Economic Rationality Analysis of Forestry Sector with Econometric Methods (The General Directorate of Forestry Case)

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Abstract

Economic rationality, defined as achieving a certain outcome with minimum spending, is important in ensuring the economic sustainability of the General Directorate of Forestry (GDF), which is responsible for the administration and operation of forests. Thus, the present study aimed to determine economic rationality, which is important for the sustainability of the GDF and statistically determine whether variables such as productive forest area, non-productive forest area, class wood revenues, etc., which have economic significance for forestry affect economic rationality. Study data were obtained from the GDF Directorate of Administrative and Financial Affairs, the Directorate of Enterprise and Marketing and the Directorate of Strategy Development. The main material included the 2013, 2014 and 2015 current capital budget data obtained from the GDF Directorate of Administrative and Financial Affairs. The analyses conducted for the presented years demonstrated that the economic efficiency of GDF was below 1 in only 2013. However, relational statistical analyzes were conducted between the 19 variables and economic rationality. As a result, 8 models were determined and the effects of the variables on the economic rationality of GDF were interpreted.

Keywords: Economic rationality, econometric analyses, General Directorate of Forestry, Turkish forestry sector.

Ormancılık Sektörünün Ekonometrik Yöntemler Yardımıyla İktisadi Çözümlemesi (Orman Genel Müdürlüğü Örneği)

Öz

Belirli bir sonuca en az masrafla ulaşmak olarak tanımlanan iktisadilik, orman alanlarını yönetmek ve işletmekle sorumlu olan Orman Genel Müdürlüğü (OGM)'nün ekonomik sürekliliğinin sağlanmasında önemli olmaktadır. Bundan dolayı, bu çalışma ile, OGM sürekliliğinde önem arz eden iktisadiliğin ve ormancılıkta ekonomik açıdan etkili olan; verimli orman alanı, verimsiz orman alanı ve sınıf odunu satış gelirleri vb. değişkenlerin iktisadiliği etkileyip etkilemediğini istatistiksel olarak ortaya koymak amaçlanmaktadır. Çalışma amacına ulaşmak için kullanılan veriler; OGM İdari ve Mali İşler Dairesi Başkanlığı'ndan, İşletme ve Pazarlama Dairesi Başkanlığı'ndan ve Strateji Geliştirme Dairesi Başkanlığı'ndan temin edilmiştir. Çalışmanın ana malzemesini OGM İdari ve Mali İşler Dairesi Başkanlığından temin edilen; 2013, 2014 ve 2015 yılı döner sermaye bütçe verileri oluşturmaktadır. İlgili yıllar için yapılan çözümlemeler neticesinde OGM'nin iktisadiliğinin sadece 2013 yılında 1'in altında kaldığı görülmüştür. Bununla birlikte, belirlenen 19 değişken ile iktisadilik arasında istatistiksel analizler yapılmış, yapılan analizlerin sonucunda 8 model ortaya koyulmuş ve değişkenlerin OGM'nin iktisadiliği üzerindeki etkisi yorumlanmıştır.

Anahtar Kelimeler: İktisadilik, ekonometrik çözümlemeler, Orman Genel Müdürlüğü, Türkiye ormancılık sektörü.

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1. Introduction

The forestry sector, which is one of the 64 industries in Turkish economy, aims to preserve and expand the forests, ensure the versatile operation of the forests based on social, economic and technical concerns, continuously fulfill the demand for forestry products and services, taking necessary measures to reduce the negative pressures of the villagers living in and around the forests (MEF, 2004; MD, 2014). It is imperative for the forestry sector to comply with the rational principles laid out by the science of economics to effectively achieve the abovementioned objectives and sustain its existence. One of the principles of rationality that aims to earn the maximum profit with the least labor and spending is the principle of economic rationality (Türker, 2013). This concept is also referred as business rationality in the literature, and it provides a judgment on whether the conducted businesses and transactions were economically rational (Miraboğlu, 1983). Economic rationality is the ratio of the sale revenues that business earns as a result of the production of goods and services to the costs incurred in the stated process, and it reflects the rationality of the business, in other words, the economic expediency of the business (Daşdemir, 2011).

On the other hand, forestry activities in Turkey are mostly undertaken by the General Directorate of Forestry (GDF) that operates under the Ministry of Forestry and Water Management. This study was carried out on the basis of GDF, which is responsible for the administration and operation of the forest resources, which is also subject to state ownership and management at the rate of 99.99% and which has important functions both for the national economy and for the benefit of all living beings. The objective of the study was to determine the success rate of the GDF with a certain cost and to statistically determine whether the variables such as efficient forest area, inefficient forest area, tree assets and timber class sales revenues affected economic rationality.

2. Material and Method

The main study material included the 2013, 2014 and 2015 current capital budget data obtained from the GDF Directorate of Administrative and Financial Affairs. Current capital budget data were obtained from GDF Directorate of Administrative and Financial Affairs, the Directorate of Enterprise and Marketing and the Directorate of Strategy Development. Data on the study variables for use in the econometric analysis (efficient / inefficient forest area, assets, planted and final warehouse sales amounts, etc.) were obtained from the General Directorate of Forestry, Directorate of Enterprise and Marketing and Directorate of Strategy Development Furthermore, the Turkish National Forestry Program, Forestry Specialization Commission Report and articles and papers on both the forestry sector were also examined within the scope of the present study.

In the present study, the following equation was used to determine the economic rationality, which is expressed as the ratio obtained by dividing the total value of the goods or services produced by the enterprises (the sales revenues) by the sum of the costs spent for this production (Miraboğlu, 1983).

$$\text{Economic Rationality} = \frac{\text{Revenues}}{\text{Costs}} = \frac{\text{Income}}{\text{Expenses}} = \frac{\text{Production x Price}}{\text{Expenses}} \qquad (\text{ I })$$

Furthermore, in the present study, "regression analysis" method was also used to investigate the correlations between the economic rationality of the GDF and the variables such as total revenues, total expenditures, productive-unproductive forest areas, class wood sales volume, etc. Regression analysis is a solution that responds to questions about the dependence of a response value on one or more determinants that contain the future value of the response, and predicts the effect of the change of a determinant or an intervention on that response value (Weisberg, 2005). It is also possible to define the regression analysis as a means to predict or estimate the dependence of one dependent variable on other explanatory variable(s), the mean of the primary (population), the known or unchanged values of the secondary(ies) (Şenesen and Şenesen, 1999). On the other hand, the total revenues and total expenditures that directly affect the economic rationality and the sub items of these variables were taken into consideration individually in regression analysis. Hence, different regression equations or models were generated to study these items separately.

2.1. Determination of The Scope and Timeframe of The Study

According to Article 169 of the Turkish Constitution, the administration and operation of Turkish forests should be conducted by the state. Today, this task is largely undertaken by the GDF that operates under the Ministry of Forestry and Water Management and 243 State Forestry Enterprise that function under 28 Regional Directorate of Forestry offices, which are the provincial units of GDF. The present study scrutinized the GDF, which is

responsible for the administration and management of forest resources. However, the dataset used for statistical analyses was generated based on the 27 Regional Directorate of Forestry offices since Çanakkale Forest Regional Directorate was an exploitation directorate during the study timeframe.

On the other hand, the data that covered a 3-year period (2013, 2014 and 2015) were used in the present study, since the databases did not include the data for 2012 and the previous years as a result of a restructuring conducted on General Directorate of Forestry databases in 2011.

2.2. Study Variables

For the General Directorate of Forestry, 20 variables with socio-economic value were identified and the data for these variables were coded (X1 ... X20) and saved to the computer. The determined variables and the methods used to collect the related data are presented below in the Table 1:

Table 1.Variables used in the econometric analysis.

Variable	Unit	Code	Department	Data source
Productive Forest Area	ha	X_1	GDF Strategy Development Department	Management plan development programs.
Unproductive Forest Area	ha	X_2	GDF Strategy Development Department	Management plan development programs.
Tree Assets	m^3	X_3	GDF Strategy Development Department	Management plan development programs
Annual Increase	m^3	X_4	GDF Strategy Development Department	Management plan development programs
Total Revenues	₺	X_5	Department of the Administrative and Financial Affairs	Current Capital Budget
Gross Sales Revenues	₺	X_6	Department of the Administrative and Financial Affairs	Current Capital Budget
Ordinary Revenues and Profit from Other Operations	₺	X_7	Department of the Administrative and Financial Affairs	Current Capital Budget
Extraordinary Revenues and Profits	₺	X_8	Department of the Administrative and Financial Affairs	Current Capital Budget
Total Expenses	₺	X_9	Department of the Administrative and Financial Affairs	Current Capital Budget
Cost of Sales	₺	X_{10}	Department of the Administrative and Financial Affairs	Current Capital Budget
Operating Expenses	₺	X_{11}	Department of the Administrative and Financial Affairs	Current Capital Budget
Ordinary Expenses and Losses from Other Operations	₺	X_{12}	Department of the Administrative and Financial Affairs	Current Capital Budget
Extraordinary Expenses and Losses	₺	X_{13}	Department of the Administrative and Financial Affairs	Current Capital Budget
Economic Rationality		X_{14}	Department of the Administrative and Financial Affairs	Current Capital Budget
Class Wood Sales Revenues	₺	X_{15}	GDF Directorate of Business and Marketing	Production Department sales tables
Planted Auction Sales Revenues	₺	X_{16}	GDF Directorate of Business and Marketing	Production Department sales tables
Planted Allocated Sales Revenues	₺	X_{17}	GDF Directorate of Business and Marketing	Production Department sales tables
Last Warehouse Auction Sales Revenues	₺	X_{18}	GDF Directorate of Business and Marketing	Production Department sales tables
Last Warehouse Allocation Sales Revenues	₺	X_{19}	GDF Directorate of Business and Marketing	Production Department sales tables
Last Warehouse Discounted Sales Revenues	₺	X_{20}	GDF Directorate of Business and Marketing	Production Department sales tables

3. Results

3.1. Economic Rationality Analysis

Based on 2013 current capital budget realizations, GDF total revenues was 2.033.468.192 Ł and total expenses was 2.064.550.240 Ł (GDF, 2013a) and 2013 economic rationality was calculated as 0,98 with Equation I (Table 2). Moreover, it was determined that GDF had a total income of 2.349.020.592 Ł and an expense of 2.201.561.303 Ł in 2014 (GDF, 2014). Based on the data above, the economic rationality was calculated as 1,07 for 2014 (Table 2). An analysis of the 2015 financial books of GDF, the highest state department responsible for forestry operations, demonstrated that the total revenues were 2.720.158.559 Ł and the expenditures were 2.494.649.424 Ł (GDF, 2015) and the economic rationality, calculated with the ratio of revenues to expenditures, was 1,09 (Table 2). Three-year economic rationality for the GDF demonstrated that only the 2013's ratio was below 1.

Table 2. Annual total revenues, total expenditures and economic rationality of GDF.

Years	Total Revenues (Ł)	Total Expenditures (Ł)	Economic Rationality
2013	2.033.468.192	2.064.550.240	0,98
2014	2.349.020.592	2.201.561.303	1,07
2015	2.720.158.559	2.494.649.424	1,09

3.2. Econometric Analysis

As a result of the regression analysis, 8 economic rationality models were developed. These models are presented in Table 3.

Table 3. Models obtained with regression analysis.

Variable/models	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
C (constant)	0.984	1.084	1.016	0.849	1.013	0.811	0.842	0.849
X1	1.08*	1.31	1.28*	2.25	1.23*	3.37	2.46	3.15
X2	-8.26*	-1.02*	-9.76*	-7.10*	-8.55*	-6.18*	-7.06*	-7.36*
X3	-2.52	-9.25	-6.43	3.51	-3.84	5.91	3.80	3.08
X4	-1.50	5.80	-6.27	-2.70	-1.10	-3.14	-2.85	-2.71
X5				4.50	8.23	4.52	1.66	
X6	1.10							
X7		3.46						
X8			-2.30					
X9	-9.73*	-1.05*	-8.05*					
X10				-9.25				
X11					-1.18*			
X12						3.11		
X13							4.93	
X14								
X15	-1.47	1.89*	1.42	5.87	-2.68	-7.12	-1.78	8.86
X16	2.13	1.51*	1.51*	7.65	6.12	3.80	3.95	6.15
X17	-1.10	-1.83	-1.54	-2.83	-8.67	-2.37	-2.62	-2.64
X18	7.94	2.72*	1.83	1.34	1.45	1.45	2.32	2.65
X19	4.31	8.89*	1.18	-2.93	8.21	8.21	9.96	1.11*
X20	-5.24	8.02	1.12	-8.75	1.04	1.04	1.18	1.38
R-squared	0.963	0.954	0.919	0.966	0.924	0.924	0.917	0.916

*: Prob. value <0.05

Analysis of the correlation between the dependent variable of economic rationality (X14) and the independent variables presented in Model 1 above demonstrated that the total expenditures (X9), productive forest area (X1) and unproductive forest area (X2) were significant at 95% confidence level. However, it was found that X1

affected the ratio positively, while X9 and X2 affected it negatively.

Analysis of the new model that was constructed by removing the gross sales (X6) and by including the other operational ordinary revenues and profit (X7) variable demonstrated that productive forest area (X1), unproductive forest area (X2), total expenditures (X9), class wood sales revenues (X15), planted auction sales revenues (X16), and last warehouse allocated sales revenues (X19) variables were significant on economic rationality dependent variable (X14) at 95% confidence level. Furthermore, it was determined in Model 2, which was presented in Table 3, that among the abovementioned variables that were effective on economic rationality, total expenditures (X9) and unproductive forest area (X2) had a negative impact, while the other variables had positive significant effects.

Another model was obtained by substituting other ordinary operational revenues and profits (X7) with extraordinary revenues and profits (X8). In the new model, it was determined that productive forest area (X1), unproductive forest area (X2), total expenditures (X9), class wood sales revenues (X15), planted auction sales revenues (X16), last warehouse auction sales revenues (X18) and the last warehouse allocated sales revenues (X19) were significant, and all variables except X2 and X9 affected the X14 dependent variable in a positive manner (Table 3, Model 3).

Analysis of the new model constructed by substituting the total expenditures (X9) and extraordinary revenues and profits (X8) variables with the total revenues (X5) and cost of the sales (X10) variables demonstrated that only the unproductive forest area (X2) variable was effective on the economic rationality variable at the 95% confidence level and it affected the X14 variable in a negative direction (Table 3,Model 4).

In the study, another model that excluded the cost of sales (X10) variable and included operating expenses (X11) was constructed. Analysis of this model demonstrated that X14 variable was affected by the productive forest area (X1), unproductive forest area (X2) and operating costs (X11) variables at the 95% confidence level. Furthermore, it was determined in Table 3, Model 5 that the impact of X1 variable was positive and the effects of X2 and X11 variables were negative.

In the new model (Model 6), where the other ordinary operating expenses and losses (X12) variable was included and the operating expenses (X11) variable was excluded, it was determined that only the unproductive forest area (X2) variable influenced the economic rationality at the 95% confidence level and the effect was negative.

Similarly, a new model was constructed with the inclusion of the last sub-item of total expenditures, namely the extraordinary expenses and losses (X13) variable, and the constructed Model 7 demonstrated that only the independent variable of unproductive forest area (X2) was significant on the economic rationality variable (X14) at 95% confidence level, and the significance was negative.

The last model (Model 8) used in determining the variables that affected economic rationality was constructed by excluding revenue and expense items used in the calculation of economic rationality. Analysis of this final model demonstrated that the unproductive forest area (X2), planted auction sales revenue (X16) and last warehouse allocated sales revenues (X19) were significant on X14 variable at the 95% confidence level. Furthermore, it can be observed that the X2 variable affected the economic rationality in a negative direction, while the X16 and X19 variables affected the dependent variable in a positive manner.

4. Discussion and Conclusion

Forest ecosystems have benefits such as their prevalence, their share in the biomass, level of organization, extraordinary number of benefits, vital functions in energy and material provision, the size of the human mass that they are directly beneficial for, their genetic potential, etc. (Geray, 1998) Considering these benefits, economic rationality analysis is significant since it would help the sustainability of the forestry sector, which possesses 99.9% of forest resources that are at the center of sustainable development.

Based on GDF 2013, 2014 and 2015 current capital budget realizations, it was found that economic rationalities that are obtained with the ratio of total revenues to total expenditures were 0,98, 1,07 and 1,09, respectively. It can be argued that the lower than 1 economic rationality observed in 2013 was due to the restructuring of GDF in 2011 and association of non-market-oriented organizations such as General Directorate of Afforestation (GDA) and General Directorate of Forestry and Village Affairs (GDFVA) with GDF.

Whether 19 variables (X1, X2, X3….X19) had statistically significant effects on economic rationality variable was analyzed. At the same time, it was determined that 8 variables (X1, X2, X9, X11, X15, X16, X18 and X19) were effective on the economic rationality.

On the other hand, out of these 8 variables, it was determined that X2, X9 and X11 had negative and X1, X15, X16, X18 and X19 had positive effects on the dependent variable. It was determined that as the productive forest area (X1) increased, the economic rationality increased, contrary to the unproductive forest area (X2). In fact, the fact that the products cultivated in the productive forest area is abundant and better quality affected the revenues in positively and thus, the rate of economic rationality increased. On the other hand, as the unproductive forest area (X2) increased, the rate of economic rationality decreased. In other words, it can be stated that the increase of unproductive forest area reduces the rate of economic rationality since it would affect the revenues by negatively affecting the production of quality products. Furthermore, the increase in unproductive forest areas can reduce the rate of economic rationality, because it would increase the costs due to the increase in improvement activities. As the operating expenses (X11) increase, the total costs (X9) would increase and the economic rationality rate would decrease as a result. In a study conducted by GDF, it was demonstrated that the lack of sufficient supply of products in the desired quantity and quality resulted in an increasing trend in wood imports (GDF, 2013b). Thus, an increase in class wood sales revenues (X15) would increase the quantity and the prices of the product supply based on the supply of the national demand, increasing total revenues. This increase in total revenues would have a positive impact on the economic rationality. On the other hand, it was determined that as the planted auction sales revenue (X16) increased, the economic rationality increased as well. As is known, since planted sales practices are important in meeting the demands of buyers, this would affect the sale prices and increase total revenues, increasing the economic rationality. Furthermore, since planted tree sales also saves the cultivation costs of forest administration (Türker, 2013), it reduces the total expenditures and also helps increase the economic rationality rate. It can be argued that as the last warehouse auction sales revenues (X18) and the last warehouse allocated sales revenues (X19) increase, the economic rationality rate would also increase due to the increase in total revenues.

Acknowledgements

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