



## Estimation of Factors Affecting Demand and Supply of Cow Milk

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**Abstract:** The aim of the present study was to estimate factors affecting demand and supply of cow milk and to assert suggestions to overcome issues regarding supply and demand of cow milk in dairy cattle farms. The data were obtained from 243 dairy cattle farms in central district of Çanakkale province between June 2016 and March 2017. Multiple linear regression analysis was used to evaluate data of study. According to analysis results, it was determined that the number of cows milked, livestock diseases and price of milk had important effect on quantity of milk supplied, and age of farmers, average monthly household income and price of milk had also important effect on quantity of milk consumed. As a result, factors affecting positive of supply and demand of cow milk is also expected to enhancing to the quantity of milk supplied and consumed.

**Keywords:** Milk, production, dairy farm, price, regression

### İnek Sütünün Arz ve Talebini Etkileyen Faktörlerin Belirlenmesi

**Öz:** Bu çalışmada, süt sığırcılığı işletmelerinde inek sütü üretiminde arz ve talebi etkileyen faktörlerin tahmin edilmesi ve inek sütü arz ve talebi ile ilgili sorunlarına önerilerde bulunulması amaçlanmaktadır. Veriler, 2016 yılı Eylül ve 2017 yılı Mart ayları arasında Çanakkale merkezdeki 243 süt işletmesinden sağlanmıştır. Çalışmanın verilerini değerlendirmek için çoklu regresyon analizi kullanılmıştır. Analiz sonuçlarına göre, işletmecinin yaşının, hanehalkı gelirinin ve süt fiyatının arz edilen süt miktarı üzerinde önemli etkisinin olduğu, sağılan hayvan sayısının, hayvan hastalıklarının ve süt fiyatının da tüketilen süt miktarı üzerinde önemli etkisinin olduğu belirlenmiştir. Sonuç olarak, inek sütünün arz ve talebini pozitif etkileyen faktörlerin arz ve talep edilen süt miktarını da arttırması beklenmektedir.

**Anahtar Kelimeler:** Süt, üretim, süt işletmesi, fiyat, regresyon

#### 1. Introduction

The livestock sector in Turkey is an important part of agriculture and economy. The share of livestock in total agricultural production of Turkey is about 46%. It especially provides employment opportunity and cash flow for household living in rural area (Schaik et al. 1996; Jabir 2007). Besides, this sector provides two of the most important animal products such as milk and meat (Altarawneh 2015). Milk and dairy products have also an important role in Turkish diet habits. These products are considered as the essential food commodities for humans (Maitah and Smutka 2012). Because, it provides some

vitamins and minerals such as calcium, proteins, vitamin A and D. Additionally, milk has also been perceived by consumers as an important source of nutrient in terms of calcium for bone and teeth health, especially (De Alwis et al. 2009; Bor 2014). In Turkey, the share of milk production in value of total animal production is about 32.7%. Besides, milk production is entirely derived from cattle, sheep, goat and buffalo. In Turkey, there were about 14 million cattle (21.6%), 31 million sheep (62.7%) and 10 million goat (15.7%) in 2016. Total milk production was also about 18 million tonnes in the same year. Out of total milk production about 90.8% is supplying from dairy

cattle. The annual per capita consumption of milk was estimated about 17.8 litres in 2015 (FAO 2016; TURKSTAT 2016).

In the literature, there are a number of studies conducted for economic analysis of milk production and consumption. General structure of milk production and consumption in countries is evaluated in some of previous studies (Jabir 2007; Hussain et al. 2010; Hsu and Kao 2001; Bor 2014). Several studies have also investigated factors affecting milk production and consumption (Mckenzie and Nieuwoudt 1985; Celik et al. 2006; De Alwis et al. 2009; Maitah and Smutka 2012; Altarawneh 2015).

Çanakkale province, which is one of the provinces located in the north western of Turkey, has an important potential in terms of used technology and milk yield in dairy farming activity. It constitutes about 1.5% of total bovine animal and 2.9% of total milk production in Turkey. Approximately, 80% of animal husbandry farms in Çanakkale province has bovine animal of 5-20 head. Nearly all of the bovine animal in Çanakkale province is consisted of culture breed and dairy cattle farms are usually in the form of family enterprises. The share of milk production in value of total animal production is about 72.5% in this province. The number of cattle farms in Çanakkale province was about 19 115 farms in 2016. The number of bovine animal and milk production were 210 035 head and 485 602 tonnes, respectively. Out of total milk production about 89.2% is provided by dairy cattle (TURKSTAT 2016). Based on these data, it can be said to be important of evaluating supply and demand equilibrium for milk production in terms of sustainability of this activity in Çanakkale province. Therefore, in the present study, it was aimed to determine factors affecting demand and supply of cow milk in dairy cattle farms in central district of Çanakkale province and to give suggestions to overcome of some problems encountered in supply and demand of cow milk. In the study, the research results are expected to contribute for development of dairy farming activities in province and for similar studies performed in future.

## 2. Materials and Methods

The data of the present study were obtained through survey from dairy cattle farms in central district of Çanakkale province between June 2016 and March 2017. The data of survey were collected through a face-to-face interview technique. The central district was constituted 5.3% of dairy cattle population in Çanakkale province. It had 11 218 cattle and 1 188 dairy cattle farms (TURKSTAT 2016). Based on these data, simple random sampling method was used to determine sample size of the research. The sample size of research was also formed farms randomly selected from 1 188 dairy cattle farms in central district. In the simple random sampling method, each unit that constitutes the universe has an equal probability of being selected from a list of all population units. Also, this method is an appropriate for studies that the population is not large enough (Tillé 2006; Aksoy et al. 2011; Karkacier and Goktolga 2011). The following formula was used to determine the number of farms conducted survey.

$$n = \frac{N * \sigma^2 * Z_{\alpha}^2}{(N - 1) * D^2 + Z_{\alpha}^2 * \sigma^2} , D^2 = d^2 / z^2$$

where, n is the sample size, N is the number of dairy cattle farms in population (N=1188),  $\sigma$  is the standart deviation ( $\sigma=2.68$ ) for the population mean ( $\bar{x}=11.8$ ), Z is the confidence level (1.96 for a 95% confidence interval,  $\alpha=0.05$ ), d is acceptable error (0.05). Taking into account the number of animal in population as criterion, the sample size was determined as 243 dairy cattle farms. Multiple linear regression analysis was used in evaluation of data. The data were analyzed by using SPSS statistical analysis programme (SPSS Inc. Chicago USA). Multiple linear regression method is used to measure the degree of influence of the independent variables on dependent variable and to predict the best relationship between dependent variable and independent variables (Kim and Kohout 1975; Gujarati 1995; Agha et al. 2012). This model can be formulated as the following equation.

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n + \epsilon$$

where, Y is

dependent variable,  $\beta_0$  is constant term,  $X_n$  is independent variables,  $\beta_1, \beta_2, \dots, \beta_n$  are the regression coefficients and  $\varepsilon$  is the error term. This equation can also be written in the following form:  $Y=f(X_1, X_2, \dots, X_n)$ ; Thus, the functional form of the estimated model for determining factors affecting the quantity of milk supplied and its variables were estimated as follows:

$$S_m = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \varepsilon \quad \text{where;}$$

$S_m = f(X_1, X_2, X_3, X_4, X_5)$  where,  $S_m$  is dependent variable,  $X_n$  is independent variables.

$S_m$  = The quantity of milk supplied (tons/year)

$X_1$  = The number of cows milked (head)

$X_2$  = Average milk yield per cow (kg/head/year)

$X_3$  = Dairy farming experience of farmers (year)

$X_4$  = Livestock diseases; Do the occurrence of animal diseases in farm? (1=yes, 0=no)

$X_5$  = Price of milk (€ kg<sup>-1</sup>)

The functional form of the estimated model for determining factors affecting the quantity of milk consumed and its variables were estimated as follows:

$$D_m = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \varepsilon$$

where;

$D_m = f(X_1, X_2, X_3, X_4, X_5, X_6)$  where,  $D_m$  is dependent variable,  $X_n$  is independent variables.

$D_m$  = The quantity of milk consumed (kg/per capita/year)

$X_1$  = Age of farmers (year)

$X_2$  = Household size (person)

$X_3$  = Average monthly household income (€)

$X_4$  = Number of children less than 6 years old in household (person)

$X_5$  = Education of farmers (schooling years)

$X_6$  = Price of milk (€ kg<sup>-1</sup>)

In addition to these data, the multicollinearity problem and the collinearity diagnostic were also calculated for identify to correlation among the independent variables in these models. High tolerance (a tolerance close to 1) and low VIF (Variance-Inflating Factor) (VIF<10) values calculated in collinearity statistics of multiple linear regression analysis show that whether or not there is the multicollinearity problem among the independent variables (Topçu 2008).

### 3. Results and Discussion

The data related to socio-economic characteristics of farmers were explained by descriptive statistics (Table 1). In the present study, it was found that farmer's average age was 44.4 years, household size was 3.3 persons, the number of cows milked was 11.9 head, farmers' dairy farming experience was 19.1 years and the average household income was €1862.6 monthly. Moreover, it was determined that the average the quantity of milk consumed and supplied was 118.8 kg and 40.6 tons, respectively and the average milk yield per cow was also 4831.8 kg.

**Table 1.** Description statistics of variables used in models (supply and demand)

**Çizelge 1.** Modellerde kullanılan değişkenlerin tanımlayıcı istatistikleri (arz ve talep)

Variables	Mean	Standart deviation
<i>- Supply of cows milk</i>		
<i>Dependent variable</i>		
The quantity of milk supplied (tons/year)	40.64	26.30
<i>Independent variables</i>		
Number of cows milked (head)	11.87	7.73
Average milk yield per cow (kg/head/year)	4831.85	986.80
Dairy farming experience of farmers (year)	19.13	7.96
Livestock diseases (1= yes, 0= no)	0.56	0.50
*Price of milk (€ kg <sup>-1</sup> )	0.36	0.02
<i>- Demand of cows milk</i>		
<i>Dependent variable</i>		
The quantity of milk consumed (kg/per capita/year)	118.86	67.49
<i>Independent variables</i>		
Age of farmers (year)	44.39	9.009
Household size (person)	3.27	0.96
Average monthly household income (€)	1862.64	1266.84
Number of children less than 6 years old in household (person)	0.43	0.67
Education of farmers (schooling years)	6.22	2.19
*Price of milk (€ kg <sup>-1</sup> )	0.35	0.01

\*1 Euro=3.54 TRY (Turkish lira) in november 2016

### 3.1. Supply of cow milk

The estimated coefficients of the quantity of milk supplied are presented Table 2. As can be seen Table 2, partial correlation scores among the variables were calculated less than 0.80. This result shows that there isn't the multicollinearity problem among the independent variables. Besides, the independent variables selected to

model were found significant as a result of calculations such as determination coefficient  $R^2=0.625$ , F value ( $F=69.762$  with sig.  $F=0.00<0.01$ ), t-test and other tests.  $R^2$  value of 0.625 in model shows that 62.5% of the variance in quantity of milk supplied is explained by independent variables.

**Table 2.**The multiple regression estimates for the quantity of milk supplied

**Çizelge 2.** Sağlanan sütün miktarı için çoklu regresyon tahminleri

Variables	Unstandardized coefficients		Standardized coefficients		Correlations			Collinearity statistics	
	B	Std. Error	Beta	t	p	Partial	Part	Tolerance	VIF
Constant	105.434	24.195		4.358	0.000				
X <sub>1</sub>	2.181	0.146	0.641	14.896	0.000	0.718	0.631	0.967	1.034
X <sub>2</sub>	0.07	0.01	0.272	6.239	0.000	0.396	0.264	0.940	1.064
X <sub>3</sub>	0.623	0.143	0.189	4.360	0.000	0.289	0.185	0.958	1.044
X <sub>4</sub>	-10.955	2.274	-0.207	-4.817	0.000	-0.316	-0.204	0.970	1.031
X <sub>5</sub>	222.725	65.020	0.146	3.425	0.000	0.231	0.145	0.980	1.020

Dependent variable: Y (the quantity of milk supplied); Independent variables: X<sub>1</sub>(number of cows milked), X<sub>2</sub>(average milk yield per cow), X<sub>3</sub>(dairy farming experience of farmers), X<sub>4</sub>(livestock diseases), X<sub>5</sub>(price of milk); Determination coefficient  $R^2 = 0.625$ ; P: Statistical significance  $p<0.05$ ; Durbin-Watson = 1.619 ( $1.5 < 1.6 < 2.5$ );  $F= 69.762$   $p=0.000$

As can be seen from Table 2, there is a positive and statistically significant relationship ( $P<0.05$ ) between the quantity of milk supplied and some independent variables (the number of cows milked, average milk yield per cow, dairy farming experience of farmers and price of milk) and is a negative and statistically significant relationship ( $P<0.05$ ) between the quantity of milk supplied and livestock diseases. In the present study, it was found that there was a positive and significant relationship between the number of cows milked and the quantity of milk supplied. This result shows that for each per one-unit increase in number of cows milked, the quantity of milk supplied milk increases by 2.181 tons. But, this increase may not be easy. Because, it can be said to this increase expected in short run is only possible with taking new animals to dairy cattle farms, and this situation also shows a change depending upon farmer's income level. However, if the number of other bovine animals except cow increase in dairy cattle farms, this increase can affect adversely on farm's milk production. Therefore, the increase in the number of cow is rather important in farms. The result of a study conducted by Doğan and Kızıloğlu (2015)

showed that the quantity of milk per farm would decrease and cost would increase if the number of cows milked in farm was less than the other animals. In the study conducted in Jordan, it was found that there was a positive and significant relationship between number of milking animals and the quantity of milk supplied (Altarawneh 2015) Taking together the present and previous findings, it appears that the results of this study corroborate to the previous findings.

In dairy cattle, it can be expected to increasing of its production and milk yield with precautions taken as a result of determination of factors affecting milk yield (feed, diseases, etc), and this situation can also affects on quantity of milk supplied (Singh et al. 2010). In the present study, it was found that there was a positive and statistically significant relationship between average milk yield per cow ( $P<0.05$ ) and the quantity of milk supplied. Thus, for each per one-unit increase in average milk yield, the quantity of milk supplied increases by 0.07 tons. Besides, the increase of total milk production depending on milk yield per cow will be positive effects on quantity of milk supplied, and that these findings are in line with the findings of Singh et al (2010).

It is necessary to work for many years in order to be more economical in areas administration, feeding and maintenance in dairy farming. Because, farmers will also gain experience related to this activity area in time (Güler et al. 2016). Thus, savvy farmers are expected to be effect on amount of milk production. Besides, this situation will also cause a positive effect on quantity of milk supplied. In the present study, it was found that there was a positive and statistically significant relationship ( $P<0.05$ ) between dairy farming experience of farmers and the quantity of milk supplied. This result shows that for each per one-unit increase in dairy farming experience of farmers, the quantity of milk supplied increases by 0.623 tons. According to these results, it is expected to increasing of dairy farming experiences of farmers is positive effect on average milk yield per cow.

Livestock diseases is one of the most important factors that impact to production and to productivity in farms. Because, these diseases are cause of the cow's inability to cope with demands of high production, and of economic loss to the dairy farming (Mulligan and Doherty 2008; Thornton 2010). In some studies conducted regarding economic losses of animal diseases, they were found that diseases caused the loss of milk production (Curtis et al. 1985; Pryce et al. 1999; Ingvarsten et al. 2003) In the present study, it was determined that there was a negative and statistically significant relationship ( $P<0.05$ ) between livestock diseases and the quantity of milk supplied. This result shows that for each per-unit increase in the number of sick animals, the quantity of milk supplied decreases by 10.955 tons. Taking together the present and previous findings, it can be said that is a major economic problem for farmers of livestock diseases. Because, milk yield can decrease considerably depending on the increase in the number of sick animals and so it can affect adversely on quantity of milk supplied.

Generally, it is expected that more milk to be supplied if there are more dairy farms or more cows per farm in dairy cattle farms, and it is

supposed that a higher price calls forth a greater quantity supplied. Besides, only if farmers sell the milk at a high price enough to cover the additional costs in order to boost the production, it will be profitable to increase milk production for they. Thus, the quantity supplied normally also increases as the price increases (William and Alan 2007). Taking into account all of these findings, milk price is one of the most important affecting farmers' income in dairy cattle activity. Because, farmers' income may also increase significantly depending on increase in milk price. In the present study, it was found that there was a positive and statistically significant relationship ( $P<0.05$ ) between the price of milk and the quantity of milk supplied. This result shows that for each per-unit increase in the price of milk, the quantity of milk supplied increases by 222.725 tons. In a study conducted by Altarawneh (2015), milk price found to be significant for the quantity of milk supplied. Based on these results, it can be said that these findings are in line with the findings of William and Alan (2007), and Altarawneh (2015).

In view of the above data, it can be said that the variables have individual explanatory power on the quantity of milk supplied and the regression equation relating to these variables is as follows:

$$S_m = 105.434 + 2.181X_1 + 0.07X_2 + 0.623X_3 - 10.955X_4 + 222.725X_5 + \varepsilon$$

### 3.2. Demand of cow milk

The estimated coefficients of demand function are presented Table 3. Partial correlation scores among the variables were calculated less than 0.80 (Table 3). This result shows that there isn't the multicollinearity problem among the independent variables. The independent variables selected to model were found significant as a result of calculations such as determination coefficient  $R^2=0.667$ , F value ( $F=69.291$  with sig.  $F=0.00<0.01$ ), t-test and other tests.  $R^2$  value of 0.667 in model shows that 66.7% of the variance the quantity of milk consumed milk is explained by independent variables.

**Table 3.**The multiple regression estimates for the quantity of milk consumed

**Çizelge 3.** Tüketilen süt miktarı için çoklu regresyon tahminleri

Variables	Unstandardized coefficients		Standardized coefficients			Correlations		Collinearity statistics	
	B	Std. Error	Beta	t	p	Partial	Part	Tolerance	VIF
Constant	395.147	68.895		5.736	0.000				
X <sub>1</sub>	1.163	0.309	0.155	3.766	0.000	0.253	0.151	0.944	1.060
X <sub>2</sub>	-36.615	2.997	-0.519	-12.216	0.000	-0.646	-0.489	0.888	1.126
X <sub>3</sub>	0.01	0.002	0.225	5.538	0.000	0.358	0.222	0.974	1.026
X <sub>4</sub>	65.767	4.238	0.655	15.520	0.000	0.733	0.621	0.899	1.112
X <sub>5</sub>	7.688	1.273	0.249	6.041	0.000	0.386	0.242	0.945	1.059
X <sub>6</sub>	-864.780	181.040	-0.193	-4.777	0.000	-0.314	-0.191	0.986	1.015

Dependent variable: Y (the quantity of milk consumed); Independent variables: X<sub>1</sub>(age of farmers), X<sub>2</sub>(household size), X<sub>3</sub>(average monthly household income), X<sub>4</sub>(number of children less than 6 years old in household), X<sub>5</sub>(education of farmers), X<sub>6</sub>(price of milk); Determination coefficient R<sup>2</sup> = 0.667; P: Statistical significance p<0.05; Durbin-Watson = 1.923 (1.5 < 1.9 < 2.5); F= 69.291 p=0.000

As can be seen from Table 3, there is a positive and statistically significant relationship (P<0.05) between the quantity of milk consumed and some independent variables (age of farmers, average monthly household income, number of children less than 6 years old in household and education of farmers) and is a negative and statistically (P<0.05) between the quantity of milk consumed and the others (household size and price of milk). In the present study, it was found that there was a positive and statistically significant relationship (P<0.05) between age of farmers and the quantity of milk consumed. This result shows that for each per one-unit increase in age of farmers, the quantity of milk consumed milk increases by 1.163 litres. Besides, the positive relationship between the age of farmers and their milk consumption can also be interpreted as an indication of their awareness of the importance of milk consumption. The result of a study conducted by Trung et al (2014) showed that there was a negative and significant relationship between age of the head of rural household and milk consumption, and it was implied that the budget for milk consumption of the rural household was limited. In contrast to these findings, in the present study, it was found that the age of farmers have positive effect on the quantity of milk consumed. Similarly, in some studies, it was determined that there was a positive relationship between age and milk consumption (Agbola 2003; De Alwis et al. 2009, Bilgiç and Yen 2013). Based on these data, it can

be said that the results of this study corroborate to the previous findings.

In the present study, it was found that there was a negative and statistically significant relationship (P<0.05) between household size and the quantity of milk consumed. This result shows that for each per one-unit increase in the number of household, the quantity of milk consumed decreases by 36.615 litres. That is, it can be said that milk consumption will be decrease depending on increase in the number of household. In the study conducted in Jordan, it was determined that there was a positive and significant relationship between household number and the quantity of milk consumed per capita (Altarawneh 2015). The result of a study conducted by Davis et al (2014) showed that household size have positively influence on milk consumed. In contrast to both of these studies, in the present study, it was found that there was a negative relationship between household size and the quantity of milk consumed. Based on this result, it can be said that farmers may prefer to put the whole milk on the market instead of separating of a certain quantity for household consumption of milk produced without considering the increase in household size depending on increase in milk price.

It was found that there was a positive and statistically significant relationship (P<0.05) between average monthly household income and the quantity of milk consumed. This result shows that, farmers' milk consumption can also increase as the income of consumers is increase. Thus, for

each per one-unit increase in household income, the quantity of milk consumed increases by 0.01 litres. The result of a study conducted by Altarawneh (2015) showed that there was a positive and significant relationship between per capita income and the quantity of milk consumed per capita. Similar results were reported by Rodolfo et al (1999), Phuong et al (2014) and Terin et al (2015). Taking together the present and previous findings, it appears that the results of this study corroborate to the previous findings.

Generally, families have to take care to development and nourishment of their children. Therefore, it can be said to attach great importance to milk consumption in families with children. In the study, it was found that there was a positive and statistically significant relationship ( $P < 0.05$ ) between number of children less than 6 years old in household and the quantity of milk consumed. Thus, for each per one-unit increase number of children less than 6 years old in household, the quantity of milk consumed increases by 65.767 litres. According to these findings, milk consumption can increase for farmers who have got to children less than 6 years old in household. Similar results were reported by Davis et al (2012), Bilgiç and Yen (2013), Trung et al (2014) and Urak et al (2017). In this context, it can be said that the results of this study corroborate the previous findings.

There is an important role of education in assuring consciousness on nourishment. Because, it is also expected to increase of tendencies to their milk consumption with increasing of farmers' educational level and so this situation is thought to be positive effect on milk consumption of household. In the study, it was determined that there was a positive and statistically significant relationship ( $P < 0.05$ ) between farmers' educational level and the quantity of milk consumed. Thus, for each per one-unit increase farmers' educational level, the quantity of milk consumed increases by 7.688 litres. The result of a study conducted by Urak et al (2017) determined that there was a negative and significant relationship between educational level and milk consumption. However, in the present

study, it was found that there was a positive relationship between education and milk consumption. Similarly, in some studies, it was found that there was a positive relationship between educational level and milk consumption (Agbola 2003; Fuller et al. 2007; Bilgiç and Yen 2013; Terin et al. 2015). Thus, it can be said that the results of this study corroborate the previous findings.

Price plays an important role in a market economy. Because, if the price of milk is very high, its market potential may be very small or if the price of milk declines, people will tend to drink more milk (William and Alan 2007). Taking into account all of these findings, it can be said that milk price is one of the factors affecting the quantity of milk consumed of household. Also, the quantity of milk consumed of household may change depending on increase or decrease in milk price. In the present study, it was determined that there was a negative and statistically significant relationship ( $P < 0.05$ ) between the price of milk and the quantity of milk consumed. Thus, for each per-unit increase in the price of milk, the quantity of milk consumed decreases by 864.780 litres. Additionally, it can be said that milk consumption has become more price-responsive and it may decrease the quantity of milk consumed of household when milk price increases. In a study conducted by Altarawneh (2015), it was found that if milk price increases by 1 percent, the demand for milk decreases by 1.135 percent. Similar results were reported by William and Alan (2007) and Altarawneh (2015).

In view of the above data, it can be said that the variables have individual explanatory power on the quantity of milk consumed and the regression equation relating to these variables is as follows:

$$D_m = 395.147 + 1.163X_1 - 36.615X_2 + 0.01X_3 + 65.767X_4 + 7.688X_5 - 864.780X_6 + \varepsilon$$

#### 4. Conclusions

In the present study conducted in order to estimate factors affecting demand and supply of cow milkin dairy cattle farms in central district of Çanakkale province, it was found that the most

important factors affecting the quantity of milk supplied were the number of cows milked, average milk yield per cow, dairy farming experience of farmers, livestock diseases and price of milk, and that the most important factors affecting the quantity of milk consumed were age of farmers, household size, average monthly household income, number of children less than 6 years old in household, education of farmers and price of milk. Thus, it has been concluded that the price of milk is rather important for both the quantity of milk supplied and the quantity of milk consumed and there will be changes in these quantities (milk supplied and milk consumed) depending on decrease or increase in the price of milk. Taking all of these findings into account, it can be said that the supports provided by government to farmers' in order to reduce costs of feed, and to take new cow to dairy cattle farms can contribute to increasing of milk production. As the result, it is expected to be important effects on milk industry of incentives and agricultural supports applied by government related to the price of milk for increasing consumption and production of cow milk. Besides, the present study is expected to contribute for similar studies performed in future.

### References

- Agbola FW (2003). Estimation of food demand patterns in South Africa based on a survey of households. *Journal of Agricultural and Applied Economics*, 35:663-670.
- Agha SR and Alnahhal MJ (2012). Neural network and multiple linear regression to predict schoolchildren dimensions for ergonomic school furniture design. *Applied Ergonomics*, 43:979-984.
- Aksoy A, Külekçi M and Yavuz F (2011). Analysis of the factors affecting the adoption of innovations in dairy farms in Erzurum Province, Turkey. *African Journal of Agricultural Research*, 6: 2966-2970.
- Altarawneh M (2015). Estimating supply and demand functions for dairy cows milk production. *Asian Journal of Agricultural Extension*, 7:1-5.
- Bilgiç A and Yen ST (2013). Household food demand in Turkey: A two-step demand system approach. *Food Policy*, 43:267-277.
- Bor Ö (2014). Economics of dairy farmer in Turkey. *International Journal of Food and Agricultural Economics*, 4:49-62.
- Celik Y, Bilgic A, Karli B and Celik S (2006). Factors affecting milk consumption pattern in southern Anatolian region: an application of a two-stage econometric model. *Die Bodenkultur*, 57:57-64.
- Curtis CR, Erb HN, Sniffen CJ, Smith RD and Kronfeld DS (1985). Path analysis of dry period nutrition, postpartum metabolic and reproductive disorders, and mastitis in Holstein cows. *Journal of Dairy Science*, 68: 2347-2360.
- Davis CG, Dong D, Blayney D, Yen ST and Stillman R (2012). U.S. fluid milk demand: a disaggregated approach. *International Food and Agribusiness Management Review*, 15:25-50.
- De Alwis AEN, Edirisinghe JC and Athauda AMTP (2009). Analysis of factors affecting fresh milk consumption among the mid-country consumers. *Tropical Agricultural Research and Extension*, 12:103-109.
- Doğan N and Kızıloğlu S (2015). Analysis of factors that affect dairy farms' success: case of Gumushane province. *Iğdır University Journal of the Institute of Science and Technology*, 3:49-56.
- FAO (2015). Statistical database. <http://faostat.fao.org> (Accessed to web: 12.02.2017).
- Fuller F, Behgin J and Rozella S (2007). Consumption of dairy products in urban China: results from Beijing, Shanghai and Guangzhou. *The Australian Journal of Agricultural Resource Economics*, 51:459-474.
- Gujarati DN (1995). *Basic econometrics*. McGraw-Hill International Editions Publishers, New York.
- Güler O, Aydın R, Yanar M, Diler A, Koçyiğit R and Avcı M (2016). Socio-economic structures of cattle enterprises in Hınıs district of Erzurum province. *Alinteri Journal of Agricultural Sciences*, 30:27-37.
- Hussain M, Ghafoor A and Saboor A (2010). Factors affecting milk production in buffaloes: acase study. *Pakistan Veterinary Journal*, 30:115-117.
- Hsu JL and Kao JS (2001). Factors affecting consumers' fluid milk purchasing patterns in Taiwan: product comparisons and marketing implications. *Journal of Food Products Marketing*, 7:41-51.
- Ingvartsen KL, Dewhurst RJ and Friggens NC (2003). On the relationship between lactational performance and health: is it yield or metabolic imbalance that cause production disease in dairy cattle? A position paper. *Livestock Production Science*, 83:277-308.
- Jabir A (2007). Livestock sector development and implications for rural poverty alleviation in India. *Livestock Research for Rural Development*, 19:1-13.
- Karkacier O and Goktolga ZG (2011). A case study investigating farmers' view regarding soil analysis: estimates using a logit model. *Journal of Agricultural Science and Technology*, 13:467-476.
- Kim JO and Kohout FJ (1975). Multiple regression analysis: subprogram regression. In: NH Nie, CH Hall, JG Jenkins, K Steinbrenner and D Bent (Eds). *Statistical Package for the Social Sciences*, McGraw-Hill, New York.
- Maitah M and Smutka L (2012). Economic analysis of milk production and consumption in the Middle East and North Africa. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, 26:245-254.
- Mckenzie CC and Nieuwoudt WL (1985). Estimation of demand and supply functions for fresh and industrial milk in South Africa. *Agricultural Economics*



- Research, Policy and Practice in Southern Africa, 24:27-33.
- Mulligan FJ and Doherty ML (2008). Production diseases of the transition cow. *The Veterinary Journal*, 176:3-9.
- Phuong NV, Cuong TH, Mergenthaler M (2015). Effects of household characteristics on expenditure for dairy products in Vietnam. *International journal of Research Studies in Agricultural Sciences*, 1:1-13.
- Pryce JE, Nielsen BL, Veerkamp RF and Simm G (1999). Genotype and feeding system effects and interactions for health and fertility traits in dairy cattle. *Livestock Production Science*, 57:193-201.
- Rodolfo M, Nayga J, Siebert JW (1999). Analysis of at-home consumption of dairy products in the United States. *Journal of Food Products Marketing*, 5(3): 65-78.
- Singh KM, Singh RKP, Jha AK and Meena MS (2010). Dynamics of livestock sector in Bihar: a temporal analysis. *Agricultural Situation in India*, 66:687-702.
- SPSS (1998). *SPSS Base 8.0 for Windows User's Guide*. SPSS Inc., Chicago IL.
- Terin M, Bilgiç A, Güler Oİ and Yavuz F (2015). Analyzing factors affecting household milk products' expenditures in Turkey: a multivariate heckman sample selection system approach. *Journal of Agricultural Sciences*, 21:500-515.
- Thornton PK (2010). Livestock production: recent trends, future prospects. *Philosophical Transactions of The Royal Society B Biological Sciences*, 1554:2853-2867.
- Tillé Y (2006). *Sampling Algorithms*. Springer-Verlag Publishers, New York.
- Topcu Y (2008). Analysis of success factors in dairy farms: case study of Erzurum province. *Journal of the Faculty of Agriculture OMU*, 23:17-24.
- TURKSTAT (2016). Statistical database. <http://www.turkstat.gov.tr/> (Accessed to web:13.02.2017).
- Trung TQ, Giam DQ, Hai VT, Thao LP, Hang NTT, Son LTK and Linh BTM (2014). Factors influencing milk consumption of rural households in Northern Vietnam. *Greener Journal of Business and Management Studies*, 4:31-40.
- Urak F, Dağdemir V and Bilgiç A (2017). Econometric Analysis of factors affecting household spending on some animal products in Turkey. *Turkish Journal of Agricultural Economics*, 23:45-53.
- Schaik GV, Perry BD, Muhkebi AW, Gitau GK and Dijkhuizen AA (1996). An economic study of smallholder dairy farms in Muranga district, Kenya. *Preventive Veterinary Medicine*, 29:21-36.
- William JB and Alan SB (2007). *Economics: principles and policy*. Courier Kendallville, Inc, USA.