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Determination of factors affecting willingness to pay for low SAR value cell phones: A case study of Turkey

Rüştü YAYAR
University of Gaziosmanpaşa, Tokat, Turkey
rustu.yayar@gop.edu.tr
Yücel EROL
University of Gaziosmanpaş, Tokat, Turkey
yucel.erol@gop.edu.tr
Derya DEMIR
University of Gaziosmanpaşa,
Reşadiye Vocational School, Reşadiye, Tokat, Turkey
derya.demir@gop.edu.tr

Abstract. *Along with the technological developments, products that improve the life quality have become commonplace. Cell phones are one of these products. Some of the radioactive waves produced during the communication of cell phones with base stations are absorbed by tissues in human body and negatively affect human health. SAR (Specific Absorption Value) is the rate with which these waves are absorbed by body tissues. The aim of the present study was to determine factors affecting the willingness of consumers in Tokat Province of Turkey to pay more for low SAR value cell phones using ordered probit analysis. Of the variables used in the model, age of the consumer, average monthly income, sickness feeling during long cell phone calls, awareness of SAR value, double SIM-card phone, use of earphone, level of social responsibility had positive coefficient values and were statistically significant.*

Keywords: mobile telephones, mobile communication, specific absorption rate, ordered probit.

JEL Classification: D01, D12.
REL Classification: 7B.

1. Introduction

With the advance of the technology, life-improving products have become commonplace. Mobile telephones, internet, wireless communication tools such as Wi-Fi technology are among the fast-growing technologies in recent years. Cell phones are one of these products. New cell phone models are brought to market and used for many aims such as sending message, taking pictures, listening to music, internet access in addition to phone calls. Based on the recent data, there are more than 5 billion active cell phones in the world and more than 65 million in Turkey.

Bestselling cell phone manufacturers in the world and their market shares are given in Tables 1 and 2.

Table 1. *Top Five Smartphone Vendors, Shipments, and Market Share, 2012 Q3 (units in millions)*

Vendor	3Q12 Unit Shipments	3Q12 Market Share	3Q11 Unit Shipments	3Q11 Market Share	Year-over-year Change
Samsung	56.3	31.3%	28.1	22.7%	100.4%
Apple	26.9	15.0%	17.1	13.8%	57.3%
Research In Motion	7.7	4.3%	11.8	9.6%	-34.7%
ZTE	7.5	4.2%	4.1	3.3%	82.9%
HTC	7.3	4.0%	12.7	10.3%	-42.5%
Others	74.0	41.2%	49.9	40.3%	48.3%
Total	179.7	100.0%	123.7	100.0%	45.3%

Source: www.idc.com, Access: 1 March 2013.

The top five smart phone sellers, marketed smart phone numbers and their market shares in the third quarter of 2011 and third quarter of 2012 are given in Table 1. Samsung had the largest market shares with 22.7 and 31.3% in the third quarters of 2011 and 2012, respectively.

Table2. *Top Five Total Mobile Phone Vendors, Shipments, and Market Share, 2012 Q3 (units in millions)*

Vendor	3Q12 Unit Shipments	3Q12 Market Share	3Q11 Unit Shipments	3Q11 Market Share	Year-over-year Change
Samsung	105.4	23.7%	87.2	20.1%	20.9%
Nokia	82.9	18.7%	106.5	24.5%	-22.2%
Apple	26.9	6.1%	17.1	3.9%	57.3%
LG Electronics	14.0	3.1%	21.1	4.9%	-33.6%
ZTE	13.7	3.1%	17.6	4.1%	-22.2%
Others	201.6	45.3%	184.6	42.5%	9.2%
Total	444.5	100.0%	434.1	100.0%	2.4%

Source: www.idc.com, Access: 1 March 2013.

The top five mobile phone sellers, number of cell phones marketed and their market shares from the third quarter of 2011 and third quarter of 2012 are given in Table 2. Samsung had the largest market shares with 20.1 and 23.7% in the third quarters of 2011 and 2012, respectively.

Table 3. *Mobile Phone Vendors and Market Share in Turkey, 2006*

Vendor	Market Share (%)
Nokia	64.8
Samsung	16.8
Sony/Ericcson	6.8
Motorola	5.8
Siemens	2.2
LG	1.9
Others	1.7
Total	100.0

Source: Şimşek and Noyan, 2009, Middle East Technical University (ODTU) Development Magazine, p.133.

Bestselling cell phone brands and their market shares are given in Tables 3 and 4. As can be seen in Table 3, the most selling cell phone brand in Turkey in 2006 was Nokia and had a 64.8% market share. Samsung followed Nokia with a market share of 16.8%. Table 4 shows the top selling cell phone brands in Turkey in 2012. Samsung is at the top of the list with a market share of 52.5%, followed by Nokia with 29.5%.

Table 4. *Mobile Phone Vendors and Market Share in Turkey, 2012*

Vendors	Market Share (%)
Samsung	52.5
Nokia	29.5
Apple	5.0
HTC	3.5
Sony/Ericcson	3.0
LG	1.5
Blackberry	1.5
Others	3.5
Total	100.0

Source: Akinci Electronic Communications, Istanbul, 2013.

The technological innovations and products that make human life more comfortable also bring some negative impacts on human life. Studies conducted so far have shown that cell phones cause dose-dependent complaints such as inability to concentration, fatigue, headache, insomnia, and pose threats for human reproductive system.

Communications among cell phones are carried out via base stations. Possible health risks of cell phones, therefore, are mediated by the signals emitted by the base stations (Cox, 2003: p. 241). A portion of radioactive waves released during the communications between cell phones and base stations are absorbed by the tissues of human body. SAR value represents the radiation emitted per tissue weight (Luxon et al., 2006: p. 1). Direct measurement of SAR value is almost impossible. Therefore, some parameters that can be easily measured or observed are used in determination of critical levels. SAR caused by a radio-frequency

emitting device is determined by measuring the electrical field in a nearby human tissue (Fung et al., 2002: p. 656). The more the human body absorbs energy, the higher the temperature increase and the risk for causing disorders in immune system. Studies showed that human body cannot regulate one °C temperature increase and remain vulnerable to certain risks. For a 1°C increase, 4W energy is needed to be absorbed per a kg of tissue (Taktak et al., 2005: p. 645).

Human body absorbs the radiation from radiofrequency waves in three ways (Aksoy et al., 2005: p. 3):
1. Based on the size of body part and wavelength of the signal,
2. Based on the interaction of radiofrequency waves and the tissue,
3. Based on the absorbance by vibration.

Cell phones are a radio receiver and transmitter, and need to be manufactured according to some standards in order to prevent the exposure to radioactive waves. Electromagnetic Field Study conducted by the World Health Organization suggested that SAR values of cell phones should be less than 0.1 Watt/kg. Cell phones sold in Turkey have SAR values between 0.1 and 1.11 Watt/kg (www.emo.org.tr).

There are many studies about the SAR value in literature. Moulder et al. (1999) investigated the association between radiation waves and cancer, and concluded that the epidemiological evidence of such an association was weak and inconsistent. This study indicated that the evidence for a causality relationship between the radiation from cell phones and cancer was only weak. Fung et al. (2002) found that efficiency of SAR lowering products is not sufficient, but some protective materials result in about a 9% decrease in SAR. Hossmann and Herman (2003) concluded that as long as the radiation intensity remains in non-thermal interval, its negative impacts on health will remain negligible. Cox (2003) studied possible adverse effects as well as short and long term impacts of base stations. The author concluded that these technologies have not been used sufficiently long enough to reach a clear conclusion. Timotijevic and Barnett (2006) studied the public behavior towards the recommendations by the British Government about the possible health risks of these technologies. They verified the present concerns of the public about the level of phone use. Dewenter et al. (2007) conducted a hedonic price analysis over mobile phones in German market. The investigators found that radiation was not statistically significant and its impact on the price of phone was not important. Wiedemann et al. (2008) studied the effect of SAR value on cell phone purchasing preference of public as well as the effect of declared precautionary SAR value on the risk perception of people. In empirical purchasing, price and features were the leading factors affecting the preference, while the information about the precautionary limit did not affect the risk

perception. Yeowve et al. (2008) investigated the factors affecting customer satisfaction in cell phone use in Malaysia. Using factor analysis, the investigators revealed that six independent factors explained 73.72% of the total variance. As the duration of total cell phone calls and family coordination increased, so did the exposure to radiation waves. Barnett et al. (2008) studied the mobile communication regulations in the UK, and tried to determine the public behavior towards the health precautions using exploratory factor analysis. Cousin and Siegrist (2010) carried out a study using cognitive models and determined that the participants were aware of but tended to disregard the damage caused by base stations. Markov (2012) dealt with the potential effects of wireless technologies on children's brains. He concluded that there is no way of determining the effects of radiation on the brains of children exposed to it.

Since the radioactive waves from cell phones cannot be seen and felt directly, their possible cumulative long term effects are not taken duly into account by the public. The aim of the present study was to determine factors affecting the willingness to pay more for purchasing low SAR value phones.

2. Methodology

2.1. Data collection

Data used in the study was sound first hand data obtained from a questionnaire [(1)]. In the present study where the factors affecting the willingness for the consumers to pay more for low SAR value cell phone was investigated, population over 18 years of age and over living in the town of Tokat in Turkey was studied. Data were obtained from randomly selected 550 consumers over the period from April to June, 2012, but 50 of them were discarded since they were not suitable for analysis. In order to determine the validity of the questions in the questionnaire form, a pilot application was conducted in downtown Tokat on 25 consumers, and final adjustments were made. In preparation of the questionnaires, other studies were also taken into account. Likert-type scale was used in the study. For the reliability of the scale, Cronbach Alpha coefficient was used and it was found that the scale had a moderate level (0.55) of reliability. In the questionnaire form prepared, questions about which factors were taken into account while purchasing a cell phone were asked.

In the first part of the questionnaire, the consumers were asked questions about their demographic and socio-economic situations. The questions in the second part was about the duration of cell phone use, considerations taken into account while purchasing cell phone, average daily time of cell phone calls and any disturbance after long phone calls. In the third part, awareness of consumers about

SAR value and their willingness to pay more for low SAR phones were determined. In the last part, consumers were asked to answer the questions about social responsibility level, behavior towards risks and adaptation processes to innovations.

For the analysis of the factors involved in consumers' willingness to pay more for their cell phone preferences, ordered probit model was used. This method has been commonly used in scientific studies. Bocaletti and Moro (2000) investigated the consumers' willingness to pay for food products obtained through biotechnology in Italy in 1999. Using ordered probit model, the investigators revealed that willingness to pay is influenced by income and awareness. Nayga, Poghosyan and Nichols (2002) studied the consumers' willingness to pay for radiated beef products using ordered probit model and found that about 58% of the participants were willing to pay a premium for radiated beef. Cranfield and Magnusson (2003) investigated the consumers' willingness to pay for the food containing pesticides using an ordered probit analysis and found that more than 65% of the participants were willing to pay more to these products compared to the traditional ones. Magnusson and Cranfield (2005) studied the consumer preference for food that does not contain pesticide in three Canadian towns using ordered probit analysis. They found that pesticide-free food products were preferred by consumers who were sensitive about environment, non-sensitive about the price, younger, who had better training and higher household income. Using a combination of an ordered probit and a split probit model, Harris and Zhao (2007) developed a zero-inflated ordered probit model. Erdem, Şentürk and Şimşek (2010) developed an ordered probit model and investigated Turkish consumers' willingness to pay for hybrid automobiles. They found that higher education, income, and environmental sensitivity levels were the major determinants of hybrid automobile preference. Gündüz and Emir (2010) analyzed the factors affecting frozen food consumption using ordered probit model. Results indicated that socioeconomic variables such as household size, age of household head, monthly household income, employment status of spouse, and behavioral variables such as health, price and the need to save time have significant effects on frozen food use. Hasegawa (2010) made a Bayesian estimate using ordered multiple probit and found that service and food had the highest share in total satisfaction of tourists. Lefevre (2011) used ordered probit model to measure the willingness of Senegal consumers to pay fresh local dairy products instead of products manufactured from imported powdered milk. Large households were less willing to pay for dairy products produced from local milk. Wealthy households, on the other hand, were willing to pay more to dairy products produced from local milk compared to moderate income households.

Definitions and descriptive statistics of variables used in the prediction model are given in Table 5. Descriptive statistics of variables obtained from the answers to some of the questions in the questionnaire form are given below: 49.8% of the participants were male and 50.2% were female. Average age interval was 18-40, the median education was college, and the median monthly income was 1500-2000 Turkish Liras.

Average daily cell phone use of the consumers was 30-60 minutes. Consumers felt moderate level of sickness feeling during long calls, had low awareness level for SAR value, and half of them valued use of earphones during cell phone calls. In terms of adopting the new developments, 30.4% adopted late, 27.4% the latest, and 24.2% fast. It was found that 30.8% of the consumers were risk takers, 38.4% moderate level of risk takers, and 30.8% low level risk takers. On average, consumers were willing to pay 20% more for low SAR value cell phones.

Table 5. *Variable definitions and their descriptive statistics*

Variables	Definitions of variables	Mean	St. dev.
WTP	Consumers' willingness to pay for lower SAR value mobile phones (none=0; %10 more=1; %20 more=2; %30 more=3; %40 more=4; %50 more=5; more than %50=6)	1.656	1.656
GENDER	Gender of respondent (female=0; male=1)	0.498	0.501
MARIAGE	Marital status of respondent (married=1; otherwise=0)	0.580	0.494
AGE	Age of respondent (between18 and 40 years=0; 41 years and above=1)	0.284	0.451
EDUC	Level of education (elementary school=1; secondary school=2; high school=3; vocational training school=4; university=5; master and above=6)	3.610	1.295
AVMINC	Average monthly income (0-749 TL=1; 750-1499 TL=2; 1500-1999 TL=3; 2000-2999 TL=4; 3000 TL and above=5)	2.326	1.258
CALLTIME	Average daily duration of mobile phone calls (minute) (0-5=1; 5-30=2; 30-60=3; 60-360=4; 360 and above=5)	2.802	1.047
FEELSICK	Feeling sick after long-term mobile phone calls (none=0; less=1; moderate=2; more=3; much more=4)	1.232	1.207
PUTAWAY	Put away your mobile phone when not in use (strongly disagree=1; disagree=2; Neutral =3; agree=4; strongly agree=5)	2.610	1.180
SARINFOR	Information about SAR value (none=0; lesser=1; less=2; moderate=3; more=4; much more=5)	1.884	1.535
DUALSIM	The importance of being possessed dual card mobile phone (strongly disagree=1; disagree=2; Neutral=3; agree=4; strongly agree=5)	1.810	0.951
EARPHONE	Using the earphone (strongly disagree=1; disagree=2; Neutral =3; agree=4; strongly agree=5)	2.180	1.023
SOCRESP	Level of social responsibility (lesser=1; less=2; moderate=3; more=4; much more=5)	3.362	1.065
INNOV1*	Innovators. dummy variable (if respondent is a first individual to adopt an innovation=1; otherwise=0)	0.064	0.245
INNOV2	Early adopters (if the respondent inside the second fastest category of individuals who adopt an innovation=1; otherwise=0)	0.116	0.321
INNOV3	Early majority (if the respondent adopt an innovation after a varying degree of time=1; otherwise=0)	0.242	0.429

Variables	Definitions of variables	Mean	St. dev.
INNOV4	Late majority (if the respondent adopt an innovation after the average member of the society=1; otherwise=0)	0.304	0.460
INNOV5	Laggards (if the respondent is the last individual to adopt an innovation=1; otherwise=0)	0.274	0.446
RISK1*	Risk averse (if participant is a risk averse=1; otherwise=0)	0.308	0.462
RISK2	Risk moderate(if participant is a risk moderate =1; otherwise=0)	0.384	0.487
RISK3	Risk lover(if participant is a risk lover=1; otherwise=0)	0.308	0.462

*Reference category omitted from the models to avoid multicollinearity.

2.2. Econometric model

In econometric study, when the dependent variables take more than two and qualitative values, data are categorized using a ranking system that takes into account their size. Ordered probit model is one of the most suitable ordered response models proposed for the solution of data sets with these kinds of variables. It is commonly used in social sciences (Maddala, 1983; Long, 1997: pp. 114-115). These kinds of constructs are most commonly encountered in Likert type scales in questionnaire studies. There is a clear and ranked nature of dependent variable categories. However, distances between successive categories are not equal. It is appeared that in many models where consumer theories are investigated ordered probit model is used (Bocalettive Moro, 2000; Nayga, et al., 2002; Cranfield and Magnusson, 2003; Magnusson and Cranfield, 2005; Harris and Zhao, 2007; Erdem et al., 2010; Gündüz and Emir, 2010; Hasegawa, 2010; Lefevre, 2011).

In ordered probit model, in addition to observed, exact and ranked categories (y), there is a continuous, but unobserved dependent variable. The unobserved latent dependent variable (y*) is explained by explanatory variables vector and error term. Error term is supposed to have normal distribution and the model is represented as follows (Greene, 2002: pp. 736-737):

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

$$y = 0 \text{ if} y^* \leq 0 \quad (2)$$

$$y = 1 \text{ if } 0 < y^* \leq \mu_1 \quad (3)$$

$$y = 2 \text{ if} \mu_1 < y^* \leq \mu_2 \quad (4)$$

$$\vdots$$

$$y = J \text{ if} \mu_{J-1} \leq y^* \ . \quad (5)$$

Here, x represents x explanatory variables vector, β – parameter vector to be estimated, and ε – error term. Relationship between dependent variable (y) and unobserved dependent variable (y^*) is expressed as a function of threshold values(μ_J) which can take different values in different participants and which are estimated using (β) regression coefficients.

Since the consumers select one of the seven alternatives which they see fits best to themselves, dependent variable is ordered in a way to take seven different values ($y = 0, 1, 2, 3, 4, 5, 6$). In ordered probit model, probabilities for students to select one of the seven alternatives are calculated as follows:

$$\text{Prob}(y = 0|\text{x}) = \Phi(-x'\beta) \quad (6)$$

$$\text{Prob}(y = 1|\text{x}) = \Phi(\mu_1 - x'\beta) - \Phi(-x'\beta) \quad (7)$$

$$\text{Prob}(y = 2|\text{x}) = \Phi(\mu_2 - x'\beta) - \Phi(\mu_1 - x'\beta) \quad (8)$$

$$\text{Prob}(y = 3|\text{x}) = \Phi(\mu_3 - x'\beta) - \Phi(\mu_2 - x'\beta) \quad (9)$$

$$\vdots$$

$$\text{Prob}(y = 6|\text{x}) = 1 - \Phi(\mu_5 - x'\beta) \ . \quad (10)$$

In order for the probabilities to be positive, $0 < \mu_1 < \mu_2 < \cdots < \mu_6$ condition must be realized.

Here, Φ is cumulative normal distribution function. The model is solved through maximum likelihood method. To determine the effects of explanatory variables on probabilities, marginal effects are needed to be estimated. Marginal effects of seven probabilities can be estimated using the following equations via the help of derivation (Greene, 1997).

$$\frac{\partial \text{Prob}(y=0|\text{x})}{\partial \text{x}} = -\phi(x'\beta)\beta \quad (11)$$

$$\frac{\partial \text{Prob}(y=1|\text{x})}{\partial \text{x}} = [\phi(-x'\beta)\beta - \phi(\mu_1 - x'\beta)]\beta \quad (12)$$

$$\frac{\partial \text{Prob}(y=2|\text{x})}{\partial \text{x}} = [\phi(\mu_1 - x'\beta)\beta - \phi(\mu_2 - x'\beta)]\beta \quad (13)$$

$$\vdots$$

$$\frac{\partial \text{Prob}(y=6|\text{x})}{\partial \text{x}} = \phi(\mu_5 - x'\beta)\beta \ . \quad (14)$$

Here $\frac{\partial \text{Prob}}{\partial \text{x}}$ is the derivation of probability based onx, ϕ is cumulative normal distribution function, and estimation of ordered maximum likelihood ofβ, x.

Dependent variable of the study was the willingness of consumers to pay more for low SAR value cell phones. This variable was classified into seven groups, i.e. not willing to pay more, willing to pay 10% more, 20% more, 30% more, 40% more, 50% more and over 50% more. Descriptive statistics of variables used in the study are given in Table 5.

The assumption that consumers' willingness to pay more for low SAR value cell phones vary with socioeconomic and demographic features were taken as the basic hypothesis in the study. Expectations regarding the coefficients of some basic explanatory variables were summarized below:

Education variable was expected to be positive. It was thought that consumers with a higher degree of education are more conscious and they make a longer and more conscious market research before buying a product. Therefore, they are expected to be willing for paying more for low SAR value cell phones.

Coefficient of age of the consumer variable (AGE) was expected to be positive. Older consumers are expected to pay more for low SAR value cell phones, as older individuals take more care of their health and are willing to pay more.

Average monthly income variable (AVMINC) was expected to have a positive coefficient. Consumers with higher incomes are expected to prefer healthier, better quality and safer products. There is a positive correlation between income level and demand for superior quality products.

GENDER and MARRIAGE variables were expected to have negative coefficients. It is assumed that women are more sensitive than men, and married people are more sensitive than unmarried ones in terms of health issues.

Average daily cell phone call time (CALLTIME) was integrated into the model. It was assumed that there would be a positive relationship between CALLTIME variable and willingness to pay more for low SAR value cell phones. Therefore, consumers who make more daily cell phone calls would be willing to pay more.

Consumers' attitudes towards risk could affect their willingness to pay for low SAR value cell phones. It was presumed that there would be a negative relationship between risk variable and willingness to pay more for low SAR value cell phones. Consumers who want to take more risks are thought to be less willing to pay more for low SAR cell phones. In order to eliminate the dummy variable danger, RISK1 variable was taken as a reference category.

Rogers (1995) classified the consumers into five categories based on adoption characteristics of new developments: innovators, early adopters, early majority, late majority and laggards. Definitions for these categories are given in Table 5.

In order to test the association between categories for adoption of new developments and willingness to pay more, four variables (INNOV2, INNOV3, INNOV4 and INNOV5) were included in regression model. In order to eliminate the dummy variable danger, INNOV1 variable was taken as basic category. It was presumed that there would be a positive relationship between adoption of new developments and willingness to pay more for low SAR value cell phones. Low SAR value phones were considered as a new product for the consumers.

In the regression model was included the variables of feeling sick in long cell phone calls (FEELSICK), knowing SAR value (SARINFOR), use of dual SIM card (DUALSIM) and earphone (EARPHONE), level of social responsibility (SOCRESP) and putting away the cell phone while not using (PUTAWAY). Willingness to pay more for low SAR value cell phone was presumed to have a negative correlation with PUTAWAY variable and positive ones with other variables.

2.3. Experimental findings

Results of ordered probit model are given in Table 6. Of the variables in the model, age of the consumers (AGE), average monthly income (AVMINC), feeling sick during long cell phone calls (FEELSICK), knowing the SAR value of the phone (SARINFOR), dual SIM card phone (DUALSIM), earphone use (EARPHONE), social responsibility level (SOCRESP), INNOV3 and INNOV5 had significant positive coefficients. GENDER, MARIAGE, EDUC, CALLTIME, PUTAWAY, INNOV2, INNOV4, RISK2 and RISK3 variables of the model, on the other hand, were not statistically significant and were not discussed.

In order to eliminate Multicolinearity (multiple linear correlation), INNOV1 and RISK1 variables were randomly removed from the model. Based on maximum likelihood method, ordered probit model was statistically significant ($P < 0.000$). Coefficients of the model were tested using t ratio and standard error. Estimated threshold values in the model showed the quantitative association between benefit function of consumers and willingness to pay more for low SAR cell phones. According to Maddala (1983), threshold values should be positive and $\mu_1 < \mu_2 < \mu_3 < \mu_4 < \mu_5$. Threshold values of the model was positive and statistically significant ($P<0.01$). This finding implied that categories of willingness to pay more were suitably ordered and that socio-economic and demographic properties of the consumers had considerable effects on their willingness to pay more for low SAR cell phones.

Table 6. *Ordered probit model results*

Variables	Coefficients	Standard error	t values	P values
CONSTANT	-1.854***	0.400	-4.634	0.000
GENDER	0.076	0.109	0.702	0.483
MARIAGE	-0.061	0.127	-0.477	0.633
AGE	0.309**	0.130	2.377	0.018
EDUC	0.027	0.049	0.556	0.578
AVMINC	0.106**	0.045	2.364	0.018
CALLTIME	0.015	0.543	0.278	0.781
FEELSICK	0.078*	0.433	1.801	0.072
PUTAWAY	0.055	0.046	1.199	0.231
SARINFOR	0.275***	0.035	7.895	0.000
DUALSIM	0.129**	0.056	2.282	0.023
EARPHONE	0.101*	0.058	1.734	0.083
SOCRESP	0.090*	0.471	1.911	0.056
INNOV2	0.399	0.319	1.249	0.212
INNOV3	0.679**	0.291	2.330	0.020
INNOV4	0.378	0.295	1.285	0.199
INNOV5	0.477*	0.297	1.605	0.108
RISK2	0.184	0.133	1.386	0.166
RISK3	0.034	0.138	0.246	0.806
Mu(1)	0.879	0.065	13.435	0.000
Mu(2)	1.521	0.081	18.740	0.000
Mu(3)	2.109	0.096	22.087	0.000
Mu(4)	2.283	0.099	22.993	0.000
Mu(5)	2.660	0.115	23.132	0.000

Note: *, ** and ***show that the coefficients are statisticallysignificantat1, 5 and 10 percent significance levels.

Log likelihood function -753.9381, restricted log likelihood -837.8309,

Chi-squared (18) 167.7857, Significance level 0.000.

Marginal effects of variables in ordered probit model are given in Table 7. In order to take into account the marginal effects while interpreting the variables, coefficients given in Table 6 and marginal effects given in Table 7 were discussed together.

A one year increase in age of consumers over 40 years of age lowered the willingness not to pay more and to pay 10% more for low SAR value cell phones by 9.8 and 2.3%, respectively. Willingness to pay 20, 30, 40, 50% and over 50% more increased by 3.5, 4.2, 1.0, 1.7 and 1.7% with a one year of age increase.

Marginal effect of monthly income variable was negative in the first two categories, but positive in the subsequent ones. This finding implied that a one-unit increase

in monthly income lowered consumers' willingness to not pay more and to pay 10% more by 3.4 and 0.8%, respectively, but increased the willingness to pay more in other categories, though only slightly.

Table 7. *Marjinal effects for ordered probit model*

Variables	Prob(Y=0)	Prob(Y=1)	Prob(Y=2)	Prob(Y=3)	Prob(Y=4)	Prob(Y=5)	Prob(Y=6)
GENDER	-0.024	-0.006	0.009	-0.253	0.003	0.004	0.004
MARIAGE	0.019	0.004	-0.007	-.008	-0.002	-0.003	-0.003
AGE	**-0.098**	**-0.023**	**0.035**	**0.042**	**0.010**	**0.017**	**0.017**
EDUC	-0.009	-0.002	0.003	0.004	0.001	0.001	0.001
AVMINC	**-0.034**	**-0.008**	**0.012**	**0.015**	**0.004**	**0.006**	**0.006**
CALLTIME	-0.005	-0.001	0.002	0.002	0.001	0.001	0.001
FEELSICK	**-0.025**	**-0.006**	**0.009**	**0.011**	**0.003**	**0.004**	**0.004**
PUTAWAY	-0.017	-0.004	0.006	0.008	0.002	0.003	0.003
SARINFOR	**-0.087**	**-0.020**	**0.031**	**0.038**	**0.009**	**0.015**	**0.015**
DUALSIM	**-0.041**	**-0.009**	**0.014**	**0.018**	**0.004**	**0.007**	**0.007**
EARPHONE	**-0.032**	**-0.007**	**0.011**	**0.014**	**0.003**	**0.005**	**0.006**
SOCRESP	**-0.029**	**-0.007**	**0.010**	**0.012**	**0.003**	**0.005**	**0.005**
INNOV2	-0.127	-0.029	0.045	0.054	0.013	0.022	0.022
INNOV3	**-0.216**	**-0.049**	**0.076**	**0.092**	**0.022**	**0.037**	**0.038**
INNOV4	-0.120	-0.028	0.042	0.052	0.013	0.020	0.021
INNOV5	**-0.152**	**-0.035**	**0.053**	**0.065**	**0.016**	**0.026**	**0.027**
RISK2	-0.059	-0.013	0.021	0.025	0.006	0.010	0.010
RISK3	-0.011	-0.003	0.004	0.005	0.001	0.002	0.002

Marginal effects of FEELSICK, SARINFOR, DUALISM, EARPHONE and SOCRESP variables were negative in no-extra payment and 10% extra payment (the first and second extra-payments), but positive in others. Marginal increase in EARPHONE variable lowered consumers' willingness to pay 10% more for low SAR cell phones by 0.7%, but increases the willingness to pay more than 50% more by 0.6%. A one-unit marginal increase in FEELSICK, SARINFOR, DUALISM and SOCRESP variables increased consumers' willingness to pay 30% more for low SAR value cell phones by 1.1, 3.8, 1.8 and 1.2%, respectively.

In the top category, marginal effects of INNOV3 and INNOV5 variables were 3.8 and 2.7%, respectively, meaning that consumers who early adapt to new developments 3.8% more likely to pay more than 50% for low SAR value cell phones compared to other consumers. Similarly, the consumers who adapt last to new developments are 2.7% more likely to pay more than 50% more for low SAR value phones compared to others.

3. Conclusions

The aim of the present study was to determine the factors affecting the willingness of consumers to pay for low SAR value cell phones. Data were obtained from 500 consumers who were 18 years old and over living in the town Tokat in Turkey over a period from April to June, 2012, and subjected to ordered probit analysis. Of the variables in the Model, effects of age of the consumers, average monthly income, feeling sick during long phone calls, knowing SAR value of the phone, use of double SIM card phone, use of earphone, level of social responsibility variables were positive and statistically significant. It was revealed that average daily cell phone calling time was 30-60 minutes, that consumers felt less sickness when they made long calls compared to when they made moderate long calls, that they were less aware of SAR value, and that about half of the consumers valued using earphone when making cell phone calls.

Dewenter et al. (2007) conducted a hedonic price analysis about mobile phones in German market. In that study, radiation was not statistically significant and did not have a significant effect on the price of phone. Wiedeman et al. (2008) studied whether SAR value was associated with cell phone purchasing considerations of public and the effect of disclosure of precautionary SAR value over the risk perception of people.

In studies about empirical purchasing, it was found that price and features were the first considerations and that knowledge of precautionary limit did not affect the risk perception. In the present study a different approach was used. Using ordered probit analysis, factors affecting the willingness of consumers to pay more for low SAR value cell phones were ordered. It was found that the consumers were on the average willing to pay 20% more for low SAR value phones. The findings of the present study, thus, contradict the findings from other two studies.

The present study can be considered as a data set for both producers and manufacturers. Increasing health awareness of consumers would increase the awareness about using low SAR value cell phones. It can be concluded that a production planning considering the factors affecting and not affecting the cell phone prices by manufacturers would be extremely important for a more efficient use of resources and profitable production.

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