Analysis of factors affecting production costs and profitability of milk and dairy products in Turkey

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Abstract

White cheese, kashar cheese, yogurt, and ayran are among the most common products produced by the dairy industry in Turkey. The present study determined the production cost of 1 kg of these packaged products as well as the financial implications on their distribution and the total cost. The study also estimated the cost factors affecting the profitability of the products by identifying the cost differences between production regions and scales, using a mean regression model for each product. The study used the data collected through a survey involving 15 dairy plants of three different sizes located in five different regions and involved in raw milk production. The study found a 2-year average capacity utilization rate of the businesses to be 68.80%. The R^2 of the analyzed products using the backward multiple regression model was 0.874 and above ($p < 0.001$). In conclusion, the regression analysis demonstrated that the major factors affecting profitability were the quantity of raw milk contained in the product, the sale price of the product, and the purchase price of raw milk.

Keywords: dairy industry; economic; cost; husbandry; regression analysis.

Practical Application: The study would be helpful in providing decision support to managers for a profitable production of dairy products.

1 Introduction

Milk and dairy products are essential food products that are required for the proper growth and development of humans since birth. These are, therefore, considered as an essential foodstuff (Duman, 2003).

Numerous studies highlight that milk and dairy products are basic dietary items that fulfill important functions regarding protection of human health (Lago-Sampedro et al., 2019; Marangoni et al., 2019; Martins et al., 2018).

The functions fulfilled by dairy products as functional goods are mentioned in many studies. It is highlighted that consumption of Probiotic Prato cheese attenuates development of renal calculi (Martins et al., 2018), that L. casei 01-added Probiotic Minas Frescal cheese has desirable effects on the physicochemical and bioactivity characterization and hematological/biochemical parameters of hypertensive overweight women (Sperry et al., 2018), that consumption of yoghurt supplemented with 1000 IU vitamin D by diabetic patients with vitamin D deficiency and hyperlipidemia increases serum lipid indices (Mostafai et al., 2019), and that high-quality goat milk can be used as a carrier for functional components such as prebiotics and bacteria (Verruck et al., 2019).

In Turkey, the dairy industry stands out as one of the most dynamic branches of production in the farming industry (Akın, 2011). A total of 18,655,252 tons of milk was produced in 2015, of which 90.8% comprised cow milk, 6.3% sheep milk, 2.6% goat milk, and 0.3% water buffalo milk (Türkiye İstatistik Kurumu, 2016).

A large proportion of the milk produced in Turkey is cow milk; 52.2% of the cow milk produced is processed in industrial plants. Out of the remaining, 21.5% is used to produce dairy products at home, 10.5% is directly sold to non-industrial buyers, 8.2% is consumed directly at home, 5.0% is used to feed animals, 2.2% is given free of charge, and 0.4% is consumed by other uses (Türkiye Ziraat Odaları Birliği, 2011).

According to the data of the Turkish Food and Beverage Industry Inventory, 1,523 businesses operated a milk house and produced cheese in 2012 (Federatıon of Food and Drınk Industry Assocıatıons of Turkey, 2014). Similarly, the Ministry of Food, Agriculture, and Livestock reported that there were 52 companies that produced pasteurized milk, 31 companies that produced ultra-high temperature (UHT) milk, and 23 companies that produced powdered milk in Turkey in 2012 (Turkey, 2015). In the same year, 790 white cheese producers, 674 kashar cheese producers, and 342 tulum cheese producers were reported. According to another study, 1,772 businesses existed in the Turkish dairy industry in 2012; 268 of these never purchased milk (Güneş, 2013). The businesses in the milk and the dairy product industry, based on the structure and the range of products, can be categorized into dairy farms and small-sized enterprises that produce specific products at specific times in the year. Therefore,

the number of businesses producing a wide range of products throughout the year is small. The most common dairy products produced by the businesses operating in the dairy industry in 2009 and 2012 were white cheese, kashar cheese, yogurt, ayran, and butter (Turkey, 2009, 2015).

The current study determined the production cost of 1 kg of packaged white cheese, kashar cheese, yogurt, and ayran as well as the financial implication on their distribution and total cost. The study also estimated the effects of the cost factors affecting the profitability of the products by identifying the cost differences between production regions and scales using a mean regression model for each product.

2 Materials and methods

2.1 Data collection

The present study conducted a questionnaire survey in which 15 dairy plants located in five different regions (I-V) of Turkey agreed to take part. The data for 2013 and 2014 provided by these firms were collected.

2.2 Choosing the businesses

The study was restricted to five regions in Turkey with a history of the production of milk and dairy products and that represented the dairy farming and the dairy industry. The study considered various factors such as production structure and diversity, amount of raw material production, proximity to raw materials, marketing channels, geographical location, and population density. The study regions were as follows: Region I: Konya-Karaman-Aksaray, Region II: Ankara-Yozgat-Kırşehir, Region III: Adana-Mersin-Hatay-Gaziantep, Region IV: Burdur-Antalya-Denizli-Izmir, and Region V: Tekirdağ-Bursa-Balıkesir-Istanbul. Within each region, three businesses falling within the small-size (0-50 tons), medium size (51-100 tons), and large size (101 tons and above) categories were included in the study, depending on the amount of raw milk processed in their plants.

2.3 Data collection

Face-to-face interviews were conducted with the designated officials of the businesses in the five regions, and the monthly data on white cheese, kashar cheese, yogurt, and ayran production required for the study were collected from the relevant departments of the plants. The content of the questionnaire was based on the questionnaires developed for analysis to be conducted to assess businesses. In this framework, the data collection form consisted of production-related questions about the monthly quantity of raw milk purchased by the businesses, monthly output of each product, and a number of personnel, as well as questions asked to determine the economic, physical, and technical structures and economic activity of the businesses.

2.4 Evaluating the data

A cost chart was developed for each product to calculate the production cost of 1 kg of packaged white cheese, kashar cheese, yogurt, and ayran. The chart included the cost components for the production of each product and the common cost items at the plant. Cost allocation keys were developed based on the quantity of raw milk contained in the products. This helped to allocate the common cost factors in each production month of the plant to the products produced, which were then distributed to the products to determine their unit costs.

2.5 Statistical analysis

Analysis of the products' unit costs by regions and plant sizes

The data collected were tested for parametric test assumptions, namely normality and homogeneity of variances using the Kolmogorov-Smirnov and Levene tests, respectively. One-way analysis of variance (ANOVA) was performed to compare the costs on the basis of regions and plant sizes. The differences were tested for statistical significance. Tukey's test, a post-hoc test, was conducted in case a significant difference was found between the unit costs of 1 kg of packaged white cheese, kashar cheese, yogurt, and ayran on the basis of regions and plant sizes. For all statistical analyses, SPSS 14.01 was used. The probability value used in the statistical evaluations was $p < 0.05$.

Regression analysis

A regression analysis was conducted within the framework of the profit function of each product to reveal the profits earned from the products and the relationship between the variables thought to affect the profits using the data on 1 kg of packaged white cheese, kashar cheese, yogurt, and ayran for 2013 and 2014.

The function applied in this analysis was formulated as follows in the Equation 1:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \ldots + \beta_n X_n \qquad (1)$$

where β_0 is the constant coefficient and β_1, β_2, β_3... β_7 are the regression coefficients. Each of the βi (i = 1, 2, 3, 4, 5, 6, 7) coefficients represents the rate of change of the Y as a function of the change in the relevant independent variable (Özdamar, 2003).

The dependent (Y) and independent variables (Xn) in the regression analysis model for white cheese, kashar cheese, yogurt, and ayran were:

Y = profit per kilogram (TRY); $X_{1,2,3,4,5,6,7}$ = labor cost per kilogram (TRY): labor and food expenses; energy cost per kilogram (TRY): electricity, natural gas, and coal expenses; transportation cost per kilogram (TRY): fuel and transportation expenses; unit price of milk (TRY): 1 kg price of raw milk; raw material used per kilogram (kg): amount of raw milk in 1 kg of product; sale price of 1 kg (TRY): sale price of 1 kg of the product; packaging cost per kilogram (TRY): and packaging expenses for 1 kg of the product.

Backward regression analysis was conducted on the model consisting of seven independent variables for 1 kg of white cheese, kashar cheese, yogurt, and ayran. The models obtained as a result of the analysis are given for the product.

3 Results and discussion

The current study reported the average capacity utilization rate of dairy businesses in Turkey in 2013 and 2014 to be 68.80%. More specifically, the average capacity utilization rate in Turkey in 2012 was 45.52% for kashar cheese, 51.82% for white cheese, and 88.39% for UHT milk (Turkey, 2015). With respect to the monthly changes of the capacity utilization rates of the surveyed businesses in 2013 and 2014, the lowest capacity utilization rate of 63.65% was reported in January. The supply of raw milk increases in May in Turkey (Food and Agriculture Organization of the United Nations, 2007) with a parallel increase in the capacity utilization rates of the businesses. The capacity utilization rates of the surveyed businesses reach the peak in June and July. In a study conducted in Kırklareli, the average capacity utilization rate of 65 industrial businesses engaged in the production of milk and dairy products was found to be 37.8%. It was noted that 83.11% of the surveyed dairy industry businesses had a capacity below 30 tons/day (Azabağaoğlu & İnce, 2004). Another study conducted in Kahramanmaraş in 2011 reported the average capacity utilization rate of 10 businesses engaged in the production of milk and dairy products to be around 31% (Bars & Akbay, 2013). The milk and dairy products sub-committee report under the eighth five-year development plan observed the capacity utilization rate to increase from 63% in 1994 to 70.7% in 1996 (State Planning Organization, 2001). In a study conducted in Kars in 2006 and 2007, the average capacity utilization rate of 35 dairy farms and dairy industry businesses was calculated to be 31.4% in 2006 and 31.3% in 2007 (Demir & Aral, 2010). Another study by Şahin (1998) conducted on 81 small- and medium-sized businesses operating in the milk and dairy products industry noted the average capacity utilization rate of the businesses to be 61.4%. In a questionnaire survey conducted on four dairy farms in Van in July 2002, Coşkun et al. (2005) reported the capacity utilization rates of the businesses in this province to be very low. As suggested by the previous research, it may be concluded that the capacity utilization rate in the milk and dairy products industry is generally low in Turkey.

The study on dairy industry businesses in each region revealed that the differences between plants of the same size could result in variations to a certain extent between their cost items. This depended on the distance to the supply of raw milk, quality of raw milk, number of personnel, pricing policy, marketing channels, and output.

The average values of the production of 1-kg packages of white cheese, kashar cheese, yogurt, and ayran in 2013 and 2014 suggested that raw material expense was the primary input used in production by the milk and dairy product industry (Table 1). In a previous study, the cost of raw material in the total cost of tulum cheese production was found to be 80.3% (Dağdemir, 2000). Another study noted the cost of raw milk in the total cost of kashar cheese production to be 71.2% (Demir, 2009). The cost of raw materials in the total cost of production by the public sector in 1992, as revealed by the Milk and Dairy Products Specialization Committee, was 67.97% for yogurt production, 66.82% for white cheese production, and 64.04% for kashar cheese production, whereas it was 56.7% for yogurt, 58.2% for white cheese, and 66.8% for kashar cheese in the private sector (State Planning Organization, 1995). Another report noted this percentage to be 33.3% for ayran production, 48% for yogurt production, 58.9% for white cheese production, and 50.7% for kashar cheese production in 1998 in private sector (State Planning Organization, 2001). These differences between the distribution percentages of raw material expenses are directly associated with the price of raw milk and the rate of yield of the businesses at the time.

Dağdemir (2000) noted the percentage of personnel expenses in the total cost of tulum cheese production to be 1.8%. Similarly, another study reported this percentage to be 5.1% (Demir, 2009). The specialization committees reported the percentage of personnel expenses in the total cost of production by the public sector in 1992 to be 8.08% for yogurt, 10.46% for white cheese, and 12.41% for kashar cheese, whereas the respective percentages in the private sector in the same period were 4.4%, 6.4%, and 10.4%, respectively (State Planning Organization, 1995). This difference between the private-public sectors was clearly observed in this study as well. Another study calculated, though by a different method, that the percentage of partial direct personnel expenses in the total cost was 17% (Uzun, 2012).

The percentage of packaging expenses in the total cost of production by the private sector in 1992 was 13.4% for yogurt and 6.8% for white cheese (State Planning Organization, 1995), whereas the same company reported percentage of packaging expenses in the total cost of production in 1998 to be 21.9% for

Table 1. Distribution of cost factors of the products in the surveyed businesses for the period between 2013 and 2014.

Cost Items	White Cheese (%)	Kashar Cheese (%)	Yogurt (%)	Ayran (%)
Raw Material Expenses	71.062	73.398	68.106	54.398
Personnel Expenses	5.931	6.116	5.694	4.545
Packaging Expenses	4.744	1.807	9.000	25.715
Transport Expenses	4.416	4.563	4.232	3.370
Energy Expenses	3.568	3.685	3.426	2.737
Maintenance/Repair/Depreciation Expense	2.959	3.055	2.830	2.266
Auxiliary Material Expenses	1.727	1.602	0.679	0.627
Cleaning/Water Expenses	1.046	1.080	1.001	0.800
Overhead Expenses	2.155	1.112	1.032	0.819
Other Manufacturing Expenses	2.392	3.582	4.000	4.732
TOTAL COST	**100**	**100**	**100**	**100**

ayran, 8% for yogurt, 3.3% for white cheese, and 1.5% for kashar cheese (State Planning Organization, 2001). Furthermore, a study conducted on kashar cheese reported the share of packaging expenses in the total cost to be 1.3% for small-sized dairy farms, 1.0% for medium-sized dairy farms, 1.1% for large-sized dairy farms, and 4.6% for milk plants (Demir, 2009). The increase in the packaging cost and its share in the total cost of production was attributed to the use of glass bottles and vacuum pumps in the sale of ayran and yogurt, respectively. The results of the current study are similar to the findings of the reports for each product.

The distribution of transportation expenses was found to be uneven leading to higher shares faced by small- and large-sized businesses compared to medium-sized businesses. This could be attributed to the fact that the milk supply points of small-sized businesses are widely distributed, whereas the large-sized businesses procure milk from mostly large farms at remote distances.

Nicholson et al. (2015) in his study conducted in the United States reported that a 7 to 15% increase in the total distance covered for procuring raw milk may result in a 1 to 2% increase in the overall cost of the supply chain. Another study noted that the disorganized structure of dairy farming businesses increased the raw milk transportation cost by 20% (Pimpicki, 1999). Castillo (1990) reported that the insufficient infrastructure of production regions and the distributed structure and remote distance of collection points would increase the costs. It was noted that merging small-sized producers would decrease the transportation costs (Ghosh & Maharjan, 2002). The study conducted by Demir (2009) found that the average share of the milk collection cost in the total cost of production was 4.2%. The study also reported that the distributed structure of small dairy farming businesses negatively affected the costs. These results are consistent with the results obtained in our study. Another area in which the raw milk collection system in Turkey has been facing a huge problem is quality. The lack of a good collection system for procuring raw milk escalates the costs. It is noted that the milk collection expenses of the dairy industry businesses operating in Turkey has a share of 15 to 20% in the total cost of production. In France, the milk collection expenses in the west of the country is around 5% of the average cost of milk (Food and Agriculture Organization of the United Nations, 2007).

With respect to the energy expenses in the total cost of production, large-sized businesses have the highest share, followed by small-sized businesses and medium-sized businesses. The results of this study are similar to the data provided by the specialization committee (State Planning Organization, 1995).

The State Planning Organization report of 1995 mentions the depreciation rates of a private company for 1992. These were reported to be 3% for yogurt, 3.1% for white cheese, and 3.2% for kashar cheese, whereas these rates were 3.78% for yogurt, 3.68% for white cheese, and 2.87% for kashar cheese in the public sector. These data are consistent with the results of the present study. A study conducted in Kars found that the share of maintenance/repair and depreciation expenses in the total cost of production was 4.3% for dairy farms and 8.2% for dairy plants. The higher values found in that study were associated with the low-capacity utilization rate (Demir, 2009).

In the present study, a high depreciation cost was associated with the fact that the medium-sized businesses have more machinery and equipment than small-sized businesses. Also, these have not reached a sufficient level in terms of capacity utilization results.

The inter-relations between various factors, such as the price of raw milk, quality of milk, transportation distances, number of personnel, and wages, are important in determining the production costs. No study could be found that compares the costs of milk and dairy products between regions and plant sizes. With respect to the differences between the unit costs in each region, the costs incurred by the businesses in region V were higher than those incurred by the businesses in other regions (Table 2). This is attributed to the economic and social structure of that region where costs are increased. The differences between unit costs were found to be statistically significant ($p < 0.05$) when compared with the difference between the unit costs of white cheese and kashar cheese in region V with the other regions. The major factors responsible for this difference could be the price of raw material and personnel expenses. Additionally, the amount of raw milk going into the manufacturing of the products has an important role in increasing the costs. The costs in region V were found to be statistically similar ($p < 0.05$) to the cost of yogurt in region II and the cost of ayran in region IV. The reason for this might be the similarity of the costs in the three regions due to factors such as consumer preferences and packaging. Also, the difference in the amount of raw milk used to produce those products did not result in a substantial difference between the three regions.

The lowest unit cost of white cheese was found to be in region III; however, the cost difference was statistically similar to the region I ($p > 0.05$). The businesses in these two regions were not engaged in white cheese production of the same quality as regions IV and V, as a result of which both lower and similar costs were reported in regions I and III.

The lowest unit cost of kashar cheese was found to be in region III. The cost difference between this region and other regions was statistically significant ($p < 0.05$). The lowest unit cost of yogurt was found to be in the region I, which was statistically significant ($p < 0.05$). The lowest unit cost of ayran was found to be in region III. The major reasons for this difference are packaging, the amount of raw milk going into the production, and prices of raw materials. The cost difference between this region and other regions was statistically significant ($p < 0.05$).

Small-sized businesses reported the highest unit costs of all products (Table 3). The major reasons underlying this cost disadvantage were the failure to benefit from returns to scale and the idle capacity being greater than that of other businesses. The differences between the unit costs of white cheese and kashar cheese in small-sized enterprises and the unit costs of such products in larger businesses were found to be statistically significant ($p < 0.05$). The unit costs producing yogurt and ayran in small-sized businesses were found to be similar to those in medium-sized businesses ($p > 0.05$) and different than those in large-sized businesses ($p < 0.05$). The cost difference between large-sized businesses and other businesses ($p < 0.05$) was found to be statistically significant. The major factor behind the cost

Table 2. Statistical comparison of the costs of 1-kg packaged products between regions.

	Region	N	Arithmetic Mean*	Std. Error	Std. Deviation	Median	Minimum	Maximum	p
Cost of White Cheese ($/kg)	I	72	3.53 [c]	0.09	0.40	3.52	2.66	4.37	<0.001
	II	72	4.23 [b]	0.14	0.61	4.33	3.15	5.57	
	III	72	3.50 [c]	0.06	0.28	3.55	2.81	4.11	
	IV	72	4.29 [b]	0.09	0.37	4.28	3.45	5.07	
	V.	72	4.48 [a]	0.06	0.24	4.46	3.90	4.96	
Cost of Kashar Cheese ($/kg)	I	72	5.76 [c]	0.21	0.89	5.87	4.02	7.12	
	II	72	6.77 [b]	0.25	1.07	6.88	4.97	9.32	
	III	72	5.32 [d]	0.11	0.47	5.34	4.27	6.11	
	IV	72	6.81 [b]	0.14	0.61	6.66	5.60	7.91	
	V.	72	7.42 [a]	0.13	0.55	7.48	6.35	8.44	
Cost of Yogurt ($/kg)	I	72	0.91 [d]	0.02	0.10	0.91	0.68	1.12	
	II	72	1.08 [a]	0.03	0.12	1.05	0.85	1.41	
	III	72	0.95 [c]	0.02	0.10	0.95	0.71	1.14	
	IV	72	1.00 [b]	0.02	0.08	1.01	0.81	1.15	
	V.	72	1.11 [a]	0.01	0.06	1.12	0.97	1.22	
Cost of Ayran ($/kg)	I	72	0.45 [c]	0.01	0.05	0.45	0.37	0.53	
	II	72	0.57 [b]	0.01	0.05	0.57	0.48	0.68	
	III	72	0.42 [d]	0.01	0.05	0.44	0.34	0.48	
	IV	72	0.62 [a]	0.01	0.04	0.62	0.54	0.68	
	V.	72	0.63 [a]	0.01	0.05	0.64	0.55	0.71	

*Different letters in the same column represent statistical significance ($p<0.05$). N = Month; Std. = Standard; p = p-value.

Table 3. Statistical comparison of the costs of 1-kg packaged products between plant sizes.

	Sizes	N	Arithmetic Mean*	Std. Error	Std. Deviation	Median	Minimum	Maximum	p
Cost of White Cheese ($/kg)	Small	120	4.28 [a]	0.11	0.59	4.37	3.07	5.57	<0.001
	Medium	120	4.07 [b]	0.08	0.46	4.08	3.05	5.15	
	Large	120	3.67 [c]	0.09	0.49	3.58	2.66	4.63	
Cost of Kashar Cheese ($/kg)	Small	120	6.97 [a]	0.19	1.05	7.09	4.98	9.32	
	Medium	120	6.64 [b]	0.14	0.79	6.66	4.76	8.39	
	Large	120	5.64 [c]	0.16	0.88	5.55	4.02	7.17	
Cost of Yogurt ($/kg)	Small	120	1.06 [a]	0.02	0.11	1.08	0.82	1.31	
	Medium	120	1.04 [a]	0.02	0.11	1.05	0.80	1.41	
	Large	120	0.93 [b]	0.02	0.11	0.93	0.68	1.13	
Cost of Ayran ($/kg)	Small	120	0.57 [a]	0.02	0.11	0.59	0.37	0.71	
	Medium	120	0.56 [a]	0.01	0.08	0.58	0.42	0.68	
	Large	120	0.49 [b]	0.02	0.09	0.52	0.34	0.62	

*Different letters in the same column represent statistical significance ($p<0.05$). N = Month; Std. = Standard; p = p-value.

advantage of large-sized businesses was the decrease in costs with the increase in the scale of production.

Table 4 shows the relationship between the profit per unit of the product (assumed to be constant in the model developed with the independent variables whose effect on profit (Y) was found to be statistically significant) and the independent variables to be as anticipated.

Previous studies conducted in this field in Turkey were statistically insufficient. The explanatory power of the R^2 value of the profitability model in the study by Demir & Aral (2010) is lower than that of our model. Also, the order of the powers of independent variables to affect the dependent variable differs in the two studies.

It can be said that the findings obtained from this study are generally consistent with the previous studies and reports, and reflect the unit costs in the dairy industry. In other words, the study obtained results that can help explaining the dairy industry in terms of both the cost distribution and the regional production patterns. The results also highlight that the differences at regional and business level stem from partial differences arising out of production technologies, quality perception, hygiene and market conditions that change periodically. Furthermore, it was found that in the regression models developed with the independent variables whose effect on unit profit of dairy products was found to be statistically significant, the relationship between the unit profit of the fixed product and the independent variables was as expected.

Table 4. The results of the regression analysis for the estimated profit from certain products of the businesses.

	Parameters		N	β	Std. Error	t	Sig.	Adj. R²	F	Sig. F	Tolerance	VIF
White Cheese	Constant		360	-0.307	0.045	-6.838	<0.001	0.921	697.737	<0.001		
	Personnel	X_1		-0.163	0.007	-22.223					0.692	1.444
	Energy	X_2		-0.153	0.011	-13.897					0.825	1.213
	Transportation	X_3		-0.079	0.011	-7.552					0.632	1.581
	Price of Milk	X_4		-0.979	0.071	-13.846					0.361	2.773
	Raw Material	X_5		-0.686	0.049	-14.12					0.561	1.782
	Sales Price	X_6		1.575	0.049	31.94					0.304	3.289
Kashar Cheese	Constant		360	-0.302	0.071	-4.266	<0.001	0.874	417.604	<0.001		
	Sales Price	X_1		1.580	0.061	25.997					0.357	2.799
	Personnel	X_2		-0.199	0.011	-18.606					0.584	1.711
	Energy	X_3		-0.167	0.016	-10.333					0.751	1.331
	Transportation	X_4		-0.114	0.014	-7.928					0.632	1.582
	Raw Material	X_5		-0.632	0.062	-10.192					0.454	2.203
	Price of Milk	X_6		-0.924	0.086	-10.7					0.467	2.142
Yogurt	Constant		360	-0.645	0.014	-47.294	<0.001	0.973	1843.363	<0.001		
	Personnel	X_1		-0.083	0.003	-30.468					0.757	1.322
	Energy	X_2		-0.087	0.004	-19.875					0.794	1.259
	Transportation	X_3		-0.025	0.004	-5.975					0.650	1.539
	Price of Milk	X_4		-0.589	0.025	-23.866					0.429	2.331
	Raw Material	X_5		-0.349	0.016	-21.707					0.861	1.161
	Sales Price	X_6		1.487	0.020	75.321					0.316	3.160
	Packaging	X_7		-0.115	0.007	-17.442					0.668	1.497
Ayran	Constant		360	-0.376	0.009	-42.523	<0.001	0.968	1551.925	<0.001		
	Personnel	X_1		-0.039	0.004	-10.851					0.467	2.139
	Transportation	X_2		-0.029	0.005	-6.536					0.580	1.724
	Energy	X_3		-0.048	0.005	-9.728					0.740	1.352
	Raw Material	X_4		-0.420	0.013	-32.744					0.529	1.892
	Price of Milk	X_5		-0.322	0.027	-11.804					0.435	2.298
	Sales Price	X_6		0.903	0.017	52.228					0.365	2.742
	Packaging	X_7		-0.208	0.009	-22.816					0.554	1.806

N = Month; Adj. R² = Adjusted R Squared; VIF = Variance İnflation Factor; Sig. = Significance; Sig. F = Significance F.

4 Conclusion

The profitability of dairy industry businesses depends on minimizing the cost of items constituting the total cost of producing milk and dairy products. On the other hand, the low-capacity utilization rates observed in the present study negatively affect the production costs. The effect of returns to scale on the costs was observed in field conditions. To earn higher profits, it is important for businesses to increase the scale of their production and keep it at an optimum level. Regional differences, in terms of costs, might arise, depending on the quality and content of products, consumer preferences, economic welfare level of the region, and density of raw milk producers. The regression analyses showed the sales price and the price of raw milk to be major factors affecting the profitability of products for white cheese, kashar cheese, and yogurt. However, for ayran, the sales price is followed by the amount of raw milk contained in the product. In conclusion, this study indicates that the businesses need to take into account the cost of items for a sustainable production and their effects on the businesses from the perspective of business administration.

Acknowledgements

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