

The analyzing of cost, profitability, economic and technical efficiency of fattening enterprises for beef production in Turkey: an example study from Hatay province.

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Abstract

The purpose of this study was to determine cost, profitability, economic and technical efficiency of cattle fattening enterprises in Turkey. The enterprises were divided into 3 groups according to the number of fattening cattle. The average labor force and land use were 3,06 person and 43,49 da. The average fattening period, total live weight gain per cattle, daily live weight gain, hot carcass weight and carcass yield were 251,8 days, 250 kg, 1002 g, 311 kg and 60,3% for the technical efficiency, respectively. The average gross production value, gross income, total operation cost, variable cost rate in total cost and fixed cost rate in total cost were 86 947, 101 168, 54 867 USD, 74,25% and 25,75%, respectively. The average production costs of per fattening cattle, per kg beef carcass, beef carcass sale price including support, net incomes of per fattening cattle and per kg carcass were 1 451 and 4,71, 5,64, 291 and 0,93 USD. While the marketing problem, skilled worker employment problem, feed price, long slaughtering date for animal cutting, import decision of live cattle and carcass, high interest rate of bank loan, and fattening cattle purchase price were determined as factors that negatively affect on the economic efficiency of enterprises, carcass sale price, capital amount, government subsidies, eligible loans to cattle fattening and capacity of cattle barn were determined as factors that positively affect. The results showed that foreign labor use, property and rental land use, technical efficiency, per kg live weight cost, per kg carcass sale price, net profit per cattle and per kg carcass were higher in large-scale enterprises, whereas family labor use, production costs of per cattle per kg carcass were lower than other group enterprises.

Keywords: Fattening cattle. Production cost. Technical efficiency. Productivity. Turkey

1. Introduction

Beef and milk come to the fore as animal protein sources (İLGÜ and GÜNEŞ, 2002). To date, animal production is one of the biggest driving forces in the development of many developed countries. Livestock sector; has assumed important economic tasks in feeding countries' own citizens, increasing exports, providing raw materials to the industry, balanced development of regions and sectors, preventing unemployment in the countryside, creating

new employment opportunities in the industry and service sector, and development finance based on own resources (SAKARYA and AYDIN, 2011).

In recent years, attention has been turned to the red meat sector due to the increase in meat prices and live animal and red meat imports, which are the agenda topics in our country. Turkey is far behind developed countries in terms of both animal product production and animal product consumption. The demand of the growing population, and rising socio-economic welfare level of meat production make it necessary to increase in Turkey. Livestock; butchery increasing the amount of meat from animals, and besides improving the quality, various animal feeds and better evaluation of industry residues is an important animal husbandry sub-sector that is of great importance in terms of contribution and contributes greatly to the economy by creating new employment in Turkey (SAKARYA, 1990; ÇİÇEK and SAKARYA, 2003; AYDIN et al., 2010). While animal production constitutes 41% of the total agricultural production value of the European Union, this rate is around 15% in Turkey.

According to 2019 statistics, while 90% of the total produced red meat in Turkey is obtained from cattle, this rate is 35% in the European Union. Turkey had 17 042 506 head cattle, the number of milked cows and slaughtered cattle were 6 337 906 head and 3 426 180 head. In Turkey, which is self-sufficient in terms of cattle existence, a sustainable livestock farming could not be carried out due to the fact that it is far behind developed countries in terms of milk and meat yield from cattle, and live animals and red meat are imported. In 2018 year, 1 460 563 head live cattle and 55 753 tons red meat were imported and total of 2 014 639 000 USD was spent for this import in Turkey (TSI, 2019). Imported live animals and red meats did not solve the problems of animal husbandry in Turkey, and caused even more problems in animal husbandry. For this reason, the importance of regional or regional plans or economic research is increasing day by day, as well as macro-economic guiding plans in development of market economies (SAKARYA, 1982; CEVGER et al., 2003).

The main purpose of this study was to analyse in economic terms to determine the presence of family and external labor forces, to determine the income and expenses of the cattle fattening enterprises, to calculate the unit cost as well as the per head fattening cattle and per kg carcass. In addition, based on the results of the study, various suggestions were made for businesses.

2. Literature Review

Sakarya and Aydın (2011) reported that animal production has been one of the biggest drivers of economic growth in many developed countries. Livestock sector; It has undertaken important economic functions such as ensuring national nutrition, increasing exports, providing raw materials to the industry, balanced development between regions and sectors and achieving stable development, preventing hidden unemployment in rural areas, creating new employment opportunities in industry and services sectors, and based on development resources based on own resources.

Albez (2018) stated that the average fattening period, carcass yield, daily live weight gain, cost of per kg carcass and hot carcass weight were calculated as 180 days, 57%, 1559, 3,89 USD and 280,5 kg respectively. Feed had highest rate in the cost of beef productions. In addition to fattening material in beef production significantly in total cost was another input (ÇİÇEK and SAKARYA, 2003). Akkaya (2015) reported that the cost of per kg cattle carcass, feed cost of per cattle, marketing cost, , depreciated cost of per cattle, veterinary service and total cost of per cattle fattening were as 2,47 USD, 263,79 USD, 6,1 USD, 1 USD, 3,32 USD and 638,35 USD respectively. The demand of the growing population, and rising socio-economic welfare level of meat production make it necessary to increase in Turkey.

Livestock; butchery increasing the amount of meat from animals, and besides improving the quality, various animal feeds and better evaluation of industry residues is an important animal husbandry sub-sector that is of great importance in terms of contribution and contributes greatly to the economy by creating new employment in Turkey (SAKARYA, 1990; ÇİÇEK and SAKARYA, 2003; AYDIN et al., 2010). Somwaru and Valdesin (2004) reported that in recent years, Brazil – one of the world's main suppliers of agricultural products- has been raising beef productivity and exports.

In Brazil, large farm land availability, ample feedstuffs supplies, a large domestic consumer market, and liberalization of trade barriers have allowed large firms to achieve economies of size that have made the country a major, growing source of meat production. Major differences exist between the modern and the traditional segments of the beef-cattle sub-sector. To assess competitive strength of Brazil's livestock operations. In another study, production costs for light, medium and heavy groups were 1 533.37, 1 648.24 and 1 757.01 USD respectively, and net profits were -58.65, 27.49 and 147.59 USD respectively. Given the average profit of the light, medium and heavy groups, it was found that the profit was not sufficient to sustain a livelihood of a farm household. Since the cost and sales price of per kg carcass in the study area were close to each other, the discrepancy between these two prices was low for profit margin (KÖKNAROĞLU et al., 2017).

Alhas Eroğlu and Bozoğlu (2019) reported that the average beef production was 19 067 kg, gross profit and relative profit were 60435.24 and 1.34 USD, respectively. Fattening animal material (40.79%), concentrated feed (34.46%) and hay (6.49%) had the highest rates in fattening cost. The cost of beef and gross profit per kilogram were 7.42 USD and 3.17 USD, respectively. While the external input level of the breeder material was 49.15%, it was 40.01% for labor, 38.49% for hay and 96.59% for concentrated feed. The high external input level was a disadvantage for the economic sustainability of fattening cattle enterprises. Therefore, government supports should be revised to encourage combined production (milk and beef) and financial support should be improved to access economies of scale.

3. Material and Method

This study was carried out between 1 January and October 2019 in 15 districts of Hatay province. Considering possible disruptions in the research, 10% more than the minimum number of samples, which was 100, was surveyed with the enterprise (111 enterprises in total). Enterprises were divided into 3 groups according to the number of fattening cattle. The first group of enterprises that called small-scale had between 1 and 20 heads fattening cattle. The second group of enterprises that called medium-sized had between 21 and 50 fattening cattle. The third group of enterprises that called large-scale had 51 heads and over fattening cattle. In addition to primary data, the data gathered from other institutions and organizations and related research findings form the secondary data of this study. The following formula was used to determine the minimum number of samples (YAMANE, 1967; ÇİÇEK and ERKAN, 1996).

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

In this formula;

n = sample size,

N = the number of units in the population,

N_h = number of units in the layer h

D² = (d² / z²),

D = the maximum amount of error that can be accepted by the researcher, or the difference between the sample average and the population average (taken as 10% = 3,1),

Z = expresses the z value in the standard normal distribution table according to this error margin (z value in the 90% confidence interval is 1,645). Distribution of enterprises by scale and number of samples are given in Table 1.

The Chi-square (χ^2) independence test was used to determine whether there is a statistically significant relationship between the two variables.

Table 1: Number of samples and fattening cattle capacity of enterprises

Enterprise's Groups	Number of businesses	Minimum Number of Samples	Number of Surveys Performed	Average Cattle Capacity of Enterprises
Small Scale	310	46	51	14,9
Medium Scale	249	37	41	39,8
Large Scale	114	17	19	104,5
Total	673	100	111	39,4

Economics Efficiency:

$$EE = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11} + \beta_{12} X_{12} + \beta_{13} X_{13} + \beta_{14} X_{14} + \beta_{15} X_{15} + \beta_{16} X_{16} + \beta_{17} X_{17} + \beta_{18} X_{18} + \beta_{19} X_{19} + \beta_{20} X_{20} + \beta_{21} X_{21} + e_i \quad (1)$$

In the study, the effects of 21 independent factors on economic efficiency in cattle fattening enterprises were determined by Binary Logistic Regression analysis method (GHAFOOR et al., 2017; OKOYE et.al. 2007; SARMA and AHMED, 2011). Statistical Package for Social Sciences Version 22 (SPSS, 2013) package perogram was used in the statistical analysis of the data. The statistical model of the experiment was given below;

$$\text{logit} \left(E \left[\frac{Y_i}{X_i} \right] \right) = \text{logit}(P_i) = \ln \left[\frac{P_i}{1-P_i} \right] = \text{logit}(P) = \beta_0 + bX + e,$$

In the model;

β_0 =Intercept,

b= Regression coefficient,

X=Independent variables,

e= Error term

and $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7, \beta_8, \beta_9, \beta_{10}, \beta_{11}, \beta_{12}, \beta_{13}, \beta_{14}, \beta_{15}, \beta_{16}, \beta_{17}, \beta_{18}, \beta_{19}, \beta_{20}$ and β_{21} were the regression parameters to be estimated (Table 2).

Table 2: Factors affecting economic efficiency in cattle fattening enterprises

Variables	Symbol	Definition of Variables
Dependent	Y	Economic Efficiency.
Independent		
	X ₁	Age of enterprise owner.
	X ₂	Marketing problem (1= yes and 0= no).
	X ₃	Skilled worker employment problem (1= yes and 0= no).
	X ₄	Carcass sale price.
	X ₅	Hay and concentrate feed price.
	X ₆	Capital amount.
	X ₇	Transportation cost.
	X ₈	Experience of enterprises owners.
	X ₉	Education of enterprises owner (1=primary, 2=secondary and 3=university).
	X ₁₀	Long slaughtering date for animal cutting (1= yes and 0= no).
	X ₁₁	Decision of government to import carcass and fattening cattle (1= yes and 0= no).
	X ₁₂	Epidemics (1= yes and 0= no).
	X ₁₃	Government subsidies (1= yes and 0= no).
	X ₁₄	Sales price collection problem (1= yes and 0= no).
	X ₁₅	Veterinary and medicines.
	X ₁₆	Fattening cattle purchase price.
	X ₁₇	Eligible loans to cattle fattening (1= yes and 0= no).
	X ₁₈	Labor costs.
	X ₁₉	Capacity of cattle barn.
	X ₂₀	Land of property size.
	X ₂₁	High interest rate of bank loan (1= yes and 0= no).

4. Results and Discussion

4.1. The number and rates of enterprises

The number of surveyed cattle fattening enterprises, cattle capacity of enterprises and ratios of each group are presented in Table 1. According to Table 1, 45,95% of the enterprises were the first group (small-scale), 36,94% were the second group (medium-scale) and 17,11% were the third group (large-scale). The average number of fattening cattle in all enterprises' group was 39,4 head.

4.2. Family labor and land use of enterprises

Table 3 shows that the annual labor forces and land uses. In the enterprises, the average family labor use was the highest in the first group and the lowest use was third group. While second and third group enterprises were employed permanent worker, only family members worked in the first group enterprises. The rates of employed permanent workers were as 26,83% and 100% in the second and third group enterprises. The results of the research on the use of labor showed similarity with Kan and Direk (2006) and Tapki (2019). Kan and Direk (2006) stated that the average family and external labor forces of the enterprises was 63,61% and 36,39% respectively. The for rent (24,13 da) and total land uses (110,05 da) were the highest in the third group enterprises. The third group enterprises had higher property land than the second and first group enterprises as 63,18 and 73,83 da. Average land use size in all enterprises was 43,49 da (Table 3). In terms of land size results were higher than by reported Dung et al. (2016). Dung et al. (2016) reported this value as 3.919.

Table 3: The labor and land use of enterprises

Labor and land forces	Enterprises' Groups			
	I	II	III	Average
Family labor (person)	2,39	1,75	0,98	1,91
Foreign labor (person)	0,00	1,69	3,03	1,14
Total labor (person)	2,39	3,44	4,01	3,06
Property land (da)	12,54	23,19	86,37	29,11
For rent land (da)	9,25	16,46	24,13	14,46
Total land (da)	21,79	39,65	110,05	43,49

4.3. Technical efficiency of enterprises

The production parameters and technical structures of cattle fattening enterprises are shown in Table 4. The average fattening period was 251,8 days in all enterprises, and the shortest fattening period was observed in the third group enterprises (180 days). The third group of enterprises had the cattle with higher live weight (350 kg) at the beginning of the fattening. In terms of the final fattening live weight (28 and 37 kg), slaughter weight (26 and 33 kg), daily live weight gain (106 and 176 g), hot carcass weight (24 and 32 kg), carcass yield (1,6 and 2,4%) and feed efficiency (1,1 and 1,5 kg), the third group enterprises had more advantageous than the second and first group enterprises (Table 4).

Table 4: The parameters of technical efficiency of enterprises

	Enterprises' Groups			Average
	I	II	III	
Fattening period (days)	280 ^c	250 ^b	180 ^a	251,8
Initial fattening live weight (kg)	250 ^a	270 ^{ab}	350 ^b	274,5
Final fattening live weight (kg)	515 ^a	524 ^{ab}	550 ^b	524
Slaughter weight (kg)	507	514	537	515
Total live weight gain (kg)	265 ^{ab}	254 ^a	200 ^b	250
Daily live weight gain (g)	946 ^a	1016 ^{ab}	1122 ^b	1002
Hot carcass weight	302 ^a	312 ^{ab}	331 ^b	311
Total beef carcass weight (kg)	4500	12418	33590	12404
Carcass yield (%)	59,6 ^a	60,7 ^{ab}	61,6 ^b	60,3
Feed efficiency (kg)	8,6	8,2	7,1	8,2

^{abc}superscripts mean different in the row at the P<0.05 level.

While the results in terms of daily live weight gain were close to many previous study results (FİDAN, 1992; KILIÇ, 1994; SAYILI, 2001; HAZNECİ, 2007; GÖZENER, 2013; ÇELİK and SARIÖZKAN, 2017), it was lower than the results reported by Dung et al. (2016). Daily live weight gains of fattening cattles were reported as 1050 g by Fidan (1992), 749 g by Kılıç (1994), 1055,62 g by Sayılı (2001), 1094,77 g by Hazneci (2007), 1338,24 g by Gözener (2013), 547,5 g by Dung et al. (2016), and 1033 g by Çelik and Sarıözkan (2017). The results of hot carcass weight, fattening period and carcass yield were lower than the values reported by Albez (2018), daily live weight gain was higher. While the results of fattening period, live weight at the beginning of the fattening, live weight at the end of fattening were higher than reported by Dung et al. (2016), and Çelik and Sarıözkan (2016), the results regarding feed utilization value were lower. The results of the average total produced carcass weight were lower than reported by Alhas Eroğlu and Bozoğlu (2019). The results related to hot carcass weight and carcass yield of per cattle, and fattening period were higher than the results reported by Köknaroğlu et al. (2017).

4.4. The gross production value (GPV) and gross income (GI) of enterprises

Average gross production values, gross incomes and production costs of cattle fattening enterprises are presented in Table 5, Table 6 and Table 7.

Table 5: The total gross production values of fattening cattle enterprises (USD)

Total gross production items	Enterprises' Groups			
	I	II	III	Average
Beef production	24885	68672	188104	68997
Other livestock production	7123	10584	19501	10520
Premium and incentive	432	1152	3015	1140
Plant production	3126	3974	6521	4020
Manure sales	1065	2360	5305	2269
Total gross production value	36631	86742	222446	86947
Ratios (%)				
Beef production	67,93	79,17	84,56	74,93
Other livestock production	19,45	12,20	8,77	14,94
Premium and incentive	1,18	1,33	1,36	1,27
Plant production	8,53	4,58	2,93	6,11
Manure sales	2,91	2,72	2,38	2,75
Total gross production values	100,00	100,00	100,00	100,00

The elements of gross production values were beef sales (74,93%), other livestock production (14,94%), premium and incentive (1,27%), plant production (6,11%) and manure sales (2,75%). The average gross production value was calculated as 86 947 USD in all enterprises. The highest gross production value was observed in the third group enterprises, the third group enterprises had more gross production value than the second and first group enterprises as 135 704 and 185 815 USD (Table 5).

The elements of gross income were total gross production value (85,18%), non-agricultural income (11,41%) and housing rental fee (3,41%). The average gross income was calculated as 101 168 USD in all enterprises. The highest gross income value was observed in the third group enterprises, the third group enterprises had more gross income than the second and first group enterprises as 160 166 and 214 827 USD (Table 6). The result of average total gross production value was lower than the reported by Köknaroğlu et al. (2017). Köknaroğlu et al. (2017) reported this value as 2256,6 USD.

Table 6: The gross income values of dairy enterprises (USD)

Gross income items	Enterprises' Groups			
	I	II	III	Average
Total gross production value	36631	86742	222446	86947
Non-agricultural income	5517	9454	32517	11593
Housing rental fee	2058	2671	4070	2629
Gross income	44206	98867	259033	101168
Ratios (%)				
Total gross production value	82,86	87,74	85,88	85,18
Non-agricultural income	12,48	9,56	12,55	11,41
Housing rental fee	4,66	2,70	1,57	3,41
Gross income	100,00	100,00	100,00	100,00

The ratios of variable and fixed costs accounted for 74,25% and 25,75% of the total cost in all group enterprises. The costs of fattening cattle purchase, temporary labor, feed, veterinary, electricity and water, fuel and marketing in variable cost were as 53,12%, 0,49%, 44,30%, 2,60%, 0,24%, 0,22% and 0,52% respectively. The dept interest was the highest cost (44,76%) in the fixed cost. It was followed the permanent and the family labor (40,55%) and general insurance (8,89%). When the cattle capacity of the enterprises was analyzed, it was observed that the total operation cost of per head cattle was the lowest in the third group enterprises (1312 USD). The third group enterprises had the lower for total operation cost of per head cattle than the second and first group enterprises as 113 and 212 USD (Table 7). Costs related to animal purchase cost, labor cost and feed cost in total fattening cost differed from the results reported by Albez (2018). The animal purchase cost in the total feed cost was lower than the cost reported by Albez (2018), and the feed cost was higher. The results regarding the total cost per fattening cattle were lower than those reported by Akkaya (2015). This value was reported as 1965.97 USD in Akkaya (2015). These differences were caused by currency parity, fattening time, cattle breed and feeding method. The results regarding the total feed cost per fattening cattle were very close to those reported by Akkaya (2015). Within the total feed cost, animal purchase cost, feed cost were higher than the results reported by Çelik and Sarıözkan (2017). Çelik and Sarıözkan (2017) reported these rates as 42.95% and 33.09%. The results for the total operating cost per cattle were lower than the results reported by Köknaroğlu et al. (2017).

Table7: The beef production costs of cattle fattening enterprises (USD)

The cost items	Enterprises' Groups			
	I	II	III	Average
A. Variable Costs				
Fattening animal materials	7493	21443	60057	21643
Temporary labor	0	167	805	199
Concentrate feed	3624	13312	34623	12509
Corn silage	958	2165	5430	2169
Hay	1354	3548	8410	3372
Veterinary service	68	142	347	872
Medicine and vaccine	90	175	479	188
Electricity and water	33	107	250	97
Fuel	22	85	287	91
Marketing	47	181	729	213
Other	32	101	375	116
Total Variable Cost ^a	13721	41426	111792	40741
B. Fixed Costs				
Animal, Building and machine depreciation	84	115	153	107
Building maintenance and repair	115	145	218	144
Permanent labor and family labor	3850	7264	7450	5727
General administrative expenses	45	126	294	118

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Debt interest	3900	5791	13976	6323
Taxes	91	239	575	229
General insurance	745	1398	2322	1256
Rental fee	164	231	357	222
Total Fixed Cost ^b	8994	15309	25345	14125
Total Operation Cost (a+b)	22715	56735	137137	54867
Operation cost of per fattening cattle	1524 ^c	1425 ^b	1312 ^a	1451

^{abc} superscripts mean different in the row at the $P < 0.05$ level.

4.5. The economic efficiency and productivity of enterprises

The compatibility of the Binary Logistic Regression model was performed using the Hosmer and Lemeshow (H-L) method with a 91,53% reliability (HOSMER and LEMESHOW, 2000; PENG et al. 2002). The Hosmer & Lemeshow (H-L) coefficient was calculated as 27,981, and statistically insignificant ($P > 0,05$) indicates that the model was suitable. In the model, Cox & Snell and Nagelkerke R^2 coefficients were respectively; It was calculated as 0,619 and 0,796, and this result shows that the model was acceptable.

The economic efficiency values and productivity of cattle fattening enterprises are shown in Table 8 and Table 9. According to the Table 8, marketing problem, skilled worker employment problem, carcass sale price, high feed price, capital amount, long slaughtering date for animal cutting, the decision of governments to import fattening cattle and carcass, government subsidies, high fattening cattle purchase price, eligible loans to cattle fattening, capacity of cattle barn, and high interest rate of bank loan ($P < 0,05$) came to the fore as effective factors on economic efficiency.

The effect of nine factors such as the age of enterprise owner, transportation cost, experience of enterprises owners, education of enterprises owner, epidemics, sales price collection problem, veterinary and medicine, labor cost and land of property size of the enterprises were found statistically insignificant ($P > 0,05$). While there were negative relationship between economic efficiency and marketing problem, skilled worker employment problem, high feed price, long slaughtering date problem for animal cutting, the decision of governments to import fattening cattle and carcass, high fattening cattle purchase price and high interest rate of bank loan (Table 8). The increase in the number of enterprises with marketing problems in each unit caused 9,401 times decreases in the economic efficiency.

The research results related to marketing problem showed similarities with Sarıca et al. (2004), Sarıözkan (2006), Turhan et al. (2010), and Saygın and Demirbaş (2018). Turhan et al. (2010), and Saygın and Demirbaş (2018) stated that the market problem negatively affected the fattening enterprises and accordingly, the prices of red meat increased. The

increase in the number of enterprises with skilled worker employment problem in each unit caused 3,598 times and the increase in the number of enterprises with high feed price in each unit caused 9,123 times decreases in the economic efficiency. The research results agreed with Sariozkan (2006), Turhan et al. (2010), Saygın and Demirbaş (2018), Hacıince (2018), and Yavuz and Dilek (2019). Sariozkan (2006), Turhan et al. (2010), Saygın and Demirbaş (2018), Hacıince (2018) and Yavuz and Dilek (2019), stated that the high prices of hay and concentrated feed led to higher costs in fattening and increases in red meat prices.

The increases in the number of enterprises with long slaughtering date problem for animal cutting in each unit caused 5,970 times and the increases in the number of enterprises with the decision of governments to import fattening cattle and carcass in each unit caused 19,632 times decreases in economic efficiency. The results were agreed with Aydın et al. (2010), Hacıince (2018), and Saygın and Demirbaş (2018). Aydın et al. (2010), Er and Özçelik (2016), Hacıince (2018), and Saygın and Demirbaş (2018) stated in particular that the import of fattening live cattle and carcass caused small enterprises to go bankrupt.

Table 8: Factors affecting economic efficiency values in cattle fattening

Independent Variables	Correlation Coefficient	Standart Error	p-values	Odd ratio
Marketing problem	-2,003	0,905	0,036	-9,401
Skilled worker employment problem	-1,019	0,002	0,041	-3,598
Carcass sale price	3,687	0,259	0,025	12,512
Hay and concentrated feed price	-1,890	0,165	0,033	-9,123
Capital amount	3,793	0,120	0,014	17,181
Long slaughtering date for animal cutting	-1,031	0,026	0,040	-5,970
Import decision of live cattle and carcass	-3,205	0,321	0,009	-19,632
Government subsidies	1,168	0,023	0,042	5,298
Fattening cattle purchase price	-1,984	0,235	0,047	-8,208
Eligible loans to cattle fattening	2,651	0,127	0,038	10,077
Capacity of cattle barn	2,211	0,184	0,021	11,205
High interest rate of bank loan	-1,258	0,103	0,048	-3,412
Age of enterprise owner	0,019	0,001	0,063	0,689
Transportation cost	-0,057	0,002	0,105	-0,457
Experience of enterprises owners	0,064	0,003	0,085	0,495
Education of enterprises owner	0,045	0,001	0,073	3,169
Epidemics	-0,098	0,002	0,084	-0,102
Sales price collection problem	-0,504	0,025	0,061	-0,964

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Veterinary and medicine	-0,089	0,004	0,097	-0,423
Labor cost	-0,085	0,006	0,073	-0,908
Land of property size	0,123	0,010	0,076	0,102
Constant	9,798	1,207	0,029	324,516
Model Prediction Success (MPS)			91,53%	
Log-likelihood Ratio			81,361	
Hosmer & Lemeshow Model Test (χ^2 Ki-kare, P-value=0.041)			27,981	
Cox ve Snell R ²			0,619	
Nagelkerke R ²			0,796	

The increases in the number of enterprises with the high fattening cattle purchase price in each unit caused 8,208 times, and the increases in the number of enterprises with the high interest rate of bank loan in each unit caused 3,412 times decreases in the economic efficiency. The increases in the number of enterprises with carcass sale price in each unit caused 12,512 times increases in economic efficiency. The results of carcass sale price were similar to Sarıözkan (2006), Turhan et al. (2010), Albez (2018), Hacıince (2018) and Saygın and Demirbaş (2018). The researchers emphasized that with the drop in the carcass sale price, especially small-scale enterprises suffered great damage. The increases in the number of enterprises with capital amount in each unit caused 17,181 times increases in economic efficiency. The results were similar to Sarica et al. (2004), and Yavuz and Dilek (2019). In Yavuz and Dilek (2019), they emphasized that the cattle fattening enterprises in Turkey had insufficient capital and the necessity to increase the capital and capacity of the producers with the policies developed by the state. The increases in the number of enterprises with government subsidies in each unit caused 5,298 times and the increases in the number of enterprises with eligible loans to cattle fattening in each unit caused 10,077 times increases in economic efficiency. The results of eligible loans to cattle fattening were similar to Albez (2018) and Hacıince (2018). In Albez (2018), in order to decrease the input costs of small-scale fattening enterprises incentives such as cheap loans should be provided. The increases in the number of enterprises with capacity of barn in each unit caused 11,205 times increases in economic efficiency (Table 8).

In terms of productivity of enterprises, the average amount of total capital, capital stock, pure profit, gross profit, agricultural income, economic profitability, financial profitability, rantability factor, capital turnover duration and capital turnover rate were found as 196 825 USD, 164 507 USD, 50 070 USD, 56 559 USD, 45 432 USD, 25,15%, 24,21%, 51,22%, 2,41 years and 41,89%, respectively. While the third group enterprises were more

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advantageous in terms of economic profitability, financial profitability, capital turnover duration and capital turnover rate, the first group enterprises were more advantageous in terms of rantability factor. The fact that first group enterprises were more advantageous in terms of rantability factor resulted from gross profit amount was lower than other groups (Table 9). The results of the research were lower than the average gross profit and net profit reported by Alhas Eroğlu (2019).

Table 9: The results of annual economic success criterions

	Enterprises' Groups			Average
	I	II	III	
Total capital (USD)	83757	152105	425244	167455
Capital stock (USD)	73706	121684	314681	132676
Net profit (USD)	21491	42132	121896	46302
Gross profit (USD)	22910	45316	110654	46205
Agricultural income (USD)	21277	43374	115013	45484
Economic profitability (%)	25,66	27,70	28,66	26,93
Financial profitability (%)	23,87	29,87	34,30	27,87
Rantability factor (%)	48,62	42,61	47,06	46,13
Capital turnover periods (years)	2,29	1,75	1,91	2,03
Capital turnover rate (%)	43,73	57,03	52,31	50,11

4.6. The cost, revenue and profitability of enterprises

The costs, revenues, net incomes, sales prices and support and premium of cattle fattening enterprises are presented in Table 10. According to Table 10, the average operation cost of per head fattening cattle and per kg beef carcass in all group enterprises were 1451 and 4.71 USD. While the highest costs of per kg beef carcass (5.05 USD) and per head fattening cattle (1524 USD) for beef production were observed in the first group enterprises, the lowest costs in the third group enterprises (4.08 and 1312 USD). Average carcass weight per fattening cattle in first group, second group and third group enterprises were 302, 312 and 331 kg respectively. The third group enterprises had more carcass weight than second and first group enterprises as 19 and 29 kg. When the revenues of enterprises were analyzed, per kg

carcass sales price was higher in the third group enterprises than the others. The average net income per fattening cattle was highest in the third group of enterprises, the third group enterprises had more income than the second and first group enterprises as 186 and 341 USD. When the net income per kg beef carcass was examined, this value average was 0,93 USD in all group enterprises (Table 10). The results regarding the cost of per kg body weight gain were lower than the result reported by Albez (2018) and higher than the result reported by Akkaya (2015) and Köknaroğlu et al. (2017), while this value was reported as USD 6,83 in Albez (2018), It was reported as 4,57 USD in Akkaya (2015). The results related to the cost of per kg carcass weight were less than reported by Akkaya (2015), Köknaroğlu et al. (2017) and Alhas Eroğlu and Bozoğlu (2019). The results regarding the cost of per kg body weight gain were lower than USD 2,36 reported by Çelik and Sarıözkan (2016). While the results related to the net income of per cattle obtained were higher than 99,69 USD reported by Çelik and Sarıözkan (2016), it was close to 292,6 USD reported by Sarma and Ahmed (2011), and it was lower than the reported by Alhas Eroğlu and Bozoğlu (2019).

Table 10: The beef production costs and revenues of cattle fattening enterprises

Cost and revenues	Enterprises' Groups			Average
	I	II	III	
COST (USD)				
Total beef carcass production cost	22715	56735	137137	54867
Production cost of per kg beef carcass	5,05 ^b	4,57 ^{ab}	4,08 ^a	4,71
Production cost of per fattening cattle	1524 ^b	1425 ^{ab}	1312 ^a	1451
Production cost of per kg live weight gain	5,75 ^{ab}	5,61 ^a	6,56 ^b	5,84
REVENUES (USD)				
Amounts of beef carcass sales	24885	68672	188104	68997
Amounts of support and premium	432	1180	3015	1140
Total beef carcass sales revenue	25317	69852	191119	70147
Beef carcass sale price without support	5,53	5,53	5,60	5,54
Beef carcass sale price including support	5,63	5,63	5,69	5,64
Total net income of beef carcass sales	2602	13117	53982	15281
Net income of per fattening cattle	175 ^a	330 ^b	516 ^c	291
Net income of per kg beef carcass	0,58 ^a	1,06 ^b	1,56 ^c	0,93

^{abc} superscripts mean different in the row at the P<0.05 level.

5. Conclusions and Recommendations

The results showed that foreign labor use, property and rental land use, technical efficiency, per kg live weight cost, per kg carcass sale price, net profit per cattle and per kg carcass were higher in large-scale enterprises, whereas family labor use, production costs of per cattle per kg carcass were lower than other group enterprises. The marketing problem, skilled worker employment problem, feed price, long slaughtering date for animal cutting, import decision of live cattle and carcass, high interest rate of bank loan, and fattening cattle purchase price were as factors that negatively affect, carcass sale price, capital amount, government subsidies, eligible loans to cattle fattening and capacity of cattle barn were as factors that positively affect on the economic efficiency of enterprises.

As a result, low interest rate loans to increase the capacities of small enterprises should be provided by the government. In order to contribute to the increase of economic and technical efficiency of small scale enterprises, the government should provide incentives and supports for the animal and feed purchase, barn construction. The fluctuations in animal, feed and carcass prices should be prevented by market regulation. In order to protect small-scale businesses in Turkey, the governments must constantly take the decision to stay away from imported live animals and carcasses. The owners of fattening enterprises should be informed and trained while there should be pioneers in finding solutions to their problems. The small and medium-sized enterprises should be allowed to reach the markets easily.

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