

A Case Study of Probit Model Analysis of Factors Affecting Consumption of Packed and Unpacked Milk in Turkey

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Abstract

This paper focused on the effects of some socio-demographic factors on the decision of the consumer to purchase packed or unpacked milk in Sivas, Turkey. The data were collected from 300 consumers by using face to face survey technique. Binary probit model has been used to analyze the socio-economic factors affecting milk consumption of households. According to empirical results, consumers with higher education and income levels tend to consume packed milk consumption. Also, milk price was affective factor packed and unpacked milk consumption behavior. The majority of consumers reads the contents of packed milk and is affected by safety food in their shopping preferences.

Keywords: Milk consumption, Consumer preferences, Binary probit model

1.INTRODUCTION

Milk is a unique food item that needs to be available in the market without any shortage since it plays a key role in infant feeding and alleviating nutritional poverty in all other age groups. It has been perceived by consumers as an important source of nutrients, especially calcium for good bone and teeth health (Alwis et al. 2009). Therefore, it is advisable to consume an adequate amount of milk and milk products for healthy lifestyle (Hatirli et al. 2004). Increasing population and income, together with the growing popularity of dairy products, particularly among developing country consumers is a key factor behind strong demand in the medium term. Demand continues to be encouraged by the growing influence of retail chains and multinational companies in these countries, which is facilitating improved consumer access to dairy products. The demand for milk and dairy products is expected to remain particularly strong in important developing dairy markets such as North Africa, the Middle East and East Asia, but also in more mature markets such as those in the European Union, the United States and Russia. The rate of growth and per capita consumption of milk and milk products remains significantly different among regions. LDC (Least Developed Countries) consume less than 50 kg per person per year on average, compared with 100 kg per person for developing countries, while the developed regions of North America and Europe consume well in excess of 200 kg per person (in milk equivalent). Such a per capita consumption disparity represents an investment potential and future opportunities for both the domestic and global dairy sectors (OECD/FAO 2011).

However, per capita milk consumption in Turkey is low by any comparison due to Turkish people's consumption patterns, income levels and nutritional habits. Turkey is far behind the European countries and the world in milk consumption (Pazarlioglu et al. 2007). In Turkey, annual per capita milk consumption is 26 lt (WMDA 2011). Per capita milk consumption are 66,9 lt in EU, 90.0 lt in USA, 91.5 lt in Canada, 108.14 lt in Austria, 78.2 lt in New Zeland, 87.2 lt in Russia, 97.0 kg in Sweden, 80.1 lt in Ukrain (AEPDI 2011).

Milk is consumed as unpacked fluid milk and packed fluid milk in Turkey. Unpacked fluid milk, also called street milk in Turkey, refers to milk that is produced at farms without any control and packed fluid milk refers to milk produced under fluid milk technology such as pasteurization or UHT. Respective shares of milk processing plants in total milk consumption of Turkey are 27% modern dairy factories, 33% for medium sized establishments and dairies, 20% for uncontrolled producers, 20% for producers' self consumption (Pazarlioglu et al. 2007).

The main goal of this study was to determine the effects of some socio-demographic factors on the decision of the consumer to purchase packed or unpacked milk.

2. DATA AND METHODS

2.1. Data

The data was obtained by direct interviewing the individual households of 300 residences who live in Sivas province. The survey was conducted in June 2009. The sample size was determined using the Possibility-Sampling Method (Yamane 2001).

$$n = \frac{(Nt^2 \cdot p \cdot q)}{(d^2 N + t^2 \cdot p \cdot q)}$$

where N is the number of households in Sivas province (63153) (TURKSTAT 2009), t is z number is the required confidence interval (for 95 percent confidence interval $t = 1.96$), p is possibility for an event to occur (the rate of consuming packed milk, 0.5), q is the possibility for an event not to occurring (the rate of not consuming packed milk, 0.5), d is acceptable error rate during sampling (0.0564).

2.2. Methods

The probit model is a statistical probability model with two categories in the dependent variable (Liao, 1994). Probit analysis is based on the cumulative normal probability distribution. The binary dependent variable, y, takes on the values of zero and one (Aldrich and Nelson 1984). Binary probit model was employed to the survey data to see the effects of socio-economic and demographic variables on the consumer purchase decision of packed and unpacked milk.

In the binary probit model, packed milk preference (PACKMILKPREF) was taken as 1, while unpacked milk as 0. It is assumed that the *i*th household obtains maximum utility it has packed milk preference rather than unpacked one.

The probability p_i of choosing any alternative over not choosing it can be expressed as in equation (1), where Φ represents the cumulative distribution of a standard normal random variable (Greene 2011).

$$p_i = \text{prob} [Y_i = 1 | X] = \int_{-\infty}^{x_i' \beta} (2\pi)^{-1/2} \exp\left(-\frac{t^2}{2}\right) dt = \Phi(x_i' \beta) \quad (1)$$

The relationship between a specific variable and the outcome of the probability is interpreted by means of the marginal effect, which account for the partial change in the probability. The marginal effect associated with continuous explanatory variables X_k on the probability $P(y_i=1|X)$, holding the other variables constant, can be derived as equation 2 (Greene 2011);

$$\frac{\partial p_i}{\partial x_{ik}} = \phi(x_i' \beta) \beta_k \quad (2)$$

where ϕ represents the probability density function of a standard normal variable.

The marginal effect on dummy variables should be estimated differently from continuous variables. Discrete changes in the predicted probabilities constitute an alternative to the marginal effect when evaluating the influence of a dummy variable. Such an effect can be derived from equation 3 (Greene 2011).

$$\Delta = \Phi(\bar{x}\beta, d = 1) - \Phi(\bar{x}\beta, d = 0) \quad (3)$$

The definition belong to variables are defined in Table 1. In the study, the variables considered affecting choices of households between preference alternatives are: gender (GEN), age (AGE), education (EDU), professional status (PS), marital status (MS), household size (HS), income (INC), milk consumption (MILKCON), milk price (MILKPRI),

reason of milk preference (PREFREA) and place of milk buying (MILKPLACE). In earlier studies (Hill and Lynchehaun, 2002; Fuller et al., 2004; Hatirli et al., 2004; Vandermersch and Mathijs, 2004; Peng et al., 2006; Pazarlioglu et al., 2007; Celik et al., 2006; Akbay and Tiryaki, 2008; Alviola and Capps, 2009; Kilic et al., 2009; Tiryaki and Akbay, 2010) properties such as household size, gender, age, education, professional status, marital status, household income, ethnicity, and advertising were studied as exogenous variables.

Table 1. Definition of Variables

Variables	Defination
MILKPRE (Milk preference)	1= Packed milk; 0= Unpacked milk
GEN (gender)	1= Male; 0= Female
AGE (age)	0= 18-25; 1= 26-35; 2= 36-44; 3= 45 or older
EDU (Education)	0= Illiterate and primary school graduates; 1= Secondary school graduates; 2= High school graduates; 3= University graduate; 4= Post graduates
PS (Professional Status)	1= Employee; 2= Labourer; 3= Self employed; 4= Off-profession; 5= Retired
MS (Marital Status)	0= Married; 1= Single; 2= Divorced
HS (Household Size)	Average household size. Number of People (People/Family)
INC (Income)	Average monthly household income; (TL/Month/Household)
MILKCON (Milk Consumption)	Average monthly milk consumption (kg/Month/Household)
MILKPRI (Milk Price)	Packed milk price (TL/kg), unpacked milk price (TL/kg)
PREFREA (Reason of Milk Preference)	0= Price; 1= Trade mark; 2= Taste; 3= Natural, organic 4= hygiene, package
MILKPLACE (Place of Milk Buying)	1= home delivery 2= selling point 3= supermarket 4= handsellers 5= local bazaar 6= buying from village

In this study, in order to determine the most appropriate model the variables described above, it was made various model experiments and was tested whether statistically significant at 1% significance level or not. As a result, three estimators (EDU, INC, MPRICE) in the probit model were found statistically significant at 1% level. Final model is below;

$$\text{MILKPRE}_i = \beta_0 + \beta_1 \text{EDU}_i + \beta_2 \text{INC}_i + \beta_3 \text{MILKPRI}_i + \epsilon_i$$

3. RESULTS

The male respondents constitute 64.34% of total respondents while female respondents constitute 35,66 % of it. Average age was 38.04. Educational attainment was classified into five categories, illiterate and primary school graduates (14.33%), secondary school graduates (8.33%), high school graduates (39.67%), university graduate (36.67%) and post graduates (2.00%).

Average household size was found to be 3,95 people that is lower than the average household size (4.50 people) of Turkey (TURKSTAT 2011).

Households earning less than \$349 constituted 10 percent of total respondents, households earning between \$350 and \$1050 (49 percent) and households earning higher than \$1051 (41 percent). The survey results illustrate that average annual income of households was found \$8003 that was lower than the annual income per capita (\$8215) of Turkey (UN 2011).

In Sivas, per capita average annual milk consumption is 39.96 kg per capita whereas it is 26 kg in Turkey (WMDA 2011; 8). 71.3% of households preferred packed milk while 28.7% unpacked milk. 41.86% of illiterate and primary school graduates and 82.30% of university graduates consume packed milk. While 73.33% of consumer in low income group consume unpacked milk, 90.24% of consumer in high income group consume packed. 39.54% of households preferred unpacked milk as a priority because of cheaper than packed milk. The most important reasons were quality (28,64%) and hygiene (28.64%) for packed milk choice of consumers.

Respondent consumed unpacked milk provided by home delivery (62.79%) and buying from village (16.28%). Households consumed packed milk preferred supermarket (89.09%) and selling point (10.91%). According to the results, consumers made a point of sell-by date (44.09%), taste (36.82%) and brand (9.09%) for packed milk.

Table 2 presents results estimated from binary probit model. The model is significant at 1% level of probability. The estimated coefficients and standard errors reveal which factor influence respondents consumption intentions for fresh milk consumption. A statistically significant coefficient suggests that the likelihood of consumption of product will increase/decrease as the response on the explanatory variable increase/decrease (Borooah 2002). McFadden Pseudo coefficient of determination (R²) was calculated about 0.288. This value represents that variables placed in the model explain high level the probabilities of packed and unpacked milk choice of consumers. Three estimators (EDU, INC, MPRICE) in the probit model were found statistically significant at 1% level.

Table 2. Estimates of the binary probit model

Variable	Coefficient	Std. Error	z-Statistic	Probability	Marginal Effects
Constant	-0.36167	0.76226	-4.745	0.0000	-1.0164
EDU	0.29694	0.12694	2.339	0.0193	0.0835

INCOME	0.00057	0.00022	2.548	0.0108	0.0161
MPRICE	-0.61494	0.51561	6.110	0.0000	-0.0089
Log-likelihood	-136.6527				
Restricted Log-L	-187.5953				
Pseudo-R ²	0.288				
x ² (df =11)	105.66				
Significance level					
Akaike Info	0.000				
Criteria	0.991				

consumer's education level (EDU) was found out an important socio-economic factor for the probabilities of packed and unpacked milk choice of consumers. In estimated model, education level variable was statistically important at significant level 1% and related positively. As educational level increases, tendency to consume rises packed milk and decreases unpacked fluid milk. Educational level might be a good starting point to increase the awareness of consumers concerning fluid milk consumption (Pazarlıoglu et al. 2007). Estimated model results support to this hypothesis.

According to the estimated results, household's income level (INCOME) is one of the factors affecting their packed and unpacked milk consumption behavior. This variable is included in the model because low-income families may consume more unpacked milk when milk prices are lower. There is a positive relationship between packed consumption consumers' income level and it is statistically significant at the level of 1%. For a household with high income level, the probability of consuming packed milk decreased by only 1.6%. It would emphasize that when income level rised, packed milk consumption increased. This result is a significant and expected. Thus, households preferred unpacked milk (39.54%) as a priority because of cheaper than packed milk. When increased in income level, consumption preferences of households tend to the packed milk. It is a known fact that unpacked milk was unhygienic. Therefore, it is said that households tend to the consumption of unpacked milk because of their economic difficulties.

On the other hand, milk price (MPRICE) was determined as other main factors affecting their packed and unpacked milk consumption behavior. Price was the primary reason mentioned in the survey for not purchasing packed fluid milk, as it was perceived as being quite expensive compared to unpacked fluid milk. In average, Turkish consumers have been sensitive to price of foods which they consume (Kilic et al. 2009). This variable found out significant at 1% level and was related negatively. This sign indicated that consumers who were sensitive to price were less likely to consume packed milk. According to the results, implied that consumers preferred price of packed milk are expensive compared to unpacked milk were less likely to consume packed milk. When milk price increased, the probability of packed milk consumption decreased 0,9%.

4. CONCLUSIONS

This study focused on the socio-demographic factors influencing milk consumption in Sivas, Turkey. The findings of this study show that consumer's socio-economic characteristics were affected unpacked and packed milk consumption preferences. According to the results from binary probit model; education, income and milk price are significant and associated with packed and unpacked fluid milk consumption. According to empirical results, consumers

with higher education and income levels tend to consume packed milk consumption. Also, milk price was affective factor packed and unpacked milk consumption behavior. In the light of the findings, the necessary policies are needed as providing of accessibility to adequate price, healthy, safety food and a mechanism reached to the level of per capita milk consumption in developed countries. Also, on the basis of the results of this study, it would be expected seller's and companies' marketing strategies on packed milk by looking at specific consumer preferences.

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