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Araştırma Notu / Short Note

Profitability and Productivity Analysis of Fishery Enterprises in Lake Durusu (Terkos)

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Özet: ***Durusu (Terkos) Gölü Balıkçı İşletmelerinin Karlılık ve Verimlilik Analizi.*** Bu araştırma, Durusu Gölü balıkçı işletmelerinde kullanılan üretim faktörlerinin dağılımlarını ve kaynak kullanım etkinliğini tespit etmek, optimum kaynak kullanımını sağlayarak karlılık ve verimliliği yükseltmek için alınabilecek önlemleri belirlemek amacıyla yapılmıştır. Çalışmanın materyalini gölde tüm balıkçı işletmelerinden (23 adet) 2006-2007 yılları arasında anket yoluyla elde edilen veriler oluşturmaktadır. Balıkçı işletmelerinin değerlendirilmesinde Cobb-Douglas üretim fonksiyonu kullanılmıştır. Yapılan çoklu regresyon analizi sonucuna gore balıkçı işletmelerinde ölçeğe göre artan verim tespit edilmiştir. Girdilerin marjinal verimliliği işçilikte 2.15 TL, kumanya -1.62 TL, yakıt 1.81 TL, bakım – onarım 1.16 TL, sermaye amortismanı 2.73 TL ve diğer masraflar 2.88 TL olarak belirlenmiştir. İşletmelerin verimlilik değerleri gerçek ve tahmini üretim değerleri kullanılarak hesaplanmış ve ortalama verimlilik 102.48 olarak belirlenmiştir. İşletmelerin karlılık oranları hesaplanmış ve ortalama karlılık 1.50 olarak belirlenmiştir.

Anahtar Kelimeler: Durusu Gölü, su ürünleri, karlılık, verimlilik, cobb-douglas üretim fonksiyonu.

Abstract: Present investigation was performed with the aim of determine the distribution of production factors and to determine the efficiency of resource utilization and determine to take measures for raising of productivity by providing optimum resource utilization which were used in the fishery enterprises in Lake Durusu. Materials of the investigation was constituted on data provide from all fishery enterprises (23 piece) in the lake by questionnaire between 2006 and 2007. In the evaluation of the fishery enterprises Cobb-Douglas Production Function were used. According to the results of the multi regression analysis, increasing returns to scale in the fishery enterprises were determined. Marginal productivity of inputs were determined as 2.15 TL for labor, -1.62 TL in food, 1.81 TL in fuel, 1.16 TL in maintenance –repair, 2.73 TL in capital depreciation and 2.88 TL in other expense. Productivity values of enterprises was calculated by using real and estimated production values and average productivity were determined as 102.48. Profitability rate of the enterprises was calculated and average profitability determined as 1.50.

Key Words: Lake Durusu, aquatic products, profitability, productivity, cobb-douglas production function.

Introduction

Researches on lake fishery enterprises are concentrated mostly on the properties of fishing, socio-economic structures of fishermen and their problems. Researches about profitability and productivity analysis of lake fishery enterprises are insufficient.

Profitability and productivity of lake fishery enterprises in Turkey have not been studied. The studies that were carried out are based on sea fishing and they are limited in number. The first study in this field is profitability and productivity analysis of enterprises in Eastern Black Sea region and their production, marketing and organization problems. In the present study was made by 167 fishery enterprises. As a result of analyses on partial productivity rates of enterprises in the region was calculated as 3-3 050 ton/vessel per vessel, 10.50-14.52 kg/day per worked day, 108-22 875 kg/HP per engine power and 750-101 666 kg/person per labor (man power- work force). The most important factors effected on productivity of fishery enterprises in the region was indicated as marketing, credit with organization and finance (Aral, 1977). In another study with fishery enterprises of Marmara region was made by 156 enterprises. As a result of analyses on productivity amount was calculated as 5474.20-15781.40 kg/vessel per vessel, 21.60-71.40 kg/day per worked day, 249.30-385.50 kg/HP per engine power and 1642.70-3493.90 kg/person per labor (Soylu, 1992). Profitability and Productivity Analysis in Lake Durusu (Terkos) Fishery Enterprises' is the first in this field. To make profitability and productivity analyses of lake fishermen in Turkey, the first step has been realized by the present study.

Material and Methods

In this study, profitability and productivity of fishery enterprises located on Durusu (Terkos) Lake in the Marmara Region have

[1] This paper was presented in EIFAC (EUROPEAN INLAND FISHERIES ADVISORY COMMISSION, FAO), Symposium on Interactions between Social, Economic and Ecological Objectives of Inland Commercial and Recreational Fisheries and Aquaculture, Antalya, Turkey, 21-24 May 2008

done. There are 23 fishery enterprises in lake. In this study full enumeration method is used.

With this aim, 23 fishery enterprises were investigated. For the research, questionnaires were prepared, and these forms were filled while visiting these fishery enterprises every three months between 2006 and 2007.

To make profitability analysis of production, Cobb-Douglas production function relation has been used. Cobb-Douglas production function relation was preferred as it is suitable for data, easier for calculations and it gives enough freedom with rates even in small numbers (Heady and Dillon, 1967; Öney, 1968; Yasankul, 1974; Aral, 1977; Smith, 1981; Wattanutchariya and Panayotou, 1981; Chong and Lizarondo, 1981; Shang, 1990; Soylu, 1992).

In Cobb-Douglas equation;

$$Y = f\left(x_1^{b_1}, x_2^{b_2}, \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots x_n^{b_n}\right)$$

Table 1. Variable definitions and measurement units for the empirical model

Variable	Definition	Unit
Y	Output	TL
X1	Labour	TL
X2	Food	TL
X3	Fuel	TL
X4	Maintenance-repair	TL
X5	Capital depreciation	TL
X6	Other	TL

b_i over in equation shows the production elasticity. The total production elasticity values give the returns to scale. Estimation of returns to scale is important because it indicates at what scale firms are most efficient. In the Cobb-Douglas model, if the sum of the coefficients is larger than one, the production function has increasing returns to scale. If the sum of the coefficients is less than one, returns to scale are decreasing, while if they are equal to one, there are constant returns to scale (Bayramoğlu and Direk, 2006; Çelik ve Bayramoğlu, 2007; Karkacier, 2001; Almeida et al., 2000; Varian, 1993).

Regression analysis is used to determine the relation between two or more variables with cause and effect relation. In regression analysis independent variables are examined in relation to dependant ones. "Y" refers to the determination over (R^2), which means the dependant variant expression rate while it shows what percentage the independent total values has in dependant variable total value.

Cobb-Douglas type over function marginal productivity and averages were calculated using the following modals. As logarithmic change is used in Cobb-Douglas production function the averages of X_i and Y are geometrical averages (Karkacier, 2001).

$$MP_1 = b_i \frac{\bar{Y}}{\bar{X}_i} \qquad AP_1 = \frac{\bar{Y}}{\bar{X}_i}$$

Fishery enterprises' profitability indexes have been calculated by dividing actual production values of enterprises to estimated production value.

Productivity calculations per vessels, working days, engine power and labor force have been done and they are given in the tables.

Results and Discussion

Inputs in Fish Production

In fishing enterprises the most important input are firstly labor, fuel, capital depreciation, food whereas maintenance-repair and other inputs are secondarily important.

Fishing enterprises operational costs include % 36.90 labor cost coming first, % 18.35 fuel cost being the secondarily, and % 17.61 capital depreciation the third and % 10.62 covering the other costs as the fourth.

Average and Marginal Product Total Values in Fish Production

Table 1 shows 2006-2007 averages of Fishery enterprises, fish production parameters in fish production and multiple regression analysis.

Table 2. The values obtained from production and input applied with Cobb-Douglas equation

Variables	b_i	*Adjusted* b_i	*Geomean Log.*	*Geomean Antilog. (TL)*	*t*	*AP (Y/Xi) (TL)*	*MP (bi* AP) (TL)*
$\bar{Y}$			4.03	10 790.00			
X_1	.526	.463	3.42	2 639.58	1.942	4.09	1.89
X_2	-.077	-.071	2.71	512.60	-.424	21.05	-1.49
X_3	.219	.208	3.11	1 302.15	.959	8.29	1.72
X_4	.062	.041	2.76	576.74	.358	18.71	.77
X_5	.302	.207	3.08	1 194.78	1.377	9.03	1.87
X_6	.110	.249	2.61	411.97	1.811	26.19	6.52

R^2 = %86.90 Adjusted R^2 = %82.00, F= 17.709 Sig=.000, Durbin-Watson=1.592

In analyses associated with parameters located in the model has been determined any problem on heteroscedasticity, multicollinearity and autocorrelation.

In the estimated function, the total over b_i values is 1.14, with one point increase in the independent variables in the function, fish production increases 1.14 rate and this means higher income in production function.

The estimated and calculated regression analysis production values and indexes following the regression analysis in Fishery enterprises are given in (Table 2).

Functional Profitability Rates in Fishery Enterprises

The rates and indexes that supply total profitability in Fishery enterprises were calculated and shown in Table 3.

Table 3. The estimated and functional production values and indexes in fishery enterprises

Enterprise Nr	X_1	X_2	X_3	X_4	X_5	X_6	*Y (TL)*	*Ỳ (TL)*	*Y/Ỳ*	*Indexes*
1	822	190	346	424	471	122	3 000.00	3 056.89	98.14	95.76
2	2 465	569	847	447	707	122	8 538.15	6 906.53	123.62	120.63
3	2 465	569	2 117	748	1 702	245	11 905.88	12 263.09	97.09	94.73
4	2 191	506	753	548	897	173	8 763.56	7 217.22	121.43	118.48
5	5 879	1 315	2 540	548	1 677	6 011	25 171.41	2 6273.63	95.80	93.48
6	2 465	569	1 270	648	969	200	4 929.50	8 966.44	54.98	53.64
7	7 120	1 424	2 446	748	1 626	5 965	24 320.77	28 902.14	84.15	82.11
8	3 012	696	2 070	748	1 699	274	8 520.56	13 509.52	63.07	61.54
9	2 739	632	2 352	2 598	1 506	274	16 733.20	13 863.73	120.70	117.77
10	6 573	465	2 258	548	1 742	9 139	41 046.32	31 147.27	131.78	128.59
11	5 751	1 485	1 976	592	1 746	245	18 186.53	17 399.63	104.52	101.99
12	2 465	636	1 270	648	1 134	224	6 971.37	9 437.57	73.87	72.08
13	2 465	753	2 117	693	2 053	5 372	22 045.41	17 770.11	124.06	121.05
14	1 643	355	706	447	831	173	7 348.47	6 066.66	121.13	118.19
15	1 917	271	494	447	588	245	5 294.15	5 813.40	91.07	88.86
16	1 643	294	706	346	613	173	5 339.66	5 526.12	96.63	94.28
17	2 191	310	941	474	685	194	8 000.00	7 276.63	109.94	107.28
18	2 465	882	1 270	636	1 608	274	13 042.24	10 446.24	124.85	121.82
19	2 121	512	941	748	1 700	235	11 124.30	9 517.88	116.88	114.04
20	4 930	697	4 234	548	1 086	173	22 045.41	16 669.40	132.25	129.04
21	822	147	865	283	2 030	122	5 692.10	5 774.18	98.58	96.19
22	2 191	310	941	346	1 204	173	8 000.10	8 358.72	95.71	93.39
23	4 409	349	2 117	648	1 653	4 486	18 000.00	23 405.07	76.91	75.04

Productivity in Fishery Enterprises

Physical values were used for functional productivity in fishery enterprises. Therefore, for the productivity analysis of the enterprises;

Production amount for per engine power,

Production amount for per fishing day,

Production amount for per fishery enterprise,

Production amounts for per labor force were calculated and given in Table 4.

There are no studies deal with profitability and productivity analyses on lake fishermen in Turkey therefore only results of the article was discussed in this section.

As a result of the analysis the total elasticity was found as 1.14. That means % 1 increase in the total input refers to %1.14 increase in fish production.

On condition that other production factors are fixed, when labor input is increased % 1 fish production is increased %0.53. In the same way, when capital depreciation is concerned, fish production is increased by %0.30. Another important issue is when 1 TL marginal input is given, how much aquatic product increase is obtained.

Table 4. Total profitability rates and indexes in Fishery enterprises

Enterprises Nr.	*Y/İ*	*Indexes*
1	1.26	84.40
2	1.66	110.60
3	1.52	101.37
4	1.73	115.54
5	1.40	93.59
6	0.81	53.80
7	1.26	84.06
8	1.00	66.98
9	1.66	110.68
10	1.98	132.32
11	1.54	103.02
12	1.09	73.04
13	1.64	109.49
14	1.77	118.14
15	1.34	89.27
16	1.41	94.49
17	1.67	111.48
18	1.83	122.13
19	1.78	118.78
20	1.89	126.24
21	1.33	89.08
22	1.55	103.48
23	1.32	88.03

Table 5. Engine power, fishing day, vessel and labour force productivity in fishery enterprises

Enterprises Nr.	*kg/HP*	*kg/day*	*kg/vessel*	*kg/person*
1	74.54	22.36	670.82	670.82
2	272.74	21.21	1 909.19	1 909.19
3	98.60	29.58	2 662.24	2 662.24
4	130.64	24.49	1 959.59	1 959.59
5	208.46	46.90	5 628.50	2 814.25
6	61.24	12.25	1 102.27	1 102.27
7	247.20	41.83	5 438.29	2 719.15
8	86.60	17.32	1 905.26	1 905.26
9	116.93	37.42	3 741.66	3 741.66
10	417.19	76.49	9 178.24	4 589.12
11	476.29	122.47	12 859.82	6 429.91
12	135.55	17.32	1 558.85	1 558.85
13	144.99	54.77	4 929.50	4 929.50
14	182.57	27.39	1 643.17	1 643.17
15	118.38	16.91	1 183.81	1 183.81
16	183.69	19.90	1 193.98	1 193.98
17	178.89	22.36	1 788.85	1 788.85
18	91.14	32.40	2 916.33	2 916.33
19	92.13	49.75	2 487.47	1 243.73
20	428.65	27.39	4 929.50	4 929.50
21	50.91	42.43	1 272.79	1 272.79
22	137.60	22.36	1 788.85	1 788.85
23	149.07	44.72	4 024.92	2 012.46
Average: 177.57	Average:36.09	Average: 3 338	Average:2 476.75	

In labor input lake fishery average productivity values were found to be 4.09. This value is multiplied by b_1 elasticity value to find marginal productivity value 2.15. That means 1 TL marginal labor provides 2.15 TL marginal aquatic products output. In return for 1 TL capital depreciation increase, 2.73 TL value aquatic product output is achieved. On the other hand, it should not be forgotten that the input which is defined as other variables and includes the inputs such as fish sale tax, fees and fishing license costs, must be regarded as changeable and highly dependent on the total value rather than be considered as cause variable in output.

Based on the explanations above, when Durusu (Terkos) calculated input value marginal costs total relations are evaluated, the following important results can be obtained.

There is instability in terms of source use in the enterprises that are focused on. The marginal productivity values of the input used in production have been found to be different from 1. This case can be evaluated as that the optimum inputs forming the base of the aquatic products are benefited far from satisfactory.

As it can be seen in Table 2, when the fishery enterprises product output index average is accepted as 100, it is much easier to see how diverted they are from the average values. The enterprises have diverted from the average between +29.04 and -46.36. As it can be understood from the table, the enterprise number 6 reaches the lowest productivity level, while the enterprise number 13 reaches the highest productivity. % 43.48 of the enterprises have the productivity level above the average.

Cost value rate shows how much profit the enterprise has in return for one unit input. As it is seen in Table 3, cost value rate of the enterprises changes between 0.81 and 1.98. The average cost value of the enterprises has been found to be 1.50. Of the % 56.52 of the enterprises, cost value rate has been proved to be over this value.

As it can be seen in Table 5, Durusu (Terkos) fishery enterprises show different productivity levels for daily fishing per vessel, engine power and labor.

When the Table 4 is examined, partial productivity for per vessel ranges from 670.82 kg to 12 859.82 kg. Productivity average in the area enterprises has been calculated to be 3 338.00 kg/vessel.

In the enterprises investigated, daily productivity for the fishing days has been seen to range from 12.25 to 122.47 kg. Productivity average of these enterprises has been calculated as 36.09 kg/day.

Engine power productivity ranges from 50.91 kg to 476.29 kg. The average of the enterprises is 177.57 kg/HP.

Labor productivity ranges from 670.82 to 6 429.91 kg. Labor productivity average has been calculated to be 2 476.75 kg/person for these enterprises.

Productivity indexes per vessel ranges from +285.26 to -79.90. The enterprise number 11 has reached the highest physical productivity for per vessel, while number 1 has the lowest productivity level.

Productivity indexes for per engine ranges from +168.23 to -58.02. The highest productivity for per engine belongs to the enterprise number 11, but the lowest value belongs to the enterprise number 1.

Productivity indexes for per fishing day range from +239.38 to -66.06. Per day the enterprise number 11 achieves the highest fishing productivity, while the enterprise number 6 has the lowest productivity level.

Productivity indexes for per person ranges from +159.61 and -72.92. The highest productivity level for per person belongs to the enterprise number 11 whereas the enterprise number 1 has the lowest productivity level.

Fishermen of the Terkos Lake have not got any education about fishing. Because of this, instead of scientific fishing methods the traditional fishing methods (from father to son) are being applied (Soylu ve Uzmanoğlu, 2003). Besides, these fishermen are fishing small sized fishes which are not suitable to their fishing circular. In order to have the lake fishermen to make affective fishing, the institutions like Ministry of Agriculture and Universities related to the subject must arrange seminars, courses, etc.

Fishermen of the Terkos Lake generally do the fishing for a secondary job, and this prevents the fishermen to make a profitable and efficient job. Fishing must be made desirable by subsidizing.

Per capita aquatic products consumption in Turkey is 7.81kg and this amount must be increased (Anonymous, 2010). With this purpose, for a more qualified and high living

standard attempts on raising awareness must be concentrated.

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