Full Length Research Paper

The roles of milk collection centers in milk distribution channels in Turkey: A case study of Antalya

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The aim of this paper is to discuss the factors affecting the milk collection centers role in assuring safe distribution channel in Antalya, Turkey. The research was based on the original data obtained by face to face interviews in 2007 in Antalya province. Under random sampling method, 82 milk farms which sell milk to milk collection centers and 74 farms which do not sell to milk collection centers were selected. The empirical (Logit) model was used for evaluating the factors which affect milk selling decisions to milk collection centers. According to results of the research, milk selling decisions were significantly affected by income and demographic characteristics. Empirical findings also showed that milk producers who receive milk incentive premiums were affected by the price level of milk incentive support. In this paper, a special emphasis is given to milk production distribution and safe distribution channels in Turkey.

Key words: Milk collecting centers, selling decision, logit model, Antalya, Turkey.

INTRODUCTION

Considering the marketing and distributing structures, milk quality and hygiene, appear as an issue that requires substantial attention in Turkey. For example, raw milk distribution toward modern enterprises is still rare in Turkey, when compared with industrially developed countries. According to the latest data, there is more than 10 million ton milk production and it is marketed by 60%, consumed at farms by 25%, given to animals by 10% and loses quantity at different processing stages by 5%. On the other hand, almost all of the milk production quantity is marketed (97 to 98%) in developed countries (Sayin, 2009; 1998).

Artukoglu and Olgun (2008) indicate that, milk is consumed to a large extent at farms (40%) and street sales (24%). Elsewhere, there are small scale dairy processing plants (27%) and large scale plants (9%). The milk dairy processing plants ratio in the total food processing plants was only 7.7% in 2004. Due to the fact that milk and the other products require special treatments in terms of food safety, the first step in milk collection needs special attention. Therefore, MCCs are important as the first control point for food safety. Beside

the control criteria, registered milk sales are also important in terms of traceability and monitoring.

This is one of the ways of using premium as income transfer to dairy farmers (Sayin et al., 2007). However, the problem arises with the number of animal on dairy farms. Typically, with 5 to 10 cows, these farms could be called small family enterprises. Producer organizations require an improvement in milk market and in the registration of milk production records in Turkey. In the existence of unregistered production, raw milk, to a large extent, is publicly sold in streets. This is due to the length of the channels between producers and modern dairy enterprises. The length of the channel between the producers and modern dairy enterprises creates some problems. In order to overcome such problems, milk collection centers (MCCs) were established in recent years.

These entities work as a bridge between producers and enterprises and therefore are a sort of connecting point in an organizational network. This method helps to decrease the street sale of milk. As such, MCCs could be affiliated to the private sector, producer cooperatives or unions and other non-governmental organizations. Although the MCC's mission have important role for milk marketing, they have some problems in terms of hygienic conditions and relations with producers, in addition to several marketing problems. The aim of this paper is to

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discuss the factors that affect milk collection centers role, in assuring safe distribution channel in Antalya, Turkey.

MATERIALS AND METHODS

This research is a case study of Antalya province. In the context of project, milk marketing related subjects were evaluated and the data about producers' marketing and production conditions were not available. Therefore, face to face survey method was chosen for the data collecting method. As such, the original data from the survey were utilized in the analysis. The findings were evaluated and discussed in terms of raw milk marketing conditions and producers' attitudes and other related variables. Some farmers do not prefer selling to MCCs; so the question of why producers sell their milk to street sellers will be explored. The data used for the basic analysis and the research theme was obtained from the original data gotten from the field of the study area. Face to face survey was used for collecting data by using questionnaire forms in 2007 in Antalya province which is a popular and touristic city, located at the south coast of Turkey.

There are 250 thousand tons of raw milk produced in Antalya, of which 235 thousand tons of it is provided by cows and the rest of them by goats. There are significant numbers of MCCs in Antalya. Among them, the highest production capacity belongs to Central, Korkuteli and Elmali districts, while 80% of the total milk production is provided by them. Therefore, to get information from the MCCs, 82 milk producers, who sell to them, were selected. Also, 74 milk producers who do not sell to MCCs were selected, in order to compare their characteristics. The duration of the study was 2 months and was between the year 2006 and 2007. The questionnaire contains 60 questions. Among them, were some significant variables assumed to involve a Logit model. As such, the model was solved by using the package program called "SPSS 10.0 for Windows".

Logistic model was used by Herath and Takeya (2003), Thangataa and Alavalapatib (2003), Sheikh et al. (2003) and Gockowski and Ndoumbé (2004) in agricultural economics, whereas logistic regression model, which is a proper method, reflected differences between individual based observations and group based observations (Isyar, 1999), and also has superiority above other categorical variable estimate techniques (Maddala, 1983). Moreover, in this model, explanatory variables signify effects on qualitative variables. Logistic model is estimated by using 'maximum likelihood test' because estimated variables have asymptotic normality and show goodness of fit in many cases (Greene, 2000; Karaman and Yilmaz, 2007).
Logistic model is realized as:

$$P_i = F(Z_k) = F(\alpha + \beta X_{ij}) = 1/[1 + \exp(-Z_i)]$$

in the model;

(Z_i) = Cumulative logistic function value for each possible value which creates Zi index, Pi = Probability of the producers selling milk to MCCs (0 - 1), α = Constant number, βX_{ij} = Linear combination of explanatory variables.

So, the data analysis and common questions in the questionnaire forms were combined and prepared as a new data base. As mentioned before, there were two questionnaires in the study for farmers, whether to sell milk to MCCs or not. Therefore, farmers who prefer selling milk to MCCs were given the value 1, and 0 if otherwise (that is, selling to street sellers). Social and economic factors affect producer preferences, therefore these factors were embedded in the model as explanatory variables. Thus,

$$Z_i = \log[P_i/(1 - P_i)] = \beta_0 + \beta_1 X_{11} + \beta_2 X_{12} + ... + \beta_n X_{1n} + \varepsilon$$

i = 1,2, ..., n (observations), j = 1, 2, ..., n (independent variables), Z_i = unobserved index level or i observation choice log-odds ratio (interval: $-\infty$ / $+\infty$), X_{ij} = i observation j explanatory variables (It has been explained in the variable's definition sub-chapter), β = expected coefficient, ε = stochastic error term.

The dependent variable (Zi) in the equation is a logarithm of log-odds' preferences and the estimated parameters do not signify that the independent variable coefficients are affected directly. When Y = 1, there are possibilities of changes in the continuous variables (Pi).

$$(\partial P_i/\partial X_{ij}) = [\beta_j \exp(-\beta X_{ij})]/[1 + \exp(-\beta X_{ij})]^2$$

However, when an explanatory variable is qualitative, the ratio $(\partial P_i/\partial X_{ij})$ does not change continuously. In this case, changes in probability should be calculated with the Pi values in Xij alternative values.

$$(\partial P_i/\partial X_{ij}) = [P(Y_i IX_{ij} = 1) - P_i(Y_i IX_{ij} = 0)]/[1 - 0].$$

Odds value is calculated as antilogarithm, according to the estimated coefficients of the explanatory variables, while odds ratio and odds value for X = 1 is divided into odds value for X = 0

$$Odds.value = e^{\hat{\beta}_j}$$ (Karaman and Yilmaz, 2007).

RESULTS

First, farmers were questioned about why they sell their milk produce either to MCCs or street sellers. The answer to that question provided the explanatory variable (selling) of (Y). Therefore, the dependent variable had two probability dummies in this study, that is, if the farmer prefers selling milk to MCC (Y = 1) and if the farmer does not prefer selling milk to MCC (Y = 0). The production quantity and socio-economic factors of farmers, which are the explanatory variables, were involved in the Logistic model.

Fundamentally, the producer age (age 1) was added as an explanatory variable which is a continuous variable. As such, the lowest and highest age levels were 28 and 75, respectively. Producers' experience (s_haycil) on dairy cattle was found to be 23 years on average. Also, the number of milking cows (a_say) is an explanatory variable which affects the production sustainability and utilization of milk and milk products (Table 1). Some of the farmers do not only produce plant, but also engage in animal production. Generally, farmers meet the needs of the animal fodder with these plants. Thus, if the farmers grow plant, the variable takes the value of 1, but if not, it takes the value of 0. Moreover, about farmers training, those who participated in a course are given the value of1 and those who did not are given the value of 0 for the "course" variable. This is the dummy variable involved in

Table 1. Variables characteristics used in this model.

Variables	Minimum	Maximum	Mean	St. Deviation
Selling (D)	0.00	1.00	0.5256	0.50095
Age (S)	28.00	75.00	50.3910	10.71362
s_haycil (S)	2.00	50.00	22.8013	10.89861
Plant (D)	0.00	1.00	0.7436	0.43806
a_say (S)	1.00	11.00	4.1154	2.52206
Course (D)	0.00	1.00	0.2308	0.42268
Quality (D)	0.00	1.00	0.6410	0.48124
Closeness (D)	0.00	1.00	0.5769	0.49564

S: continues variable, D: dummy variable

Table 2. Goodness of fit criteria and heteroscedasticity test.

L_0 = -2 Log likelihood (begin) (likelihood ratio involves only constant)			—107.9257
L_1 = -2 Log likelihood (end) (likelihood ratio of all explanatory variables)			—64.37541
McFadden's- R^2			0.40
Proportion (non zero observation number to observation number)			0.56
Likelihood test	(χ^2)	Degree of freedom	Importance level
LR-statistics	87.10066	7	0.000
Hosmer and Lemeshow $\hat{H}$ test	11.135	8	0.194
LM test	14.243	7	0.047

the model. It was expected from this variable that education or awareness explain farmers' attitude to sell milk to MCC's or street sellers. As such, farmers' knowledge on milk quality is evaluated with (quality) the variable. It is known that closeness to the city center facilitates milk marketing. Therefore, the variable (closeness) refers to the agricultural farms' closeness to the city center and is embedded in the model as two groups (Table 1).

Goodness of fit calculation is essential when the explanatory variable does not fit with the model and the possibility of contrariety occurs between variables. Likelihood ratio test, McFadden's-R2 test, Hosmer and Lemeshow $\hat{H}$ tests and Model correct classification ratio methods were used to show how the explanatory variables explain the dependent variable. The calculated R2 value in the logistic regression model is different from the other regression models. However, there is more than one (pseudo) R2. One of the pseudo R2 is called McFadden's-R2' which was calculated according to the likelihood ratio index. As such, this R2 value is calculated as 0.40. This ratio explains that goodness of fit of the explanatory variables of the model is good (Karaman and Yilmaz, 2007) (Table 2), and so, the validity of the model was checked with some tests. The likelihood ratio test (LR) show that this model is statistically important at the 0.01 level. Thus, the Hosmer and Lemeshow $\hat{H}$ test gives directly goodness of fit. This test statistics is χ^2 in distribution and t-2 in the degree of freedom (Hosmer and

Lemeshow, 1989), which indicates that the model's goodness of fit is statistically important at the 0.194 level. Observations can be classified as determined groups in the logistic models and "goodness of fit" can be used as a criteria. In this study, the non-zero observation rate into the total observation rate was calculated as 0.56. Logistic regression model classification rate is 0.77 and it means this model has power for the right classification of 77%. The ratio shows that the classification is right for the model, and as such, the classification is organized as farmers who prefer selling to MCC's as 81.7% and those who do not prefer selling to MCC's as 71.6% (Table 3). Due to the fact that different characteristics among farmers affect error rate, the possibility of variance is changeable in the logistic model. Thus, the availability of 'heteroscedasticity' was checked by applying LM. According to the LM test result, the 'heteroscedasticity' problem was defined at 5% importance level. Consequently, the standard error correction was applied for eliminating the heteroscedasticity and new standard errors were obtained. Odds ratios and importance levels were used for explication of the estimated variables' coefficients in the logistic regression model. Here are the findings obtained from the model (Table 4).

DISCUSSION

Characteristics of the milk market were conducted in

Table 3. Logistic model estimation success.

C = 0.50	Estimation			Total	Correctness (%)
	Code	0	1		
Observation	0	53	21	74	71.6
	1	15	67	82	81.7
Total		68	88	156	-
The ratio of correct estimations					76.9
The number of correct estimations					120

Table 4. The highest likelihood estimations of Logistic model.

Effects	$\hat{\beta}$	SE ($\hat{\beta}$)	Z-statistics	P	$Exp(\beta)$	95% Confidence Interval	
						Lowest	Highest
Constant	-5.271	1.430	-3.687	0.000*	0.005	-	-
age1	0.054	0.026	2.074	0.038**	1.055	1.001	1.112
s_haycil	0.052	0.024	2.118	0.034**	1.053	1.002	1.106
Plant	2.367	0.583	4.063	0.000*	10.668	3.266	34.845
a_say	-0.191	0.090	-2.130	0.033**	0.826	0.689	0.991
Course	2.632	0.680	3.869	0.000*	13.897	3.490	55.339
Closeness	-0.969	0.440	-2.199	0.028**	0.380	0.155	0.929
Quality	0.842	0.449	1.873	0.061***	2.321	0.931	5.785

(*) : P < 0.01, (**) : P < 0.05, (***) : P < 0.10.

several studies (Pazarlioglu et al., 2007; Akbay and Tiryaki, 2008; Hatirli et al., 2004; Tiryaki and Akbay,2008) in Turkey. They discussed subjects about milk consumption by consumers in urban cities and in these studies, the 'logit', 'multinomial logit' and 'Heckman' models were applied. Production and distribution of milk in markets has its importance and they remained less with few exceptions. Artukoglu and Olgun (2008), Demirbas and Karagozlu (2008) and Tosun et al. (2008) conducted researches about milk production, street selling and producers' organizational types in Aegean region in Turkey in different years. They also used the survey method of the face to face interviews with producers and evaluated the raw milk distribution, marketing and prices fixation of the milk. Their common findings from their studies are supply inadequacies, little control over the raw milk supply and inferior quality of raw milk.

The basic reason is that producers have small sizes, scarcity and low productivity of the dairy farms. As such, MCCs have an important role in the raw milk supply chain in Turkey. First, dairy farms could supply raw milk through MCCs instead of small size and scarce farms. Another important function of the MCCs is to provide quality and safe raw milk by enabling cold chain in the period of passing from the milking stage to the arrival at the dairy plant, because this is one of the problematic areas for food safety conditions in raw milk marketing and

sustainable market chain for milk in Turkey (Sayin et al., 2009).

Age 1

Possibility of farmers' preference to sell milk to MCCs as their age increases. Although the lowest age is 28 and the highest age is 75 in the region, the variable coefficient is important statistically at 5% according to the model.

s_haycil

Possibility of farmers' preference to sell milk to MCCs as farmers experience increases. Each additional year of experience increases the possibility of choosing MCCs by farmers. The year of farmers' expe-rience is 23 years in the research region. Thus, there is a linear relationship between the experience and age of the farmers, and therefore, the results of the variables from the model give the same result. However, the experience variable is found to be statistically important at 5%.

Plant

This comprise farmers who grow fodder plant in the field

and the possibility of farmers' preference to sell milk to MCCs 11 times more than those who do not grow plant (vetch, clover, wheat, etc.) in their field. Plant production affects milk production and both activities show that they are rival activities. The variable has 1% importance level statistically and it shows that this factor is the second most important among other variables.

a_say

The number of cow in the agricultural enterprises has negative effects on the possibility of farmers' preference to sell milk to MCCs. If a farmer has plenty of cows, he has a tendency to do marketing on his own. As such, the possibility of farmers' preference to sell milk to MCCs decrease as the number of cows increase with 82.6%. Thus, the variable is statistically important at 5%, as proved by the expectations from the variable.

Course

The variable coefficient estimated as 2.632 and odds ratio was calculated as 13.897. This is due to the fact that training is the most effective factor for the possibility of farmers' preference to sell milk to MCCs. In this context, if farmers attend any course, the possibility of farmers' preference to sell milk to MCC's is 14 times more than those who do not attend. Also, the variable coefficient is statistically important at 1% level. As a matter of fact, farmers who attend training course are more open-minded to monitor innovations in these activities and more willing to sell milk to MCCs.

Closeness

Farmers who are closer to the city center, prefer to do marketing on their own to get more profit. Therefore, the variable has a negative effect on the possibility of farmers' preference to sell milk to MCCs as 38%. Also, this variable is statistically found to be important at 5% level.

Quality

When compared with the course and number of cows' variables, the quality variables were not found to be effective. The model results show that this variable is statistically important only at 10% level. Therefore, the quality variable does not affect the expectations directly.

Food safety and quality issues about raw milk distribution in Antalya

Food safety has broad meanings and definition in various

studies. It is defined as "taking precautions and complying with necessary rules during production, processing, storage and delivering stage of food in order to provide healthy and precise food production" (Anonymous, 2009b). According to the United States Department of Agriculture (USDA) and the U.S. Food and Drug Administration (FDA) working papers, food safety for dairy products and ensuring safety of dairy foods is a responsibility of the dairy industry, including dairy farmers and dairy processors, which are taken very seriously. As such, milk and other dairy products are among the safest and most-highly regulated foods in the world (Anonymous, 2009b). Food safety starts at the farm and ends at home. As such, there are two sides for the evaluation of the subject. The supply side involves health of cows, hygienic milk and transportation, process stations and grocery stores. On the other hand, the consumption side of food safety requires consumers' awareness of milk and dairy products at home. In this study, only the production side of raw milk was discussed.

In the context of the study, some questions regarding food safety were asked to producers.

(a) Health of cows: The first one is about the health of cows and their living and feeding conditions. Most of the producers (54.9%) believe that the most important thing is the place where cows live and their sanitary conditions. Regular veterinary controls are found to be important with 24.6% of producers. Vaccination is also important by producers (13.4%) and the last one is the blood of cows and testing of milk in laboratory by producers (7.3%). There are also some producers who are affected by animal borne illness as "brucellosis". The 9.8% of the producers in the research population, is met by this illness before. The contagious illness "brucellosis" is caused, especially, by sanitary conditions.

(b) Milk hygiene and inspection mechanism: The second important subject about food safety is milk hygiene and inspection mechanism. The control of hygiene begins at farm where the milk is produced. This control is very important because milk is delivered from this place at first. Majority of producers (86.6%) in the research area think that MCCs do controls regularly and effectively at farms before collecting milk to milk tanks. The rest of the producers think that the implementation is not effective and random. MCCs' control criteria are water and oil ratio of milk, and acidity and residue of medicines. However, it is hard to say that producers who do not sell to MCCs do controls in accordance with MCCs' criteria.

Conclusion

Dairy products have special importance in the organization of a healthy distribution system to control the supply chain. Particularly, milk distribution from farms to

consumers may create high risks in terms of pathogens and nutrition losses. Unlike other products, milk needs conservation and monitoring system to ensure healthy conditions. In Turkey, there are some problems regarding milk distribution from farmers to consumers. In some regions, farmers prefer selling milk to consumers directly and without a controlling system. To handle this problem, MCCs were established in many places in Turkey. MCCs are relatively new systems in terms of collecting milk from producers, controlling milk quality and carrying milk produce to the factory. Therefore, the aim of this study is to explore the reasons why farmers choose this distribution system.

The empirical study explored the MCCs and farmers who sell milk to these centers and who do not at the research region. The research region is defined as major dairy cattle production places (towns and villages) in Antalya province. The data from the survey have been evaluated with the econometric model (Logit model). At the first step, variables which signify the farmers' socio-economic indicators and which affect attitudes to sell milk to MCCs for exploring the main subject of the research were chosen. Thus, logit model was used to determine the degree of variables effect. Research findings show that milk selling decisions whether cooperatives or milkman are significantly affected by income and demo-graphic characteristics. In particular, income positively affects selling milk to cooperatives, while participation in cooperatives and the probability of selling milk to street sellers substantially declines as age increases. Empirical findings also show that milk producers who receive milk incentive premiums are affected by the milk price level of support and as such, take advantages of the market guarantee.

In some cases, however, no price premium is covered, which raises questions over the incentive for farmers to comply with more rigorous private standards (Henson and Reardon, 2005). In the research area, some producers prefer selling milk without processing due to price incentive factors, especially those who stay close to the city center. Price is the key factor for producers to choose the milk distribution way. Comparing milk incentive premium with producer milk prices, the percentage is as small as 0.45% of the producer price. Therefore, it can be stated that the introduction of premiums do not result in changes in producers' attitudes (Sayin et al., 2008). Agricultural support for fodders affect also milk production. Milk producers should have support to produce fodders like vetch, trefoil, shamrock, etc. If a producer does not produce fodder crop, there is an advantage to produce milk with low cost.

Determination of milk prices is also another agricultural policy subject. There are market organizations or marketing boards in the EU or other developed countries, but there is no market regulator body in Turkey. In the past, a "national milk council" was established, but could not succeed. Milk prices are determined by quotation

method. In contrast to the high number of milk producers, there is a few milk buyer firms in Antalya province. Therefore, they have oligopsony power in determining the milk prices. However, producers do not have power to affect milk prices; thus, the milk council should be established for regulating the milk market.

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