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Full Length Research Paper

A study on determining the awareness level and attitudes of households on water pollution: The case of Erzurum City

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This study aimed at determining the awareness level and attitudes of households living in the central county of Erzurum Province about water pollution. The main material of the study consisted of data collected through questionnaires from households with different income levels who lived in urban area in the central county of Erzurum Province. Mean age was 39.83. It was found that an average of 4.41 people lived in the households surveyed and the average monthly income of the families was 2.063,84 TL/month. According to the data obtained from 271 households interviewed in the urban area of Erzurum city, it was found that more than half of the households (55.35 %) placed water pollution in the first place regarding environment pollution.
It was observed that while more than half of the households (64.6 %) were willing to make an extra payment for a more environment-friendly and healthier product, 35.4 % were not. When the factors affecting the willingness to make an extra payment were examined, it was determined according to the probit analysis results that marital status, profession, wife or husband's education status, income, and awareness on water pollution were significant factors. As a last step, the maximum extra payment limits for households willing to do this were determined by defining increments increasing through certain percentages. Tobit analysis was used to determine the factors affecting the amount of payment the households were willing to make. The results of the analysis revealed that the age of household head, marital status, the number of family members, following the news on water pollution, and grouping waste material as glass, plastic, metal, etc. were significant factors on the amount payment the households were willing to make.

Keywords: Water Pollution, Awareness Level, Willingness to Pay, Probit, Tobit, Erzurum

INTRODUCTION

Environment pollution generally means air, water and soil pollution. Water is the most easily and rapidly polluted one among them, because everything that is contaminated can be cleaned by washing it with water. This means the last destination of pollution is water. Air and soil renew themselves over time regarding pollution and this process causes the pollution to pass into water (Kaypak, 2012). The water on the earth is in a constant cycle due to the energy supplied by the sun. People take the water they need from this cycle and then they return it to the same cycle after they have used it up. During this process, the substances mixed in water change the physical, chemical and biological properties of water, and this causes the case defined as "water pollution". Water pollution occurs when physical, chemical, bacteriological, radioactive and ecological properties of water resource undergo a negative change. Waters in oceans, seas, lakes, rivers, streams and underground sources, and the vapor in the atmosphere are all called hydrosphere (water sphere) (Türkeş, 2011).

Water on earth is in a constant cycle due to the effect of solar energy. The water evaporating as water vapor into the atmosphere from the earth falls back onto the earth following a condensation process. This movement is called as "hydrologic cycle". People get water from this cycle to maintain their lives and meet their economic

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needs, and then they return it to the cycle after using it. The substances mixing into water during these phases cause the physical, chemical and biological properties of water to change (Şen and Başaran, 2007). Called as water pollution, these property changes also affect the various life forms in water. Therefore, water pollution can affect water-related eco-systems, spoil the natural balance and gradually bring about the reduction or extinction of the self-cleaning capacity, which all water in the nature has (Bulut et al., 2012). Starting from this point, this study aimed at determining the awareness level and attitudes of households living in the central county of Erzurum Province about water pollution. To do this, households were asked whether they would make an extra payment for a product which was healthy and environment-friendly.

Through this question, the factors affecting the households' willingness to make an extra payment were studied. The maximum extra payment limits for households willing to do this were determined by defining the increments increasing in a certain percentage. And finally, the factors affecting how much extra payment the households would make were also determined.

Material and Method

Material

The main material of the study consisted of data collected through questionnaires from households living in urban area in the central county of Erzurum Province.

Data Collection

Proportional sampling method was used for determining the sample size representing the main population best (Miran, 2003).

$$n = \frac{Np(1-p)}{(N-1)\sigma_p^2 + p(1-p)}$$

where n = sample size, N = population size (Assuming that each household has 4 members, the number of central county households was found by dividing the central county population by 4. The process was based on address-based population registration system of the year 2011.), p = estimation ratio (0.5 for maximum sample size), σ_p^2 = ratio variance (to reach the maximum sample size, the table value 1.65 in 90 % confidence interval and 5 % error margin). Since the characteristics of the households making up the main population were not known at the outset, p value was taken 0.5 (p=0.5) and the sample volume was found 271 households. The determination of the household size to be interviewed was based on the share of settlements in the total population (Engindeniz and Cukur, 2003; Armagan and Akbay, 2007; Pazarlıoglu et al. 2007) and the households included in the sample were chosen randomly.

Data Analysis Method

In addition to percentage and similar simple statistical methods helping us define the households living in the urban area of Erzurum central county, "contingent evaluation method" was used to determine the households' willingness to make an extra payment, "lower bound mean method" was used to determine the amount of money the households would willingly pay, and tobit and probit analysis were used to determine the factors affecting the households' willingness to pay (Maddala, 1992). Table 1

The contingent evaluation method used in the study is basically a survey method. The required data were collected through a survey conducted with a group of people who used or did not use the environmental resource handled in this study. The application of the method included creating a hypothetical environment for a product or service, which was not available in the market, presenting the benefits of the product to the people chosen for the survey, and asking these people how much they would pay for such a product (Carson, 2000; Gil et al., 2000; Mutlu, 2007; Cinar and Armagan, 2009). By making use of this method, used in environmental awareness studies, the aim was to determine the amount of extra payment that households living in the urban area in the central county would make for environment-friendly products (Table 2).

While evaluating the data relating to households' willingness to make an extra payment, many households were observed to be reluctant to make any extra payment. This case is called censored or limited dependent variables problem (Angulo et al., 2003; Ji et al., 2012). In this study, it was found out that some of the households were not willing to pay more than current market price for the environment-friendly products. The binary probit model was used for modeling the households' willingness to make an extra payment. In a similar study, Voltaire et al. 2013 also used binary probit model to determine the willingness to make an extra payment to protect the nature (Table 3)

Findings

To determine the awareness level and attitudes about water pollution, 271 households in the urban area of Erzurum Central County were interviewed. According to the data collected, it was determined that 94.6 % of the subjects interviewed were male and 35.4 % were female. Mean age was 39.83 and 74.5 % of the subjects were married and the rest 25.5 % single. 37.3 % of the household heads were university graduates, 24 %.0 % were high school graduates,18.8 % were primary school graduates and 10.7 % had post graduate level education. With respect to professions, 41.3 % of the household heads were civil servants, 33.6 % were workers in public

Table 1: The variables used in the model and some statistical indicators

Variable	Groups and explanations	Frequency	%	Standard deviation	Mean
Dependent Variable					
Y	Willing to pay more for an environment friendly product: value =1	175	64.6	0.479	
	Not willing: value= 0	96	35.4		
Explanatory variables					
Gender	Female:0	87	32.1	0.468	
	Male:1	184	67.9		
Age	**Constant variable**				**39.83**
Marital status	Single:0	69	25.5	0.436	
	Married:1	202	74.5		
Education	Primary school:1	51	18.8	1.280	
	Secondary school:2	25	9.2		
	High school:3	65	24.0		
	University:4	101	37.3		
	Post graduate :5	29	10.7		
Profession	Worker:1	91	33.6	1.569	
	Civil servant:2	112	41.3		
	Self-employed:3	35	12.9		
	Retired:4	7	2.6		
	Unemployed:5	6	2.2		
	Farmer:6	2	0.7		
	Housewife:7	18	6.7		
Wife's education	Not married or no education:0	191	70.5	1.561	
	Primary school:1	2	0.7		
	Secondary school:2	27	10.0		
	High school:3	19	7.0		
	University:4	21	7.7		
	Post graduate:5	11	4.1		
Working wife	Not married 0	69	25.5	0.775	
	Yes: 1	106	39.1		
	No: 2	96	35.4		
The number of people in the household	**Constant variable**				**4.41**
Income	**Constant variable**				**2.063.84**
Awareness on water pollution	No:0	23	8.5	0.279	
	Yes:1	248	91.5		
Following news on water pollution	No:0	80	29.5	0.457	
	Yes:1	191	70.5		
Classifying waste material into glass, plastic and metal, etc. groups before throwing them	No:0	168	62.0	0.486	
	Yes:1	103	38.0		
Reading environment-related information on packages and labels	No:0	127	46.9	0.500	

Table 2: The Households' Willingness to Pay for an Environment-friendly Product

Willingness (TL)	Frequency	Percent	Cumulative Percent
Reluctant to buy a product by paying a higher price	96	35.4	35.4
%1-5	57	21.0	56.5
%6-10	64	23.6	80.1
%11-15	8	3.0	83.0
%16-20	17	6.3	89.3
%21-25	12	4.4	93.7
More than %25	17	6.3	100.0
Total	271	100.0	

Table 3: Estimates of Probit Model

Variable	Units	Coefficient	Standard Error	z
Constant		1.53657**	0.69934	2.20
gender	male : 1, female: 2	-0.25883	0.22866	-1.13
age	Year	-0.01250	0.00978	-1.28
marital status	single : 0, married: 1	0.45246*	0.25747	1.76
education	literate : 0, primary school: 1, secondary school: 2, high school: 3, university: 4, post-graduate:5	-0.04352	0.07309	-0.60
profession	worker : 1, civil servant: 2, self-employed : 3, retired: 4, unemployed : 5, farmer : 6, housewife: 7	0.11080*	0.06466	1.71
wife's education	Single and literate: 0, primary school: 1, secondary school: 2, high school: 3, university: 4, post-graduate:5	0.12473*	0.14448	1.86
wife's employment	Single 0, Yes: 1, No: 2	-0.68397	0.44375	-1.54
number of houshold members	Household members (number)	-0.00833	0.04030	-0.21
income	TL	0.08616**	0.10798	0.80
awareness on water pollution	No: 0, Yes: 1	-0.45490*	0.32395	-1.40
following the news on water pollution	No: 0, Yes: 1	-0.19779	0.18921	-1.05
classifying waste material	No: 0, Yes: 1	-0.19779	0.01066	0.33
reading the environment-related info on packages and labels	No: 0, Yes: 1	-0.09040	0.16826	0.54
Restricted log likelihood -176.15923, Chi squared [13 d.f.] 19.97484				
Significance level .09584, McFadden Pseudo R-squared .0566954				
Note: *, **, * ==> Significance at 1%, 5%, 10% level.**				

and private sector, 12.9 % were tradesmen, and 6.7 % were housewives. It was determined that 52.5 % of the married households had working wives and that the wives of 47.5 % did not work. It was found that an average of 4.41 people lived in the households. The average monthly income of the households was TL 2.063,48.

While 91.5 % of the households stated that they gave importance to water pollution issue, 8.5 % said they did not pay attention to it though they found it important. 70.5 % of the households were observed to follow news on water pollution, whereas 29.5 % did not follow it.

Households' willingness to pay for a more environment-friendly product

In the study, the households' willingness to pay for a more environment-friendly product was determined using contingent evaluation method. The households were asked the following question for this method: "Let's assume you were told that a food product you would like to buy has less harmful effects on the environment and payment amounts increasing in a certain proportional range and questioned whether they would be willing to pay this amount for the product. If they responded positively to the amount, then the next higher amount in the range was questioned. If they responded negatively to an amount, then the amount was lowered and questioned again.

As a result, the monetary value in the last percentage slice obtained from the households indicated the amount the households' were willing to pay for a healthier and more environment-friendly food product. As presented in Table 2, while 21 % of the households were in 1-5 % range, 23.6 % in 6-10 % range, 3.0 % in 11-15 % range, 6.3 % in 16-20 % range, 4.4% in 21-25 % range, 35.4 % were observed to be unwilling to buy the product by paying more. This revealed that most of the households were willing to make an extra payment for an environment-friendly product and, as a result, it could be an indicator of the fact that the households interviewed in Erzurum central district had health and environmental awareness.

Table 4: Estimated Marginal Probabilities

Variable	Units	Partial Effect	Standard Error	z
gender	male : 1, female: 2	.08904	.07654	1.16
age	Year	.00438	.00340	1.29
marital status	single : 0, married: 1	.16166*	.09112	1.77
education	literate : 0, primary school: 1, secondary school: 2, high school: 3, university: 4, post-graduate:5	.01524	.02555	.60
profession	worker : 1, civil servant: 2, self-employed : 3, retired: 4, unemployed : 5, farmer : 6, housewife: 7	.03880*	.02233	1.74
wife's education	Single and literate: 0, primary school: 1, secondary school: 2, high school: 3, university: 4, post-graduate:5	.04368*	.05046	1.87
wife's employment	Single 0, Yes: 1, No: 2	.23953	.15366	1.56
number of household members	Household members (number)	.00292	.01411	.21
income	TL	.03018**	.03767	-.80
awareness on water pollution	No: 0, Yes: 1	-.14612*	.09222	1.58
following the news on water pollution	No: 0, Yes: 1	-.06839	.06421	-1.06
classifying waste material	No: 0, Yes: 1	.00122	.00373	.33
reading the environment-related info on packages and labels	No: 0, Yes: 1	-.03166	.05889	-.54

Note: *, **, * ==> Significance at 1%, 5%, 10% level.**

Factors affecting the households' willingness to pay for a product that would pollute the environment less (probit analysis)

Probit analysis was used to determine the factors affecting the households' willingness to pay for a product that would pollute the environment less. "Willingness to pay" was taken as dependent variable in this analysis. "Willingness to pay more" was assigned 1 and "reluctance to pay more" 0. Considering that asking the households whether they would make a direct payment might increase the incorrect answers, the series of questions were used to reveal whether the households would make a payment or not. In the analysis, the following cases were taken as independent variables for a more environment-friendly product: age of household head, gender, marital status, education, profession of the person interviewed, husband or wife's education, wife's employment, the number of household members, average monthly income of the household, awareness on water pollution, following the news on water pollution, classifying waste material into glass, plastic and metal groups, and reading the information about environment on product packages and labels. The age of the person interviewed, the number of household members, and average monthly income were taken as constant variable. Education, wife's education, and profession were grouped in the same category in the analysis, whereas gender, marital status, wife's employment, awareness on water pollution, following the news on water pollution, classifying waste material into glass, plastic and metal groups, and reading the information about environment on packages and labels were taken as dummy variables.

Probit analysis was used to determine which variables had an effect on the households' willingness to pay for a product that would give less harm to environment. As a result of the analysis, it was found out that "willingness to pay" was affected by marital status, profession, and wife's employment positively at 10 % significance level, whereas "awareness on water pollution" had a negative relation. Income was found to have a positive relation at 5 % significance level.

When the marginal effects of the independent variables in relation were examined, married people were observed to be 16 % more willing to make an extra payment than single people. As the education level of the wives increased, willingness to pay increased as well. That is, it can be stated as a result of the marginal effects that as "the university graduate" increased one unit, it yielded 4 % more "willingness to pay" compared to that of "primary school graduate". It is expected that one unit increase in households' income would bring about 3 % willingness to make an extra payment (Table 4 and 6).

Table 5: Estimates of Tobit Model

Variable	Units	Coefficient	Standard Error	z
Constant		1.67290*	0.90409	1.85
gender	male : 1, female: 2	0.09558	0.37230	0.26
age	Year	.03556**	0.01753	2.03
marital status	single : 0, married: 1	-0.79320*	0.45558	-1.74
education	literate : 0, primary school: 1, secondary school: 2, high school: 3, university: 4, post-graduate:5	0.03438	0.11746	0.29
profession	worker : 1, civil servant: 2, self-employed : 3, retired: 4, unemployed : 5, farmer : 6, housewife: 7	0.13445	0.08771	1.53
wife's education	Single and literate: 0, primary school: 1, secondary school: 2, high school: 3, university: 4, post-graduate:5	-0.07999	0.19648	-0.41
wife's employment	Single 0, Yes: 1, No: 2	.066980	0.62268	1.08
number of household members	Household members (number)	0.10125	0.06535	1.55
income	TL	-0.14522**	0.06954	-2.09
awareness on water pollution	No: 0, Yes: 1	0.22478	0.40395	0.56
following the news on water pollution	No: 0, Yes: 1	-0.73037**	0.30079	-2.43
classifying waste material	No: 0, Yes: 1	0.75811**	0.29575	2.56
reading the environment-related info on packages and labels	No: 0, Yes: 1	-0.30513	0.29649	-1.03
Sigma	Disturbance standard deviation	1.37170***	0.07332	18.71
	Log likelihood function -303.62301			
	Note: *, **, * ==> Significance at 1%, 5%, 10% level.**			

The factors affecting how much extra payment the households were willing to make for an environment-friendly product (tobit)

The number of the households reluctant to make an extra payment was subtracted from the total number of households and tobit analysis was applied to the rest 175. In this analysis, the variables in the probit analysis were considered independent variables (Table 5).

The aim of the tobit analysis was to reveal which variables affected the amount of payment that the households were willing to make for an environment-friendly product. For this analysis, the amount of payment that the households were willing to make for an environment-friendly product was taken as dependent variable, whereas age of the household head, gender, marital status, education, profession of the person interviewed, wife's education, wife's employment, the number of household members, average monthly income of the household, awareness on water pollution, following the news on water pollution, classifying waste material into glass, plastic and metal groups, and reading the environment-related information on packages and labels were taken as independent variables. According to the result of the analysis, it was found out that willingness to pay had a positive relation with the age of the household head and classifying waste material into glass, plastic and metal groups at 5 % significance level, whereas it had a negative relation with the number of household members and following the news on water pollution (Table 5).

There was a negative relation between willingness to pay and marital status at 10 % significance level. It was also determined as a result of the probit analysis that there was a positive relation between those who were willing to pay and marital status. But marital status had a negative relation in affecting the amount of payment. This can stem from the fact that married people were willing to pay compared to single people; however, the amount of payment accepted was low.

The extent of the effect can be stated by looking at the marginal effects table 6 after determining the direction of the relationship and whether the independent variables were statistically significant. It was found that an increase of one unit in the age of household head, found to be significant at 5 % level, increased the amount of payment

Table 6: Estimated Marginal Probabilities

Variable	Units	Partial Effect	Standard Error	z
gender	male : 1, female: 2	0.09236	0.35975	0.26
age	Year	0.03436**	0.01694	2.03
marital status	single : 0, married: 1	0.76646*	0.44028	1.74
education	literate : 0, primary school: 1, secondary school: 2, high school: 3, university: 4, post-graduate:5	0.03322	0.11350	0.29
profession	worker : 1, civil servant: 2, self-employed : 3, retired: 4, unemployed : 5, farmer : 6, housewife: 7	0.12992	0.08477	1.53
wife's education	Single and literate: 0, primary school: 1, secondary school: 2, high school: 3, university: 4, post-graduate:5	-0.07730	0.18986	-0.41
wife's employment	Single 0, Yes: 1, No: 2	0.64722	0.60172	1.08
number of household members	Household members (number)	0.09784	0.06315	1.55
income	TL	-0.14032**	0.06721	-2.09
awareness on water pollution	No: 0, Yes: 1	0.21720	0.39034	0.56
following the news on water pollution	No: 0, Yes: 1	-0.70574**	0.29072	-2.43
classifying waste material	No: 0, Yes: 1	0.73255**	0.28586	2.56
reading the environment-related info on packages and labels	No: 0, Yes: 1	-0.29485	0.28651	-1.03

Note: *, **, * ==> Significance at 1%, 5%, 10% level.**

3 %. That is, as the age increased, the amount of payment the households were willing to make to prevent water pollution increased as well. An increase of one unit in classifying waste material into glass, plastic and metal groups increased the amount of payment the households were willing to make 73 %. It was statistically found out from this finding that those who classified waste material into glass, plastic and metal groups were more sensitive to protecting the environment. It can be said that the amount of payment the households were willing to make to protect the environment was quite high. In addition, the separation of waste material was placed great emphasis in Erzurum city center. This can be an indication of the increase in demand for garbage cans. An increase of one unit in the number of household members decreased the amount of payment agreed willingly by the households 14 %. It can be stated that the households having more members consented to make less payment compared to those having less members. A change of one unit in those following the news on water pollution decreased the amount of payment about 71 %. When the marginal effect of the marital status, found to be significant at 10 %, was examined, it was found that an increase of one unit in married subjects decreased the amount of payment about 77 %.

CONCLUSION

Water pollution is caused by some human activities such as discharging domestic and industrial waste into water sources without treatment and transporting natural or artificial substances used for increasing productivity in agriculture into water. Water resources in many parts of the world have been extremely polluted. Industrial waste, sewage water, and water used for agricultural purposes are carried into rivers and lakes. The water in rivers and lakes are polluted by these chemical substances and water resources are poisoned. It is therefore of great importance that we should fight against water pollution. The first stage in this struggle is to know people's knowledge, thoughts and attitudes about water pollution. With this purpose, this study aimed at determining the awareness level and attitudes of households living in the central county of Erzurum Province about water pollution.

According to the data obtained from 271 households interviewed in the urban area of Erzurum city, it was found that more than half of the households (55.35 %) placed water pollution in the first place regarding environment pollution. To determine the awareness level and attitudes of the households about water pollution, a hypothetical environment was created and the

households were asked whether they would make an extra payment for a product which was healthy and environment-friendly.

The study investigated the responses given to this question. It was observed that more than half of the households (64.6 %) were willing to make an extra payment for a more environment-friendly and healthier product, whereas 35.4 % were not. When the factors affecting the willingness to make an extra payment were examined, it was determined according to the probit analysis results that marital status, profession, wife or husband's education status, income, and awareness on water pollution were significant factors. Finally, the maximum extra payment limits for households willing to do this were determined by defining increments increasing in a certain percentage range. Tobit analysis was used to determine the factors affecting the amount of payment the households were willing to make.

The results of the analysis revealed that the age of household head, marital status, the number of family members, following the news on water pollution, and grouping waste material as glass, plastic, metal, etc. were significant factors on the amount of payment the households were willing to make.

As a result of the study, the households were determined to have awareness about environment pollution, especially on water pollution. However it was also found that they were not conscious about prevention at all. It was found out that there was a demand for making more payment for healthier and more environment-friendly products, and therefore these products could be made common through motivation raising activities. In other words, this means that the supply of healthier and more environment-friendly products can be increased and new markets can be created. In accordance with this result, it is necessary that banners about environment pollution should be hung on billboards, awareness-raising activities should be performed at schools and that municipalities should organize activities and courses increasing the knowledge level of households about the measures to be taken for the prevention of pollution.

In addition, environment friendly products should be emphasized more to raise awareness on environment. It can be stated as a result of this study that the demand for environment-friendly products might increase; however, the existing potential can not be appreciated due to the lack of knowledge. Therefore, advertisements, banners, courses, conferences and seminars at universities are needed to raise the awareness and reveal the sensitivity on environment.

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