RESEARCH ARTICLE

Measuring the Performance of Cattle Fattening Enterprises with Data Envelopment Analysis: Comparative Analysis of Enterprises in the Northeast Anatolia Region (TRA) Between the Years 2009-2010

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Summary

The present study is the first study which is about measuring the efficiency of cattle fattening enterprises with data envelopment analysis in Turkey. In this study it is aimed to comparatively present the performance score of intensive cattle fattening enterprises in the Northeast Anatolia Region with data envelopment analysis in two fattening periods. The CCR input method model was established with 10 inputs and 3 outputs for analysis. The analysis program was operated with "Super Efficiency" command to see efficiency score differences among DMU. As a result of measurements, performance scores that belong to total 143 DMU were determined. According to that, while the performance score mean of DMU in first fattening period were 112.01 in all DMU, 103.97 in small scale DMU, 113.82 in medium scale DMU, and 124.88 in large scale DMU, DMU's performance score means were 105.89, 108.94, 99.40, and 94.13 respectively in the second fattening period. The inefficiency DMU rate was measured as 22.79% in the first fattening period and 31.25% in second fattening period. When two fattening periods were compared in view of measurements, it was observed that there was a significant difference between medium and large scale DMU's performance scores (P < 0.05). In conclusion, it is considered that the increase in the number of inefficiency decision making units in the second fattening period was caused by the excessive increase in the fattening material cost, the low carcass meat price in comparison to the increase in the fattening material cost, and the decrease in the capacity utilization rate.

Keywords: *Data envelopment analysis, Performance measurement, Cattle fattening, Mathematical programming, Efficiency, Productivity*

Sığır Besi İşletmeleri Performansının Veri Zarflama Analizi Yöntemiyle Ölçülmesi: Kuzeydoğu Anadolu Bölgesi'ndeki (TRA) İşletmelerin 2009-2010 Yıllarında Karşılaştırmalı Analizi

Özet

Bu çalışma Türkiye'de sığır besi işletmelerinin veri zarflama yöntemiyle etkinliğinin ölçülmesinde ilk olma özelliği taşımaktadır. Çalışmada veri zarflama analizi yöntemiyle Kuzeydoğu Anadolu Bölgesi'ndeki entansif sığır besi işletmelerinin iki besi dönemi halinde karşılaştırmalı olarak performans skorlarının ortaya konulması amaçlanmıştır. Analiz için 10 girdi ve 3 çıktı ile CCR girdi yönelimli model kurulmuştur. Analiz programı "Karar Verme Birimleri"nin (KVB) kendi aralarındaki etkinlik skor farklarını görmek amacıyla "Super Efficiency" komutuyla çalıştırılmıştır. Hesaplamalar sonucunda toplam 143 KVB'ne ait performans skorları saptanmıştır. Buna göre birinci besi dönemindeki performans skor ortalamaları KVB'nin tamamında 112.01, küçük ölçekli KVB'nde 103.97, orta ölçekli KVB'nde 113.82 ve büyük ölçekli KVB'nde 124.88 iken, ikinci besi döneminde KVB'nin performans skor ortalamaları aynı sırayla 105.89, 108.94, 99.40, 94.13 olarak belirlenmiştir. Etkin olmayan KVB oranı birinci besi döneminde %22.79, ikinci besi döneminde ise %31.25 olarak hesaplanmıştır. İki besi dönemi ölçeklere göre karşılaştırıldığında orta ve büyük ölçekli KVB'nin performans skorları arasındaki fark önemli bulunmuştur (P<0.05). Sonuç olarak; etkin olmayan KVB sayısının ikinci besi döneminde artış göstermesine; besi materyali maliyetindeki aşırı yükselmenin, besi materyali fiyatındaki yükselişe göre düşük kalan karkas et fiyatının ve kapasite kullanım oranın düşmesinin neden olduğu düşünülmektedir.

Anahtar sözcükler: *Veri zarflama analizi, Performans ölçümü, Sığır besiciliği, Matematik programlama, Etkinlik, Verimlilik*

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INTRODUCTION

According to the Nomenclature of Units for Territorial Statistics, the provinces of Erzurum, Erzincan, and Bayburt in the Northeast Anatolia Region (TRA) are in TRA-1 and Kars, Ardahan, Ağrı, and Iğdır are in TRA-2 [1]. According to 2012 data of Turkish Statistical Institute Turkey's 14.71% of Turkey's total cattle is in TRA, 3.51% is in Kars, and 4.48% is in Erzurum While considering Turkey's total cattle existence distribution, Kars and Erzurum were among the top four cities as of 2012 [2]. Cattle fattening enterprises in TRA have similar socio-economic features [3].

Cattle fattening, a subsector of the livestock sector, has an important role in transforming male calves, which are an important output of dairy farming, and female breeding stock into high quality and efficiency beef through economic utilization [4]. The live weight increase, feed intake, feed efficiency and their ability and the relationship between profitability are direct factors on cattle enterprises [4,5].

As in all commercial enterprises in cattle fattening enterprises, the main purpose is to make a profit. From this point, evaluating the performances of cattle fattening enterprises gains importance in terms of the continuation of business efficiencies. Performance in general is a concept that quantitatively or qualitatively determines the gains at the end of a purposeful and scheduled activity. In other words, performance is the level of achievement to reach the planned output level. If the business performance is in question, the first concepts that come to mind are efficiency and, productivity [6].

The concepts of effectiveness and efficiency, each a dimension of the performance, are crucial for all units in maintaining their existence, whether or not they seek profit. In order to see their own places, their superiority and inferiority among similar ones, units periodically should measure performance with measured data. Without measurement, it is not possible to decide what is good or bad by whom [6].

The fact that efficiency and productivity are so important gives way to the development of many measurement methods. They can be grouped in three groups: ratio analysis, parametric methods and non-parametric methods [6]. Of the methods used to measure efficiency ratio analysis is the simplest. In this approach, each ratio considers only one of the dimensions of efficiency while others are ignored. Generally regression techniques are used in the efficiency measurement with parametric methods. Mathematical programming has been adopted as the solution technique in performance measurement with non-parametric methods [7]. When ratio analysis and parametric methods cannot over-come

situations (particularly multi-input and multi-output conditions) data envelopment analysis (DEA) offers enormous opportunities for solutions [6].

Data envelopment analysis is an activity measurement "without parameters" first developed by Charnes, Cooper and Rhodes (1978-1979) in order to measure "relative" efficiencies of similar commercial decision making units (DMU) in terms of their goods or services [7]. The method is used for performance comparison in multi-input multi-output relations of production, to which classical regression analysis cannot be directly applied [8].

Unlike the single input, single output in the conventional efficiency analysis, DEA acts on the basis of multiple inputs multiple outputs. DEA measuring comparative efficiency originally in nonprofit public institutions, then has been used widely for the measurement of technical efficiency in profit seeking manufacturing and service sectors [9]. In this context, it has been used to measure the performances of many profit businesses including livestock enterprises [10].

In cases which inputs and outputs measured with multiple or different measurement scales make comparison difficult DEA is a linear programming-based technique aiming to measure the relative performances of DMU [11]. In this method it is possible to simultaneously measure various sizes of the DMU with respect to independence of the input and output units from the scale [12].

This study aims to determine the activity in two fattening periods of cattle fattening enterprises located in TRA by DEA based on mathematical programming suitable to measure the efficiencies of DMU using multiple inputs and multiple outputs. The present study is the first study about measuring the efficiency of cattle fattening enterprises with data envelopment analysis in Turkey.

MATERIAL and METHODS

Material

To determine intensive cattle fattening enterprises to be included in the research in 2009 in the provinces of Erzurum and Kars, pre-interviews were conducted with Food, Agriculture and Livestock Departments, Agriculture Credit Cooperatives, Meat and Dairy Institution Erzurum Slaughterhouse employees and some breeders. As a result of pre-interviews it has been identified that in the provinces many intensive cattle fattening enterprises operate through the TAR-ET project conducted by the Meat and Dairy Institution and Agriculture Credit Cooperatives. Therefore, it was decided to include intensive cattle fattening enterprises operating through the TAR-ET project in the provinces of Erzurum and Kars in the scope of the research and a total of 82 enterprises were inter-

viewed in this context.

The first degree material of the study consisted of data obtained through face-to-face interviews conducted with intensive cattle fattening enterprises in the central district of Kars, the districts of Selim and Sarıkamış, the central Erzurum districts (Aziziye, Palandöken, Yakutiye), the distract of Pasinler and affiliated villages. The Meat and Dairy Institution has benefited from data of Erzurum slaughterhouse's TAR-ET project [13]. The research includes the cattle production efficiencies of first fattening period of 2009-2010, while the second fattening period between the years 2010-2011. Cattle fattening in the provinces are usually scheduled between October and April in many enterprises once a year.

First survey application was carried out with a total of 79 voluntary enterprises participating in both provinces aimed at intensive cattle fattening enterprises at the beginning and end of the fattening period. The second fattening period survey continued to operate in provinces with a total of 64 enterprises that were surveyed in the first fattening period. Cattle fattening enterprises with 20 and less cattle are considered small scale, those with 21-40 are considered medium scaled, and those with 41 and more are considered large scaled enterprises.

Methods

Data Evaluation

Data envelopment analysis does not give absolute efficiency values while measuring DMU's activity values, it reveals how effective they are to each other [14]. Therefore, in the study DMU's performance scores were found by analyzing two fattening period's multi-input and multi-output data of cattle fattening enterprises in "Efficiency Measurement System (EMS)" package program which is suitable to measure decision- units' performance [6]. The cause of analyzing a total of 143 DMU's of two fattening periods in the EMS package program as a whole arises from the desire to reveal how effective of two fattening period to each other.

In the study, determining the performance scores' descriptive statistics and controlling the significance of differences between groups were made using One-Way ANOVA to three comparisons and T-Test to pairwise. To perform analyzes, the SPSS 20.0 statistical software package was utilized and to create the scatter diagram of the performance score, Windows Excel 2010 was utilized [15].

Data Envelopment Analysis

DEA is a multi-factor productivity measurement model that measures similar decision making unit's (homo-geneous) relative effectiveness. A multi-input and multi-output activity score factor is defined as follows [16]:

$$\text{Efficiency} = \frac{\text{Weighted Output}}{\text{Weighted Input}}$$

Charnes, Cooper and Rhodes expanded Farrell's only input/output technical efficiency measure in 1957 to multiple input/output relative effectiveness measurement, put it to the DEA's literature as the CCR model [17,18].

Following the wide recognition of the data envelopment analysis, the method's basic concepts and principles brought the model variation. A variety of models have been developed as well as CCR (Charnes, Cooper, Rhodes) ratio model, BCC (Banker, Charnes, Cooper) returns to scale model, additive model and multiplicative model [8]. In this study, the input oriented CCR technique has been used; there is no superiority over each other between the CCR and BCC techniques,

It's assumed that each unit has "m" amount of input, "s" amount of output and "n" amount of decision making unit on the problem that will be analyzed. X_{ij} parameter indicates "i" input amount using by "j" DMU and Y_{ij} parameter indicates output amount using by "j" UD. Decision variables for that decision problem are the weight to be given for the, "k" DMU's "i" inputs and "r" outputs. These weights are shown as V_{ik} and U_{rk} respectively. The objective function of fractional linear programming model was defined as maximal ratio of the "k" DMU total weighted output the sum of the weighted [14,16,19].

Objective function:

$$Enb \ h_k = \frac{\sum_{r=1}^{s} u_{rk} \, y_{rk}}{\sum_{i=1}^{m} v_{ik} \, x_{ik}}$$

Subject to:

$$\frac{\sum_{r=1}^{s} u_{rk} \, y_{rj}}{\sum_{i=1}^{m} v_{ik} \, x_{ij}} \leq 1 \qquad ; j = 1,2,\ldots,n \quad (2)$$

and:

$$u_{rk} \geq 0; \ r = 1,2,\ldots,s$$
$$v_{ik} \geq 0; \ i = 1,2,\ldots,m$$

CCR data envelopment model can be created with converting the above fractional programming model into a linear programming model [7,17,20].

Objective function:

$$Enb \ h_k = \sum_{k=1}^{s} u_{rk} \, y_{rk} \qquad k = 1,2,\ldots,n$$

Subject to:

$$\sum_{r=1}^{s} u_{rk} \, y_{rj} - \sum_{i=1}^{m} v_{ik} \, x_{ij} \leq 0 \; ; \; j = 1, 2, \ldots, n$$

$$\sum_{i=1}^{m} v_{ik} \, x_{ik} = 1 \tag{3}$$

and:

$$u_{rk} \geq 0 \, ; \; r = 1, 2, \ldots, s$$

$$v_{ik} \geq 0 \, ; \; i = 1, 2, \ldots, m$$

The above problem has been processed "n times" to determine the effectiveness of all DMU's score. Weighted inputs and outputs are chosen to optimize each decision making unit's efficiency score. In general, if a decision making unit's efficiency score is equal to one, it is efficient, if it's lower than one, it is inefficient [16].

Implementation of Data Envelopment Analysis

The analysis was applied to a total of 143 cattle fattening enterprises; it was applied to 79 of them in the first fattening period and 64 of them in the second period. Cattle fattening enterprises were coded as the "Enterprise (Ent) - Fattening Period (1, 2) - City (Erzurum-E, Kars-K) - Enterprise Number (1, 2, 3, ...)". Accordingly, for example, the first enterprise in Erzurum was "Ent1E1" in first fattening period, while the fifth enterprise in Kars was coded as "Ent2K5" in the second fattening period. The evaluation codes of 15 enterprises that didn't continue to operate in the second fattening period are not available. Cattle fattening enterprises are presented in *Table 1* according to the fattening period and scale

The fattening material costs (FMC {I}), feed expenses (FC {I}), labor costs (LC {I}), veterinary-health expenditure (VHC {I}), care-repair cost (CRC {I}), foreign capital interest (IC {I}), other costs (electricity, water, litter, transport, animals and ranch insurance) (OC {I}), general administrative expenses (GAC {I}), amortization of buildings (ABC {I}) and machinery amortization (MAC {I}) are determined as the input elements for indicating cattle fattening enterprises' performance. The carcass income (CI {O}), incentive bonus income (IBI {O}) and fertilizers income (FI {O}) were included as outputs of enterprises in the analysis. The DMU's incentive bonus income is 1.50 TL per kilogram of male animal carcass that have 60% efficiency and over 190 kg weight in the first fattening period within the TAR-ET project and whereas per men animal is 300 TL in the second fattening period [3].

Thus, by analyzing a total of 143 DMU, 10 inputs and 3 outputs, through the input oriented analysis in two fattening periods, the efficiency scores were calculated. As in all methods of mathematical analyses, in DEA in the presence of a large number of input and output increases the reliability of results. The program has been executed with "Super Efficiency" command for the enterprises on the efficiency border in EMS package program to see differences of the efficiency scores among themselves. Accordingly, the cattle fattening enterprises with the efficiency score 100% and more were evaluated as efficient and the ones with the efficiency score less than 100% as inefficient.

RESULTS

The decision making unit's capacity utilization rates evaluated in the context of research according to the fattening period and scales are given in *Table 2*. In terms of capacity utilization rate, between the first and second fattening period statistical differences are found in their medium and large scale decision making units (P<0.001).

The performance scores of the decision making units first and second fattening periods are shown in *Table 3* and in *Fig. 1*. In addition, performance scores according to the evaluation of the decision making unit measures are present in *Table 4*.

Table 1. Performance measured cattle fattening enterprises
Tablo 1. Performans ölçümleri yapılan sığır besi işletmeleri

Decision Making Units Scale	Fattening Periods	
	First Fattening Period Decision Making Units	**Second Fattening Period Decision Making Units**
≤20 Head	Ent1E1, Ent1E8, Ent1E9, Ent1E12, Ent1E15, Ent1E17, Ent1E18, Ent1E20, Ent1E22, Ent1E25, Ent1E26, Ent1E28, Ent1E29, Ent1E32, Ent1E34, Ent1E35, Ent1E36, Ent1E43, Ent1E44, Ent1E45, Ent1E49, Ent1E50, Ent1E52, Ent1E57, Ent1E58, Ent1E61, Ent1E63, Ent1E64, Ent1E65, Ent1E66, Ent1E68, Ent1E70, Ent1K2, Ent1K3, Ent1K4, Ent1K5, Ent1K8	Ent2E1, Ent2E8, Ent2E9, Ent2E10, Ent2E12, Ent2E15, Ent2E22, Ent2E25, Ent2E26, Ent2E27, Ent2E28, Ent2E29, Ent2E32, Ent2E33, Ent2E34, Ent2E35, Ent2E36, Ent2E41, Ent2E44, Ent2E49, Ent2E51, Ent2E52, Ent2E54, Ent2E60, Ent2E63, Ent2E64, Ent2E66, Ent2K2, Ent2K3, Ent2K5
21-40 Head	Ent1E2, Ent1E3, Ent1E4, Ent1E10, Ent1E13, Ent1E23, Ent1E24, Ent1E27, Ent1E30, Ent1E31, Ent1E33, Ent1E37, Ent1E41, Ent1E42, Ent1E46, Ent1E51, Ent1E53, Ent1E54, Ent1E59, Ent1E60, Ent1K6, Ent1K7	Ent2E2, Ent2E3, Ent2E4, Ent2E5, Ent2E13, Ent2E21, Ent2E23, Ent2E24, Ent2E31, Ent2E37, Ent2E42, Ent2E46, Ent2E53, Ent2E55, Ent2E58, Ent2E62, Ent2E67, Ent2E68, Ent2K6, Ent2K7
41≥ Head	Ent1E5, Ent1E6, Ent1E7, Ent1E11, Ent1E14, Ent1E16, Ent1E19, Ent1E21, Ent1E38, Ent1E39, Ent1E40, Ent1E47, Ent1E48, Ent1E55, Ent1E56, Ent1E62, Ent1E67, Ent1E69, Ent1K71, Ent1K1	Ent2E6, Ent2E7, Ent2E11, Ent2E16, Ent2E19, Ent2E38, Ent2E39, Ent2E40, Ent2E47, Ent2E48, Ent2E56, Ent2E69, Ent2E71, Ent2K1

Table 2. *Capacity utilization rates according to fattening periods*
Tablo 2. *Besi dönemlerine göre kapasite kullanım oranları*

Parameter	Fattening Periods							
	First Fattening Period Decision Making Units Scale				Second Fattening Period Decision Making Units Scale			
	≤20 Head	21-40 Head	41≥ Head	All	≤20 Head	21-40 Head	41≥ Head	All
DU Amount (Number)	37	22	20	79	30	20	14	64
Total Breeding Animal (Head)	521	684	1455	2660	422	599	863	1884
Total Capacity (Head)	1199	1021	1840	4060	1054	1104	1336	3494
Capacity Utilization Rate (%)	43.45a	66.99a*	79.08a*	65.52a**	40.04a	54.26b*	64.60b*	53.92b**
*a, b: The difference between groups with different letters in the same row and the same scale are significant; * P<0.001; ** P<0.05*								

Table 3. *EMS package program performance scores with the super efficiency command for the first and second fattening periods decision making units*
Tablo 3. *Birinci ve ikinci besi döneminde karar verme birimlerinin süper etkinlik komutuyla EMS paket programı performans skorları*

DMU	Performance Score (%)	DMU	Performance Score (%)	DMU	Performance Score (%)	DMU	Performance Score (%)	DMU	Performance Score (%)	DMU	Performance Score (%)
Ent1E1	105.07	Ent1E25	95.85	Ent1E49	102.91	Ent1K2	108.66	Ent2E22	116.60	Ent2E49	92.23
Ent1E2	121.37	Ent1E26	93.80	Ent1E50	100.90	Ent1K3	111.46	Ent2E23	101.81	Ent2E51	100.00
Ent1E3	129.81	Ent1E27	106.86	Ent1E51	111.01	Ent1K4	106.35	Ent2E24	101.68	Ent2E52	124.98
Ent1E4	109.08	Ent1E28	99.50	Ent1E52	112.12	Ent1K5	107.48	Ent2E25	106.25	Ent2E53	98.38
Ent1E5	111.24	Ent1E29	96.52	Ent1E53	105.81	Ent1K6	99.76	Ent2E26	100.99	Ent2E54	106.56
Ent1E6	112.09	Ent1E30	168.24	Ent1E54	86.19	Ent1K7	133.13	Ent2E27	131.39	Ent2E55	104.53
Ent1E7	170.43	Ent1E31	105.82	Ent1E55	125.24	Ent1K8	130.86	Ent2E28	112.48	Ent2E56	87.70
Ent1E8	101.44	Ent1E32	119.14	Ent1E56	115.61	Ent2E1	92.04	Ent2E29	113.35	Ent2E58	91.70
Ent1E9	92.53	Ent1E33	110.75	Ent1E57	107.60	Ent2E2	103.32	Ent2E31	97.22	Ent2E60	93.10
Ent1E10	112.22	Ent1E34	105.35	Ent1E58	114.35	Ent2E3	99.89	Ent2E32	117.25	Ent2E62	107.42
Ent1E11	110.57	Ent1E35	90.54	Ent1E59	113.11	Ent2E4	100.14	Ent2E33	122.43	Ent2E63	154.05
Ent1E12	90.52	Ent1E36	109.16	Ent1E60	100.67	Ent2E5	84.24	Ent2E34	90.64	Ent2E64	100.00
Ent1E13	122.93	Ent1E37	109.25	Ent1E61	115.86	Ent2E6	113.39	Ent2E35	93.88	Ent2E66	94.53
Ent1E14	240.32	Ent1E38	115.95	Ent1E62	110.71	Ent2E7	162.08	Ent2E36	103.36	Ent2E67	110.79
Ent1E15	93.29	Ent1E39	111.86	Ent1E63	135.31	Ent2E8	145.45	Ent2E37	97.15	Ent2E68	107.53
Ent1E16	126.39	Ent1E40	111.33	Ent1E64	96.60	Ent2E9	120.81	Ent2E38	100.59	Ent2E69	91.78
Ent1E17	122.67	Ent1E41	126.00	Ent1E65	126.52	Ent2E10	85.59	Ent2E39	98.74	Ent2E71	113.96
Ent1E18	101.37	Ent1E42	103.79	Ent1E66	84.24	Ent2E11	126.30	Ent2E40	106.70	Ent2K1	107.61
Ent1E19	112.01	Ent1E43	92.38	Ent1E67	116.27	Ent2E12	100.00	Ent2E41	104.79	Ent2K2	125.36
Ent1E20	97.29	Ent1E44	89.57	Ent1E68	102.03	Ent2E13	101.69	Ent2E42	89.22	Ent2K3	103.09
Ent1E21	116.59	Ent1E45	83.12	Ent1E69	93.84	Ent2E15	113.45	Ent2E44	101.55	Ent2K5	101.87
Ent1E22	106.89	Ent1E46	111.41	Ent1E70	97.73	Ent2E16	102.74	Ent2E46	98.38	Ent2K6	85.58
Ent1E23	106.96	Ent1E47	103.93	Ent1E71	123.11	Ent2E19	104.76	Ent2E47	98.31	Ent2K7	104.35
Ent1E24	109.85	Ent1E48	121.69	Ent1K1	148.50	Ent2E21	102.92	Ent2E48	106.26	-	-

In the decision making units first fattening period while the scale grows the performance score rises, it declines in the second fattening period. In addition, performance scores differences while between small scale decision making units and other scale decision making units in the first fattening period, between large scale decision making units and other scale decision making units in the second fattening period and are statistically significant (P<0.05). On the other hand, when the two fattening periods are compared according to the scales
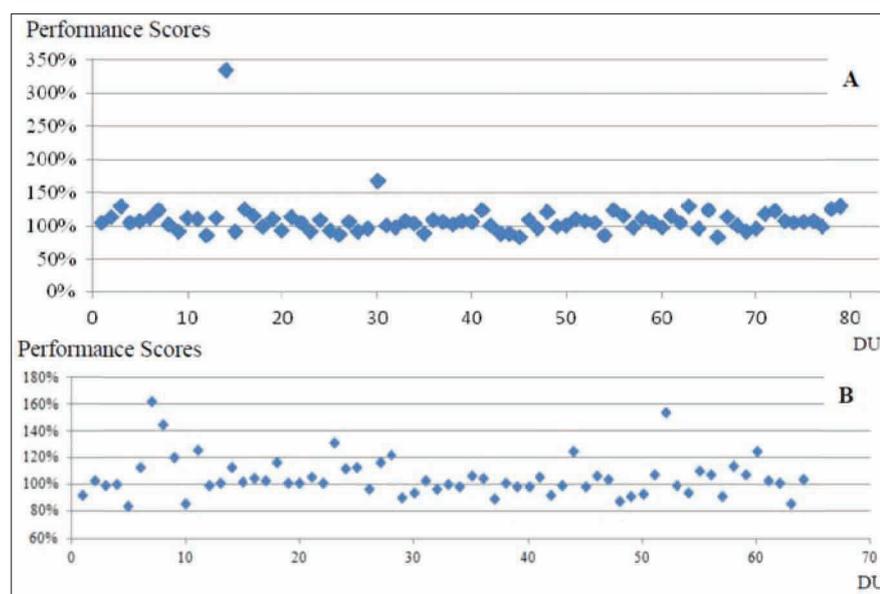
Fig 1. The scatter diagram for the first (A) and the second (B) fattening period performance scores

Şekil 1. Birinci (A) ve ikinci (B) besi dönemine ait performans skorları serpilme diyagramı

Table 4. *The evaluation of decision making units performance scores according to in the first and the second fattening periods*
Tablo 4. *Birinci ve ikinci besi döneminde karar verme birimlerinin performans skorlarının ölçeklerine göre değerlendirilmesi*

Decision Making Units Scale	Fattening Periods							
	First Fattening Period				Second Fattening Period			
	n	Performance Score (S±SE)	Inefficiency Decision Making Units		n	Performance Score (S±SE)	Inefficiency Decision Making Units	
			Number	(%)			Number	(%)
≤20 Head	37	103.97±2.02a†	15	40.54	30	108.94±2.94a†	7	23.33
21-40 Head	22	113.82±3.43b†	2	9.09	20	99.40±1.58a‡	9	45.00
41≥ Head	20	124.88±7.06b†	1	5.00	14	94.13±4.84b‡	4	28.57
Total	79	112.01±2.40†	18	22.79	64	105.89±1.86‡	20	31.25

a, b: The differences between groups in the same column bearing different letters are significant (P<0.05); †‡: The differences between groups with different icons on the same line are significant (P<0.05)

the differences between medium and large scales' decision making units performance scores are found to be significant (P<0.05).

DISCUSSION

Within the scope of the study, the first survey application done with intensive cattle fattening enterprises for the first fattening period on October 2009 began a rising trend across Turkey with the red meat prices starting with mutton prices. As of the year 2009 in Turkey live animal and carcass meat imports are not in question. However, to balance the rising red meat prices on April 30, 2010 lowering customs tax rates opened the way for live animal and carcass meat imports. On the other hand, on June 2010 the TAR-ET project was repealed [1,3,21,22].

As a result of these developments the operating 15 businesses in the first period, when the survey was applied, withdrew from this branch of production in the second fattening period, and the 64 enterprises with ongoing efficiencies capacity utilization rates on average were reduced by 17.71%.

Intensive cattle fattening enterprises quitting this business or continuing by reducing capacity; fattening material prices demonstrating extreme increases, as of the date of the study the uncertainty of the continuation of live animal and red meat imports, the increase in concentrated feed, and lack of incentives can be shown as reasons.

Aydin at al.[22] and, Aydin and Sakarya [1] reported that due to the excessive rise of costs in red meat in 2010, the general sum of the costs of fattening material shares increased proportionally, in other words the absolute value of fattening material costs according to other input elements increased more. The same study found that the period in which price increases in red meat happened, the prices of live animal that are also fattening material increased by approximately 50%.

According to the performance scores in the study, while in the first fattening period, 22.79% of the decision making units (18 DMU) are not efficient, in the second fattening period the inefficient decision making

units rate rises to 31.25% (20 DMU). Also the first fattening period decision units average performance score was calculated 5.78% more compared to the second fattening period decision making units.

At the end of the first fattening period decision making units who find a possibility to sell carcass meat high priced which is the product of livestock efficiencies, while entering the second fattening period (October 2010) in spite of buying high priced fattening material, at the end of the import the price balancing carcass meat was sold close to the price of the first fattening period [22]. The cost of fattening material in a cattle fattening enterprise makes up about 45%-55% of the total cost [3] when taken into consideration it is possible to say that the second fattening period decreases the profitability of the decision making units. On the other hand, considering the first fattening period in the second fattening period; the average feed costs per animal via current prices, labor and vet health expenditures have increased. Indeed, some of the literature resources report that one of the most important elements that directly affect the profitability of the business is the cost of fattening material [23]. This case also supports the findings of the research.

The research shows that in the first fattening period as the DMU scale grow the performance score average increases, whereas in the second fattening period it decreases remarkably. On the other hand, according to the first fattening period in the second fattening period medium and large scale decision making units differences between; capacity utilization rates (P<0.001) and average performance scores (P<0.05) are significant.

The capacity of business identified as the ability and opportunity to produce the goods or services of a business being described with a certain measure is large in importance. The capacity utilization rate being low is especially known to have an increasing effect on operating costs [24]. As the capacity utilization rate increases the businesses fixed assets are used more efficiently and fixed costs such as labor, general administrative expenses, building amortization per unit of animal are reduced.

As a result; compared to the first fattening period in the second fattening period from the cost elements the fattening material costs increased by approximately 50%, however, the carcass meat sales revenue did not show the same rate in increase. Compared to the first fattening period in the second fattening period especially medium and large scale decision making units due to the fall in capacity utilization rates fixed costs per unit of animal have increased. The increase in the number of inefficient decision making units in the the second fattening period; excessive rise in the cost of fattening material, according to the rise in the price of fattening material low carcass meat prices and capacity utilization rates are thought to have caused the falling.

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