

## **The impacts of farm size on production cost and economic performance in beef cattle farming: a case of Samsun Province, Turkey**

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### **Abstract**

The economic sustainability of the farms depends on estimating the level of cost and economic indicators. The aim of the study was to reveal the impact of farm size on beef production cost and economic performance. The data of the study were collected from 155 beef cattle sample farms via face-to-face surveys in Samsun province. A partial budgeting analysis method was used to estimate the cost and economic performance indicators such as gross production value (GDP), gross profit, net profit, relative profit, financial and economic rentability, and rentability factor. The research results show that, on average, the cattle farms produced 13,250.49 kg beef meat with a cost per kg of ₺ 21.89. The average costs of beef meat production per kg were ₺ 23.90 in small farms, ₺ 21.91 in medium farms, and ₺ 21.67 in large farms. The variable costs constituted 90.59% of the total production cost and breeding material (%56.52) and feed cost (%29.74) were the biggest cost items, respectively. The average gross profit and net profit for beef cattle farming were ₺ 97888.29 and ₺ 69784.0, while gross and net profit per kg were ₺ 7.38 and ₺ 5.26 respectively. Average financial, economic, and factor rentabilities were 9.62, 8.67, and 17.16 respectively. Farm size had a positive impact on the net profit, gross profit, and rentability of the cattle farms. In order to increase the economic performance of the cattle farms, the farmers should manage their inputs efficiently and the government should support the farms for increasing their farms' sizes.

**Keywords:** Beef fattening. Production cost. Economic performance. Rentability. Samsun.

### **1. Introduction**

Red meat is one of the main protein sources for humans, and it also includes all of the essential amino acids. Therefore, people should consume enough meat for a healthy life. However, the per capita consumption of beef meat in 2019 was lower in Turkey (9.5 kg) than

in OECD countries (14.5 kg) (OECD, 2020). Livestock makes a significant contribution to the agricultural sector and the Turkish economy. The beef cattle sector has contributed significantly to food security, employment, food industry, and rural development in Turkey (TEPGE, 2015). Between the years 2002-2019, the nominal livestock support budget in Turkey had increased from 83.2 million to 4,2 billion Turkish Liras and the share of livestock supports in the total budget increased from 4,5% to 34,6%. In Turkey, the total cattle beef population increased from 11.369.800 to 17.688.139 heads between the years 2010 and 2019. In the same period, carcass weight per cattle increased by 24.4% from 238 to 296 kilograms. In 2019, 3.633.730 heads of total beef cattle were slaughtered and 1.075.479 tons of red meat was produced. The cattle beef sector provided 89.5% of total meat production (MoAF, 2020). It is certain that increasing livestock support is one of the most important determinants for the increase in the positive development of the cattle sector.

In Turkey, livestock farms are generally small scale size and use traditional technics in their production. However, using artificial inseminations was below international averages and animal welfare was not sufficient (TCCSBC, 2013). To establish an effective and sustainable livestock sector, it is important to focus on reducing production costs and increasing the economic performance of the farms. The importance of cost estimation for policy formulation has increased over time, as the policy makers can decide to what extent the farmers should be supported. In this regard, the cost calculation is considered a helpful tool to support the decision-making process on future investment of the farms, to develop strategies with the competitors, and to evaluate the competitiveness of the sector (Hemme *et al.* 2014). Estimation of cost and economic performance for the farms can be utilized to make better business decisions for minimizing costs and maximizing the profits of their business. They could eventually perform their farming activities economically sustainable. Therefore, farm managers should focus on decreasing cost and increasing production and profitability of the farm activities (Ramsey *et al.* 2005). The farmers can get higher profitability from their production (i) by lowering production cost via preventing ineffective input use or (ii) by getting a higher price from sales or (iii) both (Pardo *et al.* 2014). Therefore, the evaluation of economic performance in beef cattle farming under the different scales of farms is worth considering.

The aim of the study was to examine the impact of farm size on the beef production cost and economic performance of the cattle farms. Analyzing production costs and economic performance of the beef cattle sector has great importance to make decisions at micro, meso, and macro levels for developing sustainability in the sector.

The remainder of the paper is structured as follows. After the introduction section, Section 2 presents the material and methods used in the study. Section 3 explains and discusses the research results. Section 5 gives the main conclusions and policy implications derived from the study.

## 2. Literature Review

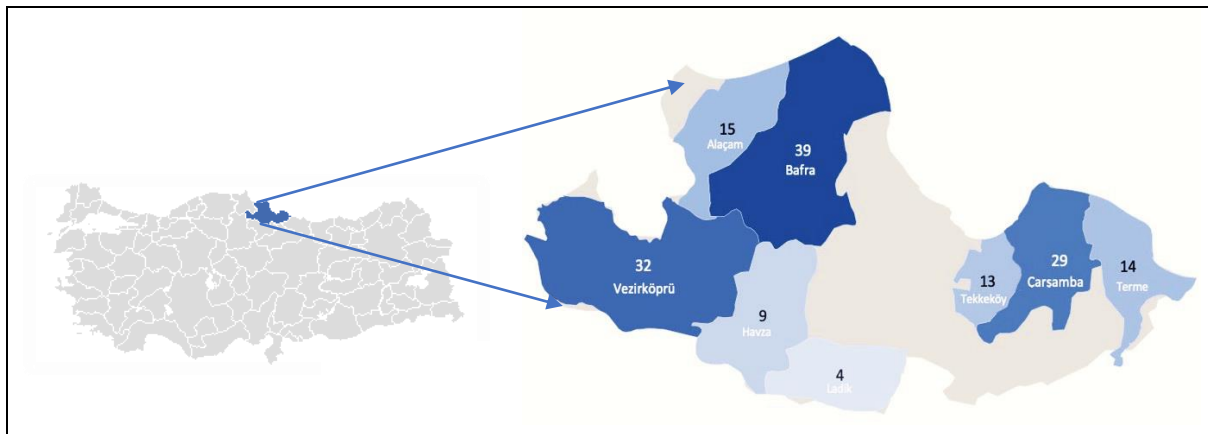
Literature review shows that there have been many studies on the beef sector. Some of them focused on the issues of production, production cost, and marketing (Alhas Eroğlu, 2019; Can, 2015; De Gregori *et al.* 2018; Sunyigono *et al.* 2020; Silva *et al.* 2020; Sever *et al.* 2017; Ünal and Karakaya, 2013; Vural and Fidan, 2007). However, the effectiveness of breeding and support policies for the cattle sector (Yavuz *et al.* 2003) and their effects on production and income (Alhas Eroğlu *et al.* 2020) were also studied. Sunyigono *et al.* (2020) studied the economic performance of cattle farms in Sapudi Island and found that the net profit rate in beef cattle farming was 4%. Silva *et al.* (2020) examined production costs and financial losses in the beef cattle industry and founded the biggest cost elements as breeding material, feed, animal health expenses, and slaughter, respectively. Alhas Eroğlu (2019) investigated the impacts of livestock supports on production and income of the cattle farms in Samsun province of Turkey and found also that breeding material (40.79%), concentrate feed (34.46%), and roughage (6.49%) as the biggest cost items. De Gregori *et al.* (2018) stated that the cost of raw material in the beef industry in Brazil was constituted 66.57% of the total cost. Sever *et al.* (2017) examined the production and marketing problems of cattle farms in the Aksaray province of Turkey. Its result shows that as the production scale increases, the farm performance improves positively. Can (2015) economically analyzed the cattle fattening farms in Ankara province of Turkey and found that the biggest cost items were breeding material (62.9%), feed (23.5%), and labor cost (4.6%), respectively. Aydın (2011) found that breeding material (50.56%), feed (27.33%), and labor cost (11.08%) were the biggest cost items for the cattle farms in Kars and Erzurum provinces. Vural and Fidan (2007) emphasized that the farm size, organization, and marketing structures should be improved to increase their performance. Yavuz *et al.* (2003) investigated the effectiveness of livestock supports in the Turkish cattle sector and found that the livestock supports have positive impacts on meat yield and prices. Alhas Eroğlu (2020) also studied the impact of livestock supports on the production and income of beef cattle farms in Samsun province of Turkey and determined as in the scenario of fewer beef cattle support, 85.9% of the beef cattle farms willing to produce

the same meat amount. This research will contribute to the literature by showing the impacts of different farm sizes on the production cost and economic performance of the cattle farms.

### 3. Material and Methods

#### 3.1. The study area and data

In 2017, the total cattle population and farms in Samsun province were 422,672 heads and 39,688, respectively (TOB, 2018). The districts of Alaçam, Bafra, Çarşamba, Havza, Lâdik, Tekkeköy, Terme and Vezirköprü were selected as the research area, and these districts provided 75.76% of the total beef cattle population in Samsun province (Figure 1). The primary data of the study were collected from the beef cattle farms via face-to-face surveys. The secondary data was obtained from the Ministry of Agriculture and Forestry.



**Figure 1: Map of the research area in Samsun Province, Turkey**

The total number of beef cattle in the farms was taken as sampling criteria to determine the sample size. The sample size was calculated to be 155 farms by using Neyman’s method in Eq. 1 (Yamane, 1967). Then, sample farms were randomly chosen among the beef cattle farms.

$$n = \frac{(\sum N_h S_h)^2}{N^2 D^2 + \sum N_h S_h^2} \quad (1)$$

Where n is the sample size; N is total beef cattle farm;  $N_h$  is the number of farms in the h strata;  $S_h$  is the standard deviation of the number of farms in the h strata.  $D^2$  equals  $d^2/z^2$  and indicates the standard error of estimate at the 10% significance level, whereas z is the value of

z in the table of standard normal distribution. Besides, 95% confidence interval was used in the sampling.

### 3.2. Calculation of economic performance and production cost

The partial budgeting analysis was used to estimate the cost and economic performance of the cattle breeding farms. This method takes into account only the cost and income of cattle breeding activity in the farm, and other farm activities were out of scope. All cost and economic performance indicators were measured and calculated for the production years of 2017-2018.

The total costs consist of variable and fixed costs. Feed costs consist of the total value of the feed obtained from inside the farm and purchased outside the farm. In the calculation of the variable cost, expenses for medicine, veterinary, vaccine, insurance, marketing, water, electricity, oil, fuel, actual expenses were taken into consideration. Depreciation was calculated based on the Revenue Administration depreciation rates. Capital interest was taken as %1.48 (CBRT, 2019). The general administration cost was 3% of the variable costs (Erkuş *et al.* 1995). Repair and maintenance costs for buildings and machinery were derived from the survey.

Gross production value (GDP), gross profit, net profit, relative profit, financial and economic rentability, and rentability factor were calculated as economic performance indicators in beef production. GDP was calculated by multiplying the amount of meat production with its price and adding the secondary product revenue (manure, etc.) to this value. The gross profit was calculated by subtracting the variable cost from the gross production value. The net profit was calculated by subtracting the total cost from the gross production value. The relative profit was obtained by dividing the gross production value by the total cost (Kiral *et al.* 1999). Rentability is the ability of a company to get more earnings during a certain period. In other words, the rentability of a firm indicates the comparison between earnings and assets or capital that can obtain the related earnings (Nalurita, 2018). Financial rentability indicates whether equity was used effectively or not, whereas economic rentability indicates whether total capital was used effectively or not. The rentability factor shows the profit earned by the farm as a percentage of the total income. Economic rentability was calculated by dividing pure profit by active capital. Financial rentability was found by dividing equity income by equity. The rentability factor was calculated by dividing the pure profit by the gross product (Erkuş *et al.* 1995).

To see the change in cost and economic performance in the different farm sizes, beef cattle farms were divided into three sub-groups as the farms with (i) 1-20 heads, (ii) 21-100 heads, and (iii) 101 and above heads. The ANOVA and chi-square tests were used to measure the differences within groups.

## 4. Results and Discussion

### 4.1. Socio-demographic, structural and cattle breeding characteristics

The descriptive statistics of the socio-demographic, structural, and livestock activities of the beef cattle farms were given in Table 1. The average household size was 5 persons and the average age of farm owners was 45. As the scale of the farm size increases, the age of farm owners decreases, while the number of households increases. General and vocational education level are of great importance for the adoption of new technologies and effective management of farms. In the study, 58% of the farm owners graduated from primary school, 16.70% from secondary school, and 15.30% from high school. The larger farm owners had a higher education than the smaller farm owners. The rates of primary school graduates were found by Budağ and Keçeci (2013) and Alhas Eroğlu (2017) as 62% and 64%, respectively. Almost all farm owners (98.80%) had social security and 67.1% of the farm owners have done beef cattle farming as their main profession. The results highlighted that as the farm scale increases, the rate of the primary profession as farmer increases (%77.80). The rates of the primary profession as a farmer were determined by Demir (2009) and Alhas Eroğlu (2017) as 63.1% and 73.68%, respectively.

The average beef cattle number in all farms was 23.66 heads, while it was 8.62 heads in small farms, 26.40 in medium farms, and 113.14 in large farms. There was a statistically significant difference among the groups in terms of the number of cattle ( $p < 0.01$ ). While Alhas Eroğlu (2017) found the number of animals in the beef cattle farms for the same area higher (35.29 heads) than our result, Özüdoğru and Tatlıdil (2012) and Topçu *et al.* (2008) found it as from between 6.72 and 12.79 heads and 19.92 heads, respectively.

Experience is a key driver for agricultural production to increase productivity and efficiency (Bozoğlu *et al.* 2020). The average experience of farm owners on beef cattle farming was 19 years and there was a statistically significant difference among the farm groups in terms of beef cattle farming experience ( $p < 0.05$ ). Aydın *et al.* (2010) found a similar livestock experience (16.5 years) in their study.



Cooperatives are an important tool for solving economic, social, and professional problems of especially small scale farms (Kılıç Topuz *et al.* 2017). Only 28.60% of the farms were members of the red meat producer association. This rate increased to 77.80% in large farms, while it decreases to 7.40% in small farms. It is compulsory to be a member of a producer association to get technical and financial supports for animal husbandry. Therefore, the rate of cooperatives membership in large farms was higher than the others. However, the rate of cooperative membership was found higher in the studies of Giannoccaro ve Berbel (2013) and Gorton *et al.* (2008) as 55% and 79.7%, respectively.

It is important to keep physical and financial records to see the economic situation or performance of the farms and to take the necessary precautions. The rates of physical and/or financial record keeping were low in all farm groups such as 28% in small farms, 37% in medium farms, and 50% in large farms. As the farm scale increases, the record keeping rate of the farmers also increases.

Beef cattle farms had a very low (18%) insurance rate for their animals. The insurance rate for animals increases in medium farms since they were using credit from the banks. Multiple land ownership and many parcels are very common in Turkish farms. Average 4.32 people had ownership of the beef cattle farm land and the farm land consisted of 8.4 parcels. The average distance of the farm buildings to the district center was 12.14 km. Large farms were closer to the district center than the other farm groups. There was a statistically significant difference among the farm groups in terms of distance to the district center.

**Table 1: Socio-demographic and structural characteristics**

	Small farms (69)		Medium farms (68)		Large farms (18)		All farms (155)	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Age (year)	47.31	11.08	46.29	10.31	42.94	11.21	46.35	10.79
Household size (person)	5.11	2.76	5.49	2.70	6.00	2.89	5.38	2.75
Education (%)								
<i>Elementary school</i>	59.10	-	63.60	-	33.30	-	58.00	-
<i>Secondary school</i>	18.20	-	15.20	-	16.70	-	16.70	-
<i>High school</i>	12.10	-	15.20	-	27.80	-	15.30	-
<i>Vocational school</i>	7.60	-	1.50	-	16.70	-	6.00	-
<i>University</i>	3.00	-	4.50	-	5.60	-	4.00	-
Social security (%)	95.70	-	97.10	-	100.0	-	96.80	-
Main profession as farmer (%)	65.20	-	66.10	-	77.80	-	67.10	-
Number of cattle***	8.62	5.58	26.40	11.62	113.14	69.94	28.56	40.35
Farming experience (year)**	17.35	6.32	20.88	9.09	19.67	11.25	19.17	8.39
Membership to farm organizations	7.40	-	36.80	-	77.80	-	28.60	-
Keeping record (%)	28.00	-	37.00	-	50.00	-	34.00	-
Farm insurance (%)	10.00	-	27.00	-	18.00	-	18.00	-
Number of land owners (person)	5.73	12.91	3.28	6.56	2.76	3.72	4.32	9.80
Number of parcels (unit)	8.13	8.39	8.35	7.77	8.25	7.72	8.24	8.00

Distance to district center (km)***	13.16	7.90	12.66	8.92	6.33	6.85	12.14	8.48
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\*, \*\*, \*\*\* significance at the 10%, 5% and 1% level, respectively

### 3.2. Production cost and economic performance

Table 2 shows the average production cost for beef cattle farming. The average total cost of beef meat production in all farms was ₺ 298,775.07 TL for 28.56 beef cattle. The average total costs of beef meat production were ₺ 1,328,483.1 in the large farms for 113.14 cattle, ₺ 261,092.36 in the medium for 26.40 cattle, and ₺ 69,687.65 in the small farms for 8.62 cattle. The shares of variable and fixed costs in the total cost for all farms were 90.59% and 9.41%, respectively. However, the shares of variable and fixed costs were 93.3% in the large farms, 89.35% in the medium farms, and 82.06% in the small farms. As the farm scale increases, the share of variable costs in the total cost decreases, while the share of fixed costs increases. This research result supports the economic theory as the fixed costs can be reduced by increasing the size of the firms. The share of the variable cost differed from 80.8 to 91.75% in other studies (Alhas Eroğlu, 2017; Gözener, 2013; Şanal, 2013; Çukur Kaya, 2006). The main costs items in beef cattle farming were breeding material and feed. While the share of breeding material in total cost was %56.52, it changed from 48.96 to 57.79% in the farm groups. The shares of breeding material in total cost were found almost similar as 60.25% by Albez (2018), 42.95% by Çelik ve Sariözkan (2017), 40.79% by Alhas Eroğlu (2017), %47.93 in small farms, 52.11% in medium farms, 54.13% in large farms by Aydın (2011). The shares of concentrate feed and roughage in total costs were found as 19.80% and 9.94%, respectively. As the farm size increases, the concentrate feeds cost rate increases. However, the roughage feed cost ratio decreased in the medium farms compared to the small farms.

**Table 2: The production costs of beef cattle farming (₺)**

Cost items	Small farms (69)		Medium farms (68)		Large farms (18)		All farms (155)	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	%
Breeding material	34,121.8	48.96						
	6		147,052.05	56.32	767,688.70	57.79	168,853.84	56.52
Concentrate feed	10,432.6	14.97						
	7		53,089.72	20.33	268,940.65	20.24	59,167.01	19.80
Roughage feed	6,657.90	9.55	21,072.60	8.07	150,525.97	11.33	29,689.03	9.94
Salt	179.67	0.26	296.16	0.11	3,267.65	0.25	571.99	0.19
Water	229.13	0.33	487.79	0.19	1,484.44	0.11	488.39	0.16
Electricity	385.49	0.55	898.53	0.34	3,463.33	0.26	967.99	0.32
Veterinary	465.22	0.67	1,208.09	0.46	4,944.44	0.37	1,311.29	0.44
Medicine	852.75	1.22	2,886.91	1.11	12,305.56	0.93	3,075.16	1.03
Disinfection	61.16	0.09	150.53	0.06	1,036.67	0.08	214.48	0.07
Vitamin	91.62	0.13	74.53	0.03	925.00	0.07	184.33	0.06



Temporary labor	383.33	0.55	1,042.21	0.40	3,735.00	0.28	1,061.61	0.36
Pasture	86.96	0.12	0.00	0.00	555.56	0.04	104.58	0.04
Halter	132.61	0.19	201.91	0.08	776.47	0.06	234.29	0.08
Membership fee	55.51	0.08	153.63	0.06	832.35	0.06	184.59	0.06
Marketing	77.54	0.11	2,107.35	0.81	5,444.44	0.41	1,591.29	0.53
Interest of c. capital	2,971.29	0.99	2,560.92	0.98	13,604.77	1.02	2,971.29	0.99
Variable cost	57,184.7	82.06						
	0		233,282.94	89.35	1,239,531.0	93.30	270,671.15	90.59
General	1,644.42	2.36						
administration			6,998.22	2.68	37,177.80	2.80	8,119.64	2.72
Family labor	6,104.35	8.76	10,647.06	4.08	8,400.00	0.63	8,363.87	2.80
Permanent labor	0.00	0.00	3,000.00	1.15	30,466.67	2.29	4,854.19	1.62
Insurance	84.62	0.12	832.58	0.32	1,097.22	0.08	538.26	0.18
Depreciations	3,516.81	5.05	4,767.40	1.83	8,944.18	0.67	4,695.73	1.57
Interest of capital	766.88	1.10	1,034.09	0.40	1,863.03	0.14	1,011.40	0.34
Repair maintenance	385.88	0.55	530.07	0.20	1,003.21	0.08	520.83	0.17
Fixed cost	12,502.9	17.94						
	5		27,809.42	10.65	88,952.11	6.70	28,103.92	9.41
Total costs	69,687.6	100.00						
	5		261,092.36	100.00	1,328,483.1	100.00	298,775.07	100.00

Table 3 shows the results of production cost and economic indicators by the size groups. The average meat production amount of all farms was 13,250.49 kg and the average meat sales price per kg was ₺ 27.16. The highest selling price per kg was observed in the large farms as ₺ 27.67. As the farm scale increases, meat selling prices increase since the large farms had higher marketing power. Average meat selling prices were ₺ 26.85 in the small farms, ₺ 27.35 in the medium farms, and ₺ 27.67 in large farms. The average cattle breeding incomes were ₺ 359,883.31 in all farms, ₺ 76,096.12 in the small farms, ₺ 315,658.11 in the medium farms, and ₺ 1,650,138.36 in the large farms. The average gross net profits in all farms were ₺ 97,888.29 and ₺ 69,784.37. Net profits were calculated as ₺ 8,370.79 in the small farms, ₺ 62,792.22 in the medium farms, and ₺ 357,877.47 in the large farms. There was a statistically significant difference among the farm groups in terms of production, selling price, cattle breeding income, manure income, GDP, variable costs, gross profit, fixed costs, total costs, and net profit ( $p < 0.01$ ).

**Table 3: Production cost, income, and profit**

	Small farms (69)	Medium farms (68)	Large farms (18)	All farms (155)
Production (kg)***	2,834.12	11,541.43	59,636.37	13,250.49
Selling price (₺/kg)***	26.85	27.35	27.67	27.16
Cattle breeding income (₺)***	76,096.12	315,658.11	1,650,138.36	359,883.31
Manure income (₺)***	1,962.32	8,226.47	36,222.22	8,676.13
GDP (₺)***	78,058.44	323,884.58	1,686,360.58	368,559.44
Variable costs (₺)***	57,184.70	233,282.94	1,239,531.00	270,671.15
Gross profit (₺)***	20,873.74	90,601.64	446,829.58	97,888.29

Fixed costs (₺)***	12,502.95	27,809.42	88,952.11	28,103.92
Total costs (₺)***	69,687.65	261,092.36	1,328,483.11	298,775.07
Net profit (₺)***	8,370.79	62,792.22	357,877.47	69,784.37

\* significance at the 1% level.

The unit cost and profitability indicators in beef cattle farming were given in Table 4. The large farms generally bought and/or use high-yield breeding materials for fattening. Therefore, the cost of animal breeding material in the large farms was higher than the other farm groups. Due to the cost of animal breeding material in the large farms, the share of variable costs in the total increased. The average cost of meat production per kg was found as ₺ 21.89 in all beef cattle farms. Average costs of meat production per kg were calculated as ₺ 23.90 in the small farms, ₺ 21.91 in the medium farms, and ₺ 21.67 in the large farms. Meat production costs were found as ₺ 27.06 by Albez (2017) and ₺ 17.30 by Alhas Eroğlu (2017). The farms earned an average gross profit per kg of ₺ 7.38 in all farms, it was ₺ 7.36 in the small farms, ₺ 7.85 in the medium farms, and ₺ 7.49 in the large farms. The net profit per kg was calculated as ₺ 5.26 in all farms, while it was ₺ 2.95 in the small farms, ₺ 5.44 in the medium farms, and ₺ 6 in the large farms. The research results show that as farm size increases, it was positively affecting the net profit of beef cattle farming. Net profit per kg of the medium farms was 84.41% higher than the small farms. The relative profit rate was determined as 1.23 in all farms, it was 1.12 in the small farms, 1.24 in the medium farms, and 1.27 in the large farms. Relative profit rate in the small farms was below the interest rate, while the medium and large farms earn an income above the interest rate. The relative profit rates were found higher (1.34) in the study of Alhas Eroğlu (2017) and lower (1.16) in the study of Albez (2018). There was a statistically significant difference among the farm groups in terms of variable costs, fixed costs, total costs, selling price, manure income, GDP, production cost, gross profit, net profit, and relative profit (Table 4).

**Table 4: Unit costs and economic performance indicators per kilogram**

	Small farms (69)	Medium farms (68)	Large farms (18)	All farms (155)
Variable costs (₺)**	20.18	20.21	20.79	20.43
Fixed costs (₺)***	4.41	2.41	1.49	2.12
Total costs (₺)***	24.59	22.62	22.28	22.55
Selling price (₺)***	26.85	27.35	27.67	27.16
Manure income (₺)	0.69	0.71	0.61	0.65
GDP (₺)***	27.54	28.06	28.28	27.81
Production cost (₺)***	23.90	21.91	21.67	21.90
Gross profit (₺)	7.36	7.85	7.49	7.38
Net profit (₺)***	2.95	5.44	6.00	5.26
Relative profit (%)***	1.12	1.24	1.27	1.23

Table 5 shows the results of the rentability rates in beef cattle farms. Economic rentability rates were found as 8.67 in all farms, 4.50 in the small farms, 10.91 in the medium farms, and 16.26 in the large farms. However, financial rentability rates were calculated as 17.16 in all farms, 4.51 in the small farms, 12.53 in the medium farms, and 18.30 in the large farms. Economic and financial rentabilities were determined as 14.41 and 15.30 by Can (2015), 10.26 and 11.26 by Aydın ve Sakarya (2012), 3.68 and 3.78 by Uğurtaş (2008), respectively. It is desirable to get high rentability rates for the farms. If the financial rentability is higher than economic rentability, this indicates that foreign capital is used effectively. The foreign capital in the medium and large farms was used profitable, and the cost of foreign capital could met by the profit of capital. To evaluate the profitability of an investment, the rentability rate is compared with the return rates of different investment instruments (Bayramoğlu *et al.* 2019). In Turkey, rentability rates are generally compared with the deposit interest rates of the Ziraat Bank. The deposit interest rate of the Ziraat Bank was 10.50% (Ziraat Bank, 2020). The study results show that the rentability rate of small farms was lower than the deposit interest rates, while the medium and large farms had higher rentability rates than the deposit interest rates.

**Table 5: Rentability results**

	Small farms (69)	Medium farms (68)	Large farms (18)	All farms (155)
Financial rentability***	4.51	12.53	18.30	9.62
Economic rentability***	4.50	10.91	16.26	8.67
Rentability factor*	14.78	18.68	20.56	17.16

\*, \*\*\* significance at the 10% and 1% level, respectively

## 5. Conclusions

Beef meat is one of the essential foods in human nutrition. Therefore, the countries should get their self-sufficiency especially from domestic markets, and supply to consumers with affordable prices. The aim of this study was to reveal the cost and economic performance in beef cattle production by the farm size groups. The cost of beef production per kg was ₺ 21.90, and the cost of production decreases as the farm-scale increases. As the farm scale increases, the share of variable costs in the total cost decreases, while the share of fixed costs increases. This research result supports the economic theory as the fixed costs can be reduced by increasing the size of the firms. The main cost items in beef cattle farming were breeding

material and feed. While the share of breeding material in total cost was %56.52, it changed from 48.96 to 57.79% in the farm groups. The large farms generally bought and/or use high-yield breeding materials for fattening. Therefore, the cost of animal breeding material in the large farms was higher than the other farm groups. The increasing scale of farms positively affects all economic performance indicators. Especially, medium farms earned 84.41% more net profit than the small farms. Also, the relative profit rate in the small farms was below the interest rate, while the medium and large farms earn an income above the interest rate.

Especially small and medium farms should decrease production costs and increase economic performances to sustain their beef cattle farming. These farms should use inputs optimally and for this, their abilities should be supported via extension and advisory services. However, the scale of small and medium farms should be increased by providing high yield breeding material and low-interest loans. The farms should be encouraged to supply their breeding materials, roughage and concentrate feed from their farms. Milk and meat combine breeds should be expanded especially among the small and medium farms. The share of culture race should be preferred by the farms instead of native race animals. Besides, livestock supports should be provided especially to economically viable beef cattle farms. The main limitation of this study was to use cross sectional data of the beef cattle farms in Samsun province. Therefore, this study should be expanded with the panel data of beef cattle farms in wider areas.

## 6. References

- ALBEZ, A. Red meat sector profitability and cost analysis in Erzurum scale. *Atatürk University Journal of Social Sciences Institute*, v. 22, n. 3, p. 2969-2986, 2018.
- ALHAS EROĞLU, N. A.; BOZOĞLU, M.; BİLGİÇ, A. The impact of livestock supports on production and income of the beef cattle farms: a case of Samsun province, Turkey. *Journal of Agricultural Sciences*, v. 26, n. 1, p.117-129, 2020.
- ALHAS EROĞLU, N.; BOZOĞLU, M. The effects of livestock supports and external input use on profitability of beef cattle farming: the case of Samsun Province, Turkey. *Custos e @gronegocio on line*, v. 15, n. 3, p. 368-383, 2019.
- ALHAS EROĞLU, N. The impacts of livestock supports on production and income of the cattle farms in Samsun province. Doctoral Dissertation, Ondokuz Mayıs University Institute of Science. Department of Agricultural Economics, p. 201, Samsun, 2017.
- AYDIN, E.; SAKARYA, E. Economic analysis of intensive cattle fattening enterprises in the provinces of Kars and Erzurum. *Kafkas Üniversitesi Veteriner Fakültesi Dergisi*, v. 18, n.6, p. 997-1005, 2012.

AYDIN, E. Economic analysis of cattle breeding enterprises in Kars and Erzurum provinces. PhD Thesis, Ankara University Institute of Health Sciences, Animal Health Economics and Management Department, p. 323, Ankara, 2011.

AYDIN, E.; CAN, M. F.; YILMAZ, ARAL, L.; CEVGER, Y.; SAKARYA, E. Effects on cattle breeders of livestock and red meat imports in Turkey decision. *The Journal of Turkish Veterinary Medical Society*, v. 81, n. 2, p. 51-57, 2010.

BAYRAMOđLU, Z.; AđIZAN, K.; KARAKAYACI Z. Evaluation of financial and economic profitability in the sustainability of agricultural enterprises. International Balkan and Near Eastern Social Sciences Congress Series, 9-10 Mart, Full Text, p. 1161-1169, Tekirdađ, Túrkiye, 2019.

BOZOđLU, M.; BASER, U.; EROđLU, N. A.; TOPUZ, B. K. Comparative analysis of cost and profitability in the irrigated and non-irrigated chestnut farming: case of Aydin province, Turkey. *Erwerbs-Obstbau*, v. 62, n. 1, p. 21-27, 2020.

BUDAđ, C.; KEĐECİ, ř. A survey study on the feeds used in cattle feeding fattening forms in Van. *Journal of The Institute of Natural & Applied Sciences*, v. 18, n.1-2, p. 48-61, 2013.

CAN, M. F. Economic analysis of cattle fattening enterprises in central districts of the Ankara. *Eurasian Journal of Veterinary Sciences*, v.1, n. 2, p. 87-94, 2015.

CBRT, 2019. Central Bank of the Republic of Turkey. <https://www.tcmb.gov.tr/> (Accessed on: 20.11.2019).

ĐELİK, C.; SARIÖZKAN, S. Economic analysis of cattle fattening enterprises in the centre of Kırřehir province. *Harran University Journal of The Faculty of Veterinary Medicine*, v. 6, n. 1, p. 38-45, 2017.

ĐUKUR KAYA, F. A research on beef production and marketing in İzmir province. PhD Thesis, Ege University Institute of Science, Department of Agricultural Economics, p. 364, İzmir, 2006.

DE GREGORI, R.; BORGES, A.P.M.; MARCO, D.D.; FLORES, S.A.M.; VASCONCELOS, G.D.; SILVEIRA, G.D. The cost structure in a beef cattle industry in Rio Grande do Sul. *Custos e @gronegocio on line*, v. 14 n. 1, p. 143-163, 2018.

DEMİR, N. Regional comparative analysis of the effects of support policies on the livestock sectori. PhD Thesis, Atatürk University Department of Agricultural Economics, p. 131, Erzurum, 2009.

ERKUř, A.; BÜLBÜL, M.; KIRAL, T.; ACIL, F.; DEMIRCI, R. Agricultural Economics. Ankara University Agricultural Faculty Research and Development Foundation, Publication No: 5, Ankara, 1995.

GIANNOCCARO, G.; BERBEL, J. Farmers' stated preference analysis towards resources use under alternative policy scenarios. *Land Use Policy*, v. 31, p. 145-155, 2013.

GORTON, M.; DOUARIN, E.; DAVIDOVA, S.; LATRUFFE, L. Attitudes to agricultural policy and farming futures in the context of the 2003 CAP reform: A comparison of farmers in selected established and new member states. *Journal of Rural Studies*, v. 24, n.3, p. 322-336, 2008.

GÖZENER, B. Economic analysis and technical efficiency of enterprises that include cattle breeding in the TR83 region. Doctorate Thesis, Gaziosmanpaşa University Institute of Science and Technology, Department of Agricultural Economics, p. 174, Tokat, 2013.

HEMME, T.; UDDIN M.M.; NDAMBI O.A. Benchmarking cost of milk production in 46 countries. *Journal of Reviews on Global Economies* v. 3, p. 254-270, 2014.

KILIÇ TOPUZ, B.; BOZOĞLU, M.; BAŞER, U. Evaluation of farmer organizations legislation in Turkey under recent developments. *Third Sector Social Economic Review*, v. 52, p. 140-161, 2017.

KIRAL, T.; KASNAKOGLU, H.; TATLIDIL, F.; FIDAN, H.; GÜNDOGMUS, E. Cost calculation methodology and database guide for agricultural products. Agricultural Economics Research Institute, Ankara. 1999.

MoAF, 2020. Livestock Data of the General Directorate of Livestock of Ministry of Agriculture and Forestry. <https://www.tarimorman.gov.tr/sgb/Belgeler/SagMenuVeriler/HAYGEM.pdf> (Accessed on: 28.11.2020).

NALURITA, F. The effect of profitability ratio, solvability ratio, market ratio on stock return. *Business and Entrepreneurial Review*, v. 15, n.1, 73-94, 2018.

OECD, 2020. OECD Meat Consumption. <https://data.oecd.org/agroutput/meat-consumption.htm> (Accessed on: 10.11.2020).

ÖZÜDOĞRU, T.; TATLIDİL, F. F. Economic analysis of the farms that are members of Amasya Cattle Breeders Association or not and the impacts of the support for the dairy cattle breeding on farm incomes. *Selçuk Journal of Agriculture and Food Sciences*, v. 26, n. 3, p.42-29, 2012.

PARDO G.; PEREA, F.; MARTINEZ, Y.; URBANO, J.M. Economic profitability analysis of rainfed organic farming in SW Spain. *Outlook on Agriculture* v. 43, n. 2, p. 115-122, 2014.

RAMSEY, R.; DOYE, D.; WARD, C.; MCGRANN, J.; FALCONER, L.; BEVERS, S. Factors affecting beef cow-herd costs, production and profits. *Journal of Agricultural and Applied Economics*, v. 37, n. 1, p. 91-99, 2005.

SEVER, E.; İĞDELİ, A.; HAN, V. Production and marketing problems of cattleEntrepreneurs: The Case of Aksaray province. *Journal of Advances in VetBio Science and Techniques*, v. 2, n.2, p.10-23, 2017.

SILVA, V. L.; OLIVEIRA, G. D.; KOVALESKI, J. L.; PARANI, R. N. Production costs and financial losses in beef cattle industry: A case study. *Custos e @gronegocio on line*, v. 16, n. 2, p.152-171, 2020.



SUNYIGONO, A. K.; SUPRAPTI, I.; ARIFIYANTI, N. Economic performance of Madura beef cattle industry in Sapudi Islan. *In IOP Conference Series: Earth and Environmental Science*, v. 518, n.1, p. 012064, 2020.

ŞANAL, A. Efficiency analysis of cattle-breeding farms district of Erzurum, Turkey. Ms.Thesis, Atatürk University Graduate School of Natural and Applied Sciences Department of Agricultural Economics, p. 70, Erzurum, 2013.

TCCSBC, 2013. Strategy and Budget Department of the Republic of Turkey, Tenth Development Plan. <http://www.sbb.gov.tr/wp-content/uploads/2018/11/Onuncu-Kalk%C4%B1-nma-Plan%C4%B1-2014-2018.pdf> (Accessed on: 01.09.2019).

TEPGE, 2015. Agricultural Economics and Policy Development Institute, Status and Forecast Red Meat. <https://arastirma.tarimorman.gov.tr/tepge/Menu/36/Durum-Tahmin-Raporlari> (Accessed on: 01.01.2020).

TOB. 2018. Ministry of Agriculture and Forestry. Animal Production Statistics. <https://www.tarimorman.gov.tr/> (Accessed on: 03.02.2020).

TOPÇU, Y.; UZUNDUMLU, A. S.; KIZILOĞLU, S. Analysis of factors affecting on failure of cattle fattening farms: case study of Erzurum province. *Alinteri*, v. 15, n. 2, p. 19-25, 2008.

UĞURTAŞ, F.T. Economic analysis of fattening cattle enterprises in Doganbey town of Beysehir district of Konya province, Ms Thesis, Atatürk University Department of Agricultural Economics, p. 86, Erzurum, 2008.

VURAL, H.; FİDAN, H. Animal production in Turkey and the features of animal Farm. *Journal of Agricultural Economics*, v. 13, n. 2, p. 49-59, 2007.

YAMANE, T. *Elementary Sampling Theory*. Prentice Hall Inc., Englewoods, 98-100, New Jersey, 1967.

YAVUZ, F.; AKBULUT, Ö.; KESKİN, A. A study on the effectiveness of breeding and support policies in Turkey's Cattle Sector. *Turkish Journal of Veterinary and Animal Sciences*, v. 27, p. 645-650, 2003.

ZİRAAT BANK, 2020. Deposit interest rates. <https://www.ziraatbank.com.tr/tr/fiyatlar-ve-oranlar> (Accessed on: 14.10.2020).

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