in Table 1. A senior household member was requested to give all necessary information regarding food safety and security that the household consumes.

An average person's age was 36 and total monthly spending on was in expected range. Interestingly, 85 per cent of individuals want compulsory GMO policy regulation. This has an intuitive sense that most of people could be well aware of risk contamination in GMO foods as policy and procedures for public notification prevails negative side that the GMO causes.

The survey sample shows that Turkish person usually has a high school degree which echoes with national indicators. Family shelters four members. We presented respondents with 6 international food related policies such as HACCP, ISO 9001, EUREPGAP, and etc whether they know them what exactly they mean. The survey result shows that respondent does not have well information regarding these policies. Most of

respondents are married and male. Only approximately 8 per cent of respondents do not hold security insurances.

4. Results and Discussions

The results of initial parameter estimates of multinomial logit model are presented in Table 2. We include important factors to examine what determines the GMO policy that could be regulated in the country. European Union requires all shops and restaurants to notify customers about genetically modified ingredients in their food. The log likelihood ratio test signifies the importance of factors used to identify variation among alternative decisions.

Focused are marginal effects because initial estimates in the multinomial logit model do not reflect true unitary impact on the decision to choose GMO alternative policy. Marginal impacts for the alternative that the individuals are not interested in at all were discussed first. Increasing food spending reduces the probability of non-GMO policies, indicating that as food spending increases, people becomes more concerned of GMO products. Educational attainments have a significant effect on the probability that the individuals who are not interested in GMO policy regulation. As people earn more educational level, the support for non-GMO policy becomes less relevant. Index for knowledge of food related food regulations reduces significantly the probability decision. This has an intuitive implication, suggesting that as people become more knowledgeable about food regulated policy, the support for GMO policy regulation becomes prevailing.

Males are less likely to support non-GMO policy than females. Interestingly employing person desires null alternative. This could be that employed person do not have enough time to read what exactly the costs and benefits of the GMO are.

Focusing on factors affecting the compulsory GMO regulation, household spending on foods had a positive impact on the decision. The more spending on foods, the more willingness the policy to be compulsorily implemented. This is an expected result, because more spending means more time to search products and ingredients than people spend less on foods. People become more conservative about what they eat. Education has a significant and positive impact on the compulsory alternative to be implemented in the nation. Knowledge variable is statistically significant, implying that consumers, who are more knowledgeable and subjective towards GMO products, become prone of the GMO regulation.

Males are more likely to support this alternative than their counterparts and married people are also support this program to be implemented than any other marital status that people hold. The respondents who have currently jobs are against the implementation of this program. This echoes with what we found for previous alternative. Interestingly people residing in metropolitan cities are less likely to support compulsory program than people residing in elsewhere.

Results are for the last alternative, voluntarily GMO food policy, to be discussed. Food spending a reflection for purchasing power had interestingly negative impact on this alternative. This is an expected result because people who spend more become more sensitive what they indeed eat and the ingredients in foods should all be clear to them. Education had positive and significant impact on the decision the program to be implemented voluntarily, while household size reduces the chance the program to be implemented voluntarily. Knowledge about food regulated policy makes people less desire voluntary program to be implemented in the country. This echoes with what we

found in two previous alternatives. Married persons are less likely to be prone of voluntary programs.

5. Conclusions and Implications

We conducted a national interviewed survey in Turkey in 2007, asking the senior person in the household for preferences about possible policy regulation to be implemented on GMO foods. The results indicate that the Turkish consumers are more prone of compulsory programs than any other programs. GMO can produce higher yields, create their own natural pesticides and foster more nourishing food--- but on the other hand, critics reveal that these foods have the potential to cause vast damage to the environment in general and human health in particular. The issue strikes a visceral chord across the world: many European Greenpeace activities have taken to hacking down swaths of these products and more mainstream groups have launched protests across the United States and Europe.

We analyzed factors affecting three possible policy scenarios to be implemented. Results showed that food spending favors the compulsory programs as people earn more incomes. However, people with lower and medium income may still purchase GMO products despite their price increase. The benefits and costs of the GMO foods should be explained to people at early age possibly at schools. Consumer group activists take food regulated policies such as HACCP and ISO 9001 to inform consumers about whey they imply for. Male and married people should be well informed about the GMO while they are shopping, eating at restaurants.

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Table 1: Descriptive Statistics of variables

Variable	Descriptions	Mean	Std
Y0	1 if the respondent chooses is not interested in GMO policies, 0 otherwise	.08503	.2790
Y1	1 if the respondent chooses compulsory GMO policy, 0 otherwise	.8457	.3613
Y2	1 if the respondent chooses voluntary GMO policy, 0 otherwise	.0693	.2540
Hfoods	Monthly food spending amounts in New Turkish Liras	470.881	299.192
Age	Age of the respondent in years	36.3156	10.5746
Educatn	The respondent education levels in years	13.0877	3.4713
Hsize	Number of household size	3.5157	1.4934
Knowindx	An index created from food policies such as HACCP utilizing whether the respondent knows this policy or not	2.6470	1.3531
Gender	1 if the respondent is male, 0 otherwise	.6080	.4883
Msatusm	1 if the respondent is married, 0 otherwise	.6802	.4665
Emplogy	1 if the respondent is currently employed, 0 otherwise	.7860	.4102
Security	1 if the respondent does not have a social security, 0 otherwise	.0755	.2642
Cdisease	1 if the household has at least one member with chronic disease, 0 otherwise	.1659	.3721
Mcities	1 if the households resides either in Istanbul, or Ankara or Izmir	.5732	.4947

Table2: Maximum Likelihood Parameter Estimates of Multinomial Logit Model

Variable	Y=1		Y=2	
	Estimate	t-value	Estimate	t-value
Constant	-.8645	-1.616	-1.0279	-1.409
Hfoods	.0009[a]	2.634	-.0003	-.566
Age	-.0054	-.644	-.0113	-.962
Educatn	.1827[a]	7.455	.1087[a]	3.170
Hsize	.0676	1.236	.1569[a]	2.265
Knowindx	.2778[a]	4.588	.0411	.492
Gender	.4357[a]	2.533	.2214	.943
Msatusm	-.0067	-.035	-.5471[a]	-2.105
Employg	-.3395[b]	-1.654	-.1333	-.475
Security	-.1455	-.577	-.2466	-.695
Cdiseas	.1905	.881	.1757	.606
Mcities	-.2009	-1.206	-.4063[b]	-1.774
Log-likelihood	-1179.369			
Restricted Log-likelihood	-1,292.838			
Chi Squared with 22 df	226.938			

Note: [a, b] represent statistically significant levels at 0.05 and 0.10 percent respectively.

Table 3: Marginal Effects of GMO Policy Alternatives

Variable	Y=0		Y=1		Y=2	
	Estimate	t-value	Estimate	t-value	Estimate	t-value
Constant	.0521^a	1.662	-.0395	-.875	-.0126	-.389
Hfoods	-.0001^a	-2.463	.0001^a	4.042	-.0001^a	-3.092
Age	.0003	.694	.00002	.024	-.0004	-.677
Educatn	-.0106^a	-7.408	.0141^a	6.755	-.0035^a	-2.286
Hsize	-.0044	-1.349	-.0010	-.228	.0053^a	1.905
Knowindx	-.0156^a	-4.416	.0280^a	5.577	-.0124^a	-3.426
Gender	-.0251^a	-2.486	.0356^a	2.515	-.0105	-1.034
Msatusm	.0025	.217	.0282^a	1.791	-.0307^a	-2.767
Employg	.0194^a	1.606	-.0298^a	-1.738	.0104	.846
Security	.0090	.607	-.0027	-.123	-.0063	-.385
Cdiseas	-.0113	-.883	.0114	.645	-.0001	-.009
Mcities	.0127	1.297	-.0003	-.023	-.0124	-1.245

Note: $^{a, b}$ represent statistically significant levels at 0.05 and 0.10 percent respectively.