

## Consumer Willingness to Pay for Pesticide Free Tomatoes in Turkey

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**Abstract:** Willingness to pay for pesticide free tomatoes were calculated and its effects of socio-demographic and risk variables were measured. The data were obtained from 666 consumers by survey method in May 2005. The surveys are conducted in Ankara and Tokat Provinces at same time. Ordered probit model was used to determine the probability of WTP for pesticide free tomatoes. The findings showed that 34.23 % of Turkish consumers not willing to pay, are 77.02 % willing to pay less than 30 percent premium and 22.97% are willing to pay more than 30 percent premium. This is shown that Turkish consumers will accept to pay only a small premium for pesticide free tomatoes. Furthermore, gender, education, statue of mother, acknowledges of ecologic agriculture, healthy food and risk index factors are impact on willingness to pay.

**Keywords:** Willingness to pay; Consumer Preferences; ordered probit.

### Introduction

The main use of pesticides is in agriculture to ensure that crops remain healthy and wastage through disease and infestation is prevented. According to the FAO data, 4046 metric tons of fungicides and bactericides, 5946 metric tons of herbicides and 13169 metric tons of insecticides were used in Turkey. In addition total pesticides use by per hectare was calculated in Turkey as 0.56 kg. Although, this amount is low when compared with some developed countries, for example cost of 48221 tons of fungicides and bactericides, 9982 metric tons of herbicides, and 8874 metric tons of insecticides were used in Italy. Total pesticides use by per hectare in Italy is 4.32 kg. This amount is 1,73 in UK (FAO, 2005).

In this study, tomato was selected to determine consumer's willingness to pay for pesticide-free fresh vegetables. In the Turkey, consumers commonly think that tomato has highest level residues pesticide and hormone (Akmaz, 2005). In addition, in another study tomato was chosen since tomatoes are widely purchased by Turkish consumer (Akgungor et al., 1999).

Consumers are very concerned about pesticide residues on food in recent years. In some researches shows that consumers are very concerned about pesticide residues on food and are willing to pay a significant premium to purchase food they perceive to be less risky. There are a lot of studies connected with pesticide residues at food in developed country. For examples (Buzby et al. 1995; Misra, et al. 1991; Fu, et al. 1999; Boccaletti and Nardella 2000). There is only one study made on this area in Turkey (Akgungor et al., 1999). Our study is a example for consumer's willingness to pay free pesticide residues in developing country. This study can provide a comparison between developed and developing country about consumer's attitude.

The purpose of this study is to calculate the effects of socio-demographic and risk variables on willingness to pay for pesticide free tomatoes. It is believed that this study will produce some results which could provide important information for producers and retailers and help them.

### Material and Methods

The data were obtained from 406 households in Ankara province and 260 households in Tokat province by survey method in May 2005. The surveys were made face to face by technique. Total 666 surveys were conducted in Ankara and Tokat provinces.

We used ordered probit model to analyze willingness to pay. To see this, consider the following

regression (Greene, 2000):

$$WTP^* = \beta'x + \varepsilon \quad (1)$$

where  $WTP^*$  is the an unobserved latent variable,  $X$  is a vector of independent variables effecting  $WTP$  (age, gender, education, household size, income, statue of mother, acknowledge of ecologic agriculture, Healthy food, risk index),  $\beta$  is a vector of parameters demonstrating the relationship between dependent variable ( $WTP$ ) and independent variables,  $\varepsilon$  is an unobserved disturbance term. The relation between the unobserved  $WTP^*$  and observed outcome for respondent  $i$ ,  $WTP$  ( $WTP=0,1,2,3,4,5,6,7$ ) can be summarized as follows:

$$\begin{aligned} WTP &= 0 \text{ if } WTP^* \leq 0, \\ &= 1 \text{ if } \mu_0 < WTP^* \leq \mu_1, \\ &= 2 \text{ if } \mu_1 < WTP^* \leq \mu_2, \\ &\dots \dots \dots \\ &= 7 \text{ if } \mu_6 \leq WTP^*, \end{aligned} \quad (2)$$

Where  $\mu$  is a parameter representing a threshold separating the categories in the observed variable. The probability can be written following equations (3):

$$\begin{aligned} \text{Prob}(wtp=0) &= \Phi(-\beta'x) \\ \dots \dots \dots \\ \text{Prob}(wtp=7) &= 1 - \Phi(\mu_6 - \beta'x). \end{aligned} \quad (3)$$

For the probabilities, the marginal effects of the repressors are

$$\begin{aligned} \frac{\partial \text{pr}(wtp = 0)}{\partial x} &= -\phi(\beta'x)\beta, \\ \frac{\partial \text{pr}(wtp = 1)}{\partial x} &= [\phi(-\beta'x) - \phi(\mu_1 - \beta'x)]\beta, \\ \dots \dots \dots \\ \frac{\partial \text{pr}(wtp = 7)}{\partial x} &= -\phi(\mu_6 - \beta'x)\beta. \end{aligned} \quad (4)$$

In the study, thresholds are ranked eight categories. This is following: Not willing to pay (0), willing to pay one to five percent premium, willing to pay six to ten percent premium, willing to pay 11-15 percent premium, willing to pay 16-20 percent premium, willing to pay 21-25 percent premium, willing to pay 26-30 percent premium, willing to pay more than a 30 percent premium.

#### Survey design

Respondents were asked to answer several questions grouped in the three main sections. In the first section, we asked to respondent's socio-demographic characteristic such as age, gender, education, household size, income, statue of mother. In the second section, we asked to questions related to respondent's risk attitude. For design of the risk index follow question was asked. "According to you, how many percent peoples damage because of pesticide residues in no certificated tomatoes (regular tomatoes)?" The maximum value was standardized at 100. In addition, we asked to questions about healthy food. "Which alternative is the most important to you in food?" The alternatives are healthy food, price of food, taste of food, promotion of food. In the section we asked acknowledge of ecologic agriculture. "Do you know the ecologic agriculture?"

In the last section we asked to questions related to  $WTP$ . Willingness to pay ( $WTP$ ) was used the dependent variable. We elicited  $WTP$  by asking respondents to indicate how much above regular prices they would be willing to pay for pesticide free tomatoes. Answers of the consumers about  $WTP$  for pesticide free tomatoes are collected and they are as follows:

- 1-No (0%), I would never pay above regular prices
- 2-Yes, I would pay between 1% and 5% more for pesticide free tomatoes
- 3-Yes, I would pay between 6% and 10% more for pesticide free tomatoes
- 4-Yes, I would pay between 11% and 15% more for pesticide free tomatoes
- 5-Yes, I would pay between 16% and 20% more for pesticide free tomatoes
- 6-Yes, I would pay between 21% and 25% more for pesticide free tomatoes
- 7-Yes, I would pay between 26% and 30% more for pesticide free tomatoes
- 8-Yes, I would pay more than 30% more for pesticide free tomatoes.

## Results

Variables Definition and code	Number of Respondents	Percentage (%)	Code Mean	Variable Mean
Age			3.16	39.04
- 25 = 1	58	8.71		
26-30 = 2	130	19.52		
31-40 = 3	221	33.18		
41-50 = 4	158	23.72		
51 + = 5	99	14.86		
Gender			0.68	0.68
Male =1	458	68.77		
Female =0	208	31.23		
Education			3.03	3.03
Primary school =1	111	16.67		
Middle school = 2	98	14.71		
High school = 3	273	40.99		
University = 4	173	25.98		
Graduate = 5	11	1.65		
Household size			2.02	4.17
1-2 =1	75	11.26		
3-5 =2	501	75.23		
6-8 =3	87	13.06		
9+ =4	3	0.45		
Income			2.66	1329.24
- 500 YTL =1	49	7.36		
501 - 1000 YTL =2	284	42.64		
1001 - 1500 YTL =3	174	26.13		
1500 - + YTL =4	159	23.87		
Statue of mother			0.35	0.35
Employed mother=1	234	35.14		
Unemployed mother=0	432	64.86		
Acknowledge of ecologic agriculture			0.44	0.44
If know of ecologic agriculture before survey =1, otherwise=0	295	44.29		
	371	55.71		
Healthy Food			0.40	0.40
If select the healthy food as 1 st.=1	398	59.75		
If other alternative( price, shape, taste, promotion) select as 1 st. =0	268	40.25		
Risk Index	666	100	—	26.24
Consumer's risk perceive in regular tomatoes. (100 %)				

1 YTL= 1, 37\$ in May 2005.

Table1. Definition of independent variables and its base statistics

Definition of independent variables and its base statistics have showed in Table 1. According to the

survey results, average age of consumers is 39.04. The male respondents constitute 68.77 % of total respondents while female respondents constitute 31.23 % of it. The survey results have showed that 16.67 % of households are primary school graduates, 14.71 % are middle school graduates, 40.99 % are high school graduates, 25.98 % are university graduates, and 1.65 % are post graduates. The average household size has been found as 4.17 people that is lower than the average household size (4.9 people) in Turkey<sup>[9]</sup>. Average monthly income of households has been found as 1329.24YTL. Mother of households 35.14 % are study in any work, 64.86 % are unemployed. The respondents 44.25 % have got acknowledge of ecologic agriculture, but 55.71 % haven't got acknowledge of ecologic agriculture. Risk difference variable calculate impact of health risk perception.

Table 2 shows distribution of dependent variable (WTP). Respondent's 34.23 % not willing to pay, 77.02 % willing to pay less than 30 percent premium. 22.97 % of respondents are willing to pay more than 30 percent premium. This is shown that the respondents will accept to pay only a small premium for pesticide free tomatoes.

W T P category	Category Code	Number of Respondents	Percentage (%)
Not willing to pay (0)	0=0	228	34.23
Willing to pay one to five percent premium	1-5=1	44	6.61
Willing to pay six to ten percent premium	6-10=2	89	13.36
Willing to pay 11-15 percent premium	11-15=3	20	3.00
Willing to pay 16-20 percent premium	16-20=4	49	7.36
Willing to pay 21-25 percent premium	21-25=5	28	4.20
Willing to pay 26-30 percent premium	26-30=6	55	8.26
Willing to pay more than a 30 percent premium	31-+=7	153	22.97

Table 2. Distribution of dependent Variable (WTP)

Table 3 shows that the results of the ordered probit model of WTP for pesticide free tomatoes. The log-likelihood ratio test indicates that the estimated model is statically significant at 0.01 level. Gender, education, acknowledge of ecologic agriculture, healthy food and risk index variables are significant at 0.01 levels. Statue of mother variable is significant at 0.05 levels. Age, household size, income variables are not significant.

Coefficient of gender variable has a positive sign. This sign shows that male respondents are willingness to pay more a premium to pesticide free tomatoes than female respondents.

Coefficient of education variable has a positive sign. The coefficient indicates that probability of willingness to pay higher prices for pesticide free tomatoes increases as the levels of education increase. This result supports the results of previous studies which were made by several other authors (Fu, et al., 1999; Sukant et al., 1991; Goktolga, et al., 2006).

Coefficient of statue of mother variable has a positive sign. The coefficient illustrated that employed mothers are more willingness to pay for pesticide free tomatoes than unemployed mother. This result is natural because of employed mothers are more conscious for safe food than unemployed mothers.

Coefficient of acknowledge of ecologic agriculture variable has a positive sign. The positive coefficient of this variable indicates that there is a positive relationship between the probability of paying a premium and acknowledge of ecologic agriculture variable. The result shows the probability of WTP for pesticide free tomatoes increases when consumers are more concerned about organic agriculture.

Variables	Coefficient	t- statistic
Constant	-1.08	-3.875
Age	0.447	1.132
Gender	0.321	2.989*
Education	0.112	2.872*
Household size	0.769	0.830
Income	0.424	0.689
Statue of mother	0.230	2.204**
Acknowledge of ecologic agriculture	0.461	4.780*
Healthy food	0.318	3.557*
Risk Index	0.623	5.074*

Log likelihood: -1114.113 , Chi-squared: 155.773, Degrees of freedom: 9

Note: \* and \*\* denotes significance at the 0.01 level and at 0.05 level, respectively.

Table 3. Results of the ordered probit model

Healthy food variable's sign is positive. This sign shows that there is positive relationship between the probability of paying a premium and healthy food variable. The probability of WTP for pesticide free tomatoes increases when consumers would rather food healthy than other choice.

Risk index variable's sign is positive. Positive sign shows that probability of WTP for pesticide free tomatoes increases when consumer's risk perception increase in regular (uncertificated) tomatoes.

Marginal effects of ordered probit model have been showed in Table 4. Marginal probabilities have been calculated from the estimated model. In each row, the sum of marginal probabilities is zero in ordered probit model (Greene, 2000).

In the Table 4 all variable's signs are negative until WTP2. After this category all variables have got positive sign. These signs show a unit increase variables of age, gender, education, household size, income, statue of mother, acknowledge of ecologic agriculture, healthy food and risk index decreases the probability of willingness to pay a premium for pesticide free tomatoes in categories lower than WTP 3 category, while the probabilities in the higher categories including WTP 3 increases.

The most positive change the probabilities of age, gender, education, household size, income, statue of mother, acknowledge of ecologic agriculture, healthy food and risk index variables have observed in the WTP 7 category. Coefficient of variables in this WTP 7 category show that a unit increase age, gender, education, household size, income, statue of mother, acknowledge of ecologic agriculture, healthy food and risk index increases the probabilities of a positive WTP by 0,0123, 0.0886, 0.0308, 0.0212, 0.0117, 0.0634, 0.1269, 0.0876 and 0.0017 in WTP 7 category, respectively. In other one study, for willingness to pay more than 20 %, marginal coefficients of knowledge of pesticide-borne health risks, pesticides concern index and food-borne risk concern index were calculated as 0.0079, 0.0021 and 0.0004, respectively in Italy (Boccaletti and Nardella, 2000).

variables	WTP=0	WTP=1	WTP=2	WTP=3	WTP=4	WTP=5	WTP=6	WTP=7
Constant	0.3907	0.0299	0.0096	-0.0069	-0.0304	-0.0259	-0.0675	-0.2995
Age	-0.0161	-0.0012	-0.0004	0.0003	0.0012	0.0011	0.0028	0.0123
Gender	-0.1155	-0.0088	-0.0028	0.0020	0.0090	0.0077	0.0199	0.0886
Education	-0.0402	-0.0031	-0.0010	0.0007	0.0031	0.0027	0.0069	0.0308
Household size	-0.0276	-0.0021	-0.0007	0.0005	0.0021	0.0018	0.0048	0.0212
Income	-0.0152	-0.0012	-0.0004	0.0003	0.0012	0.0010	0.0026	0.0117
Statue of mother	-0.0827	-0.0063	-0.0020	0.0015	0.0064	0.0055	0.0143	0.0634
Acknowledge of ecologic agriculture	-0.1656	-0.0127	-0.0041	0.0029	0.0129	0.0110	0.0286	0.1269
Healthy Food	-0.1142	-0.0087	-0.0028	0.0020	0.0089	.0076	0.0197	0.0876
Risk index	-0.0022	-0.0002	-0.0001	0.0000	0.0002	0.0001	0.0004	0.0017

Table 4. Marginal Effects for Ordered Probit

## Conclusion

The purpose of this study is to calculate the effects of socio-demographic and risk variables on willingness to pay for pesticide free tomatoes.

The results of the study suggest that Turkish consumers in Ankara and Tokat provinces are generally concerned with pesticide free tomatoes, with only 34.23 % of the respondents not willing to pay higher prices for pesticide free tomatoes. In other words, 65.77 % of the respondents are willing to pay higher prices for pesticide free tomatoes, 77.03 % of those respondents are not willing to pay a premium higher than 30 % of the regular price.

According to results; gender, education, statue of mother, acknowledge of ecologic agriculture, healthy food and risk index variables are statically significant and they have positive effects on the WTP pesticide free tomatoes. The results suggest that the firms marketing and producing farmer to pesticide free tomatoes should develop strategies for male individuals, persons have high education level, working mother, individuals have acknowledge of ecologic agriculture, consumers who prefer food healthy as first choice and consumers who don't like a risk.

The results can provide important findings for pesticide free tomatoes marketing firms and pesticide free tomatoes producers. For successful a marketing and product, pesticide free tomatoes price premium should not exceed 30 % of regular tomatoes prices in market. If the premium exceeds 30 % regular price in market, sales rate will be low. In addition, the results can provide important findings for policy maker working this area.

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