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BANKING EFFICIENCY IN THE EUROZONE[1]

Dr. Onur AKKAYA[2*]

ABSTRACT

In this case the focus of this analysis is on efficiencies of the Eurozone banking system and the existence of relationship between efficiency and technological change. In this context, given the focus of this paper research motivation has tested efficiency score for the Eurozone before 2008 mortgage crises. The Stochastic Frontier approach will be used for all analyses (in particular, Coelli (1995)). This analysis has used 13 different countries[3] in the Eurozone. These are descript an approximatively % 75 of the Eurozone banking system. The data set was prepared annually 1999 to 2009 by Eurostat. When we compare countries, efficiency score of Spain has the lowest efficiency all of the Eurozone. On the other hand, efficiency score of Italy and Finland share the first place. In general, half of the member countries score are above the average efficiency score. Then, small countries have more efficient score than bigger countries.

Key Words: *The Eurozone, Banking Efficiency, Stochastic Frontier Approach*

JEL Classification: *G21, G20, D2*

EUROZONE BÖLGESİNİN BANKACILIK ETKİNLİĞİ

ÖZ

Bu çalışmada, Eurozone bankacılık sisteminin etkinlik değerlerine ve etkinlik ile teknolojik gelişme arasındaki ilişkiye odaklanılmıştır. Çalışmanın ana motivasyonu 2008 krizi öncesinde Eurozone bölgesinin etkinlik değerlerinin ülke bazında karşılaştırılmasıdır. Bunun için Coelli (1995)'in Stokastic Sınır analizi kullanılmıştır. Analizde 13 farklı Eurozone ülkesi bulunmaktadır. Bu durum sistemin genelinde 75%'inden fazlasını açıklama konusunda yeterlidir. Kullanılan veri seti 1999 ile 2009 yılları arasını kapsamaktadır. Sonuçta, İspanya bölgede ele alınan dönem içinde en düşük etkinlik skoruna

[1] The first draft of this paper is presented ICOAEF 2017 conferance on 06-07 December 2017
[2] Corresponding Author.
[*] Department of International Trade and Logistics, Uniersity of Kilis 7 Aralık, onurakkaya@kilis.edu.tr
[3] Austria, Belgium, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Slovak Republic, Slovenia and Spain

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sahip iken İtalya ve Finlandiya en yüksek etkinlik değerlerine sahip durumdadır. Genel olarak yarıdan fazla ülke ortalama değerin altında bulunmuştur. Küçük ekonomili ülkeler daha büyük ekonomili ülkelerden daha etkin bulunmuştur.

Anahtar Kelimeler: *Eurozone Bölgesi, Bankacılık Etkinliği, Stokastik Sınır Yaklaşımı*

Jel Sınıflandırması: *G21, G20, D2*

1. INTRODUCTION

The Eurozone was commencing an expansion of the 2000s. The Eurozone banking system has caused to make more loans due to deregulation decisions. The Eurozone banking system experienced rapid consolidation during these years. This consolidation coincides with dramatic changes in regulation, market structure and in the use of information-processing technology by banks and their competitors. In this case the focus of this analysis is on efficiencies of the Eurozone banking system and the existence of relationship between efficiency and technological change. In this context, given the focus of this paper research motivation has tested efficiency score for the Eurozone before 2008 mortgage crises. The Stochastic Frontier approach will be used for all analyses (in particular, Coelli (1995)). This analysis has used 13 different countries[4] in the Eurozone. These are descript an approximatively % 75 of the Eurozone banking system. The data set was prepared annually 1999 to 2009 by Eurostat. In the following sections; section 2 is defied data and methodology. So, section 4 descried empirical evidence. Finally, section 5 is conclusions.

The Stochastic Frontier Approach (SFA) was the theoretical literature on productive efficiency which began in the 1950s with the work of Koopmans (1951), Debreu (1951), and Shephard (1953). Farell (1957) was the first to measure productive efficiency empirically (Drawing inspiration from Koopmans and Debreu but clearly not from Shephard). Aigner et al. (ALS hereafter) (1977) proposed a model in which errors were allowed to be both positive and negative but in which positive and negative errors could be assigned different weights. The ALS and Meeusen and van den Broeck (MB hereafter) papers are themselves very similar. Both papers were three years in the making and both appeared shortly before a third SFA paper by Battese and Corra (1977) the senior author of which had been a referee of the ALS paper. These three original SFA models shared the comprised error structure mentioned previously and each was developed in a production frontier context. Schmidt and Sickles (1984) were applying fixed effects and random effects models to estimate the efficiencies of the firms.

[4] Austria, Belgium, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Slovak Republic, Slovenia and Spain

Battese and Coelli (1995) proposed a model for technical inefficiency effects in a stochastic frontier production function for panel data. Provided the inefficiency effects are stochastic the model lets to estimate both technical change in the stochastic frontier and time-varying technical inefficiencies.

2. MATERIALS AND METHODOLOGY

In this context and the focus of this chapter is in using the probabilistic formulation of the DGP as developed, to adapt the order-m approaches to order- α quantile estimation. The annually collected panel data of the whole banks of Eurozone for the period between 1999 and 2009 was used. The data are reported at current prices in millions of Euros for OECD countries which are members of the Eurozone[5].The available data excluded Greece and Portugal's accounts. This analysis used one distinct dependent and three independent variables consisting of inputs and was measured.

Table.1 Descriptive statistics

Description	Name	Mean	Max	Min	Stand. Dev.
The total value of *Total Assets* (in millions of Euros) for Eurozone Banks involved	**log(TA)**	1662517	1372328	3008.372	1872438
The total value of *Capital and Reserves* (in millions of Euros) for Eurozone Banks involved	**log(CR)**	82976.18	56666.28	1751.425	89403.91
The total value of *Interbank Deposits* (in millions of Euros) for Eurozone Banks involved	**log(ID)**	416083.7	280027.1	8412.735	516341.1
The total value of *Customers Deposits* (in millions of Euros) for Eurozone Banks involved	**log(CD)**	630660.9	629814.4	10123.5	748672.1

[5] İncluding: Austria, Belgium, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, The Netherlands, Portugal, The Slovak Republic, Slovenia and Spain.

The total number of *Employees* (in thousand people) for Eurozone Banks involved	**log(EMP)**	164499.1	147000	5693	200306.7

I use one distinct dependent and three independent variables consisting of three inputs. Capital and reserves values are the lowest among input variables. So, total assets values are highest among variables. Descriptive statistics of the key variables presented in [Table.1].

2. a.Cobb-Douglas Production Frontier with Technological Change:

In case of a Cobb-Douglas production function, usually a linear time trend is added to account for technological change:

$$lny = \alpha_0 + \sum \alpha_i lnx_i + \alpha_t t \qquad (1)\ (Model\text{-}1)$$

Given this specification, the coefficient of the (linear) time trend can be interpreted as the rate of technological change per unit of the time variable t:

$$\alpha_t = \delta lny/\delta t = \delta lny/\delta y * \delta y/\delta t \sim \frac{\frac{\triangle y}{y}}{\triangle x}$$

2. b.Translog Production Function with Constant and Neutral Technological Change:

A translog production function that accounts for constant and neutral (unbiased) technological change has following specification:

$$lny = \beta_0 + \sum \beta_i lnx_i + 1/2 \sum\sum \beta_{ij} lnx_i lnx_j + \beta_t t \qquad (2)\ (Model\text{-}2)$$

In this specification, the rate of technological change is

$$\Delta lny/\delta t = \beta_t \qquad (3)$$

and the output elasticises are the same as in the time-invariant Translog production function :

$$\epsilon_i = \delta lny/\delta lnx_i = \beta_i + \sum \beta_{ij} lnx_j \qquad (4)$$

In order to be able to interpret the first-order coefficients of the (logarithmic) input quantities (β_i) as output elasticities (ϵ_i) at the sample mean, mean-scale the input quantities. Additionally, we mean-scale the output quantity in order to obtain the same estimates as Coelli et al.(2005, p.250).

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3. EMPIRICAL EVIDENCE

Table.2 Cobb Douglas Production Function of Eurozone (Model-1)

	OLS estimator				MLE Estimator		
Parameter	**Coefficient**	**Std.error**	**T-ratio**	**After the grid**	**Coefficient**	**Std.error**	**T-ratio**
Constant	0.299	0.069	4.317	0.497	0.177	0.045	3.873
lg(CR)	0.310	0.039	7.917	0.311	0.200	0.027	7.305
lg(ID)	0.205	0.028	7.379	0.205	0.164	0.018	8.761
lg(CD)	0.585	0.042	13.793	0.585	0.747	0.029	25.784
Lg(EMP)	0.676	0.014	0.486	0.676	0.0074	0.006	1.255
Time				**0.870**	**0.951**	**0.021**	**4.452**

Sourced: Calculated.

In Cobb Douglas Production Function with Constant and Neutral Technological Change (with MLE) (TPF with Time-invariant), the elasticity associated with the Customer Deposits is the largest. The sum of the four production elasticity (0.20 + 0.164 + 0.747 + 0.007) is 1.118 suggesting increasing, returns to scale at the sample mean data point. The coefficient of time is 0.951, which indicates mean technical progress of 0.95 % per year.

Table.3 Translog Production Function with Constant and Neutral Technological Change of Eurozone (Model-2)

	OLS estimator				MLE Estimator		
Parameter	**Coefficient**	**Standard-Error**	**T-ratio**	**After the grid**	**Coefficient**	**Standard-Error**	**T-ratio**
Constant	0.001	0.05	0.026	0.078	0.227	0.006	3.734
lg(CR)	1.083	0.411	2.637	1.083	0.269	0.390	0.690

lg(ID)	-0.035	0.265	- 0.131	-0.034	0.582	0.185	3.151
lg(CD)	0.07	0.604	0.116	0.070	0.153	0.412	0.372
lg(EMP)	0.252	0.187	1.343	0.252	0.137	0.145	0.939
$lg(CR)^2$	0.301	0.067	4.509	0.301	0.105	0.052	1.980
$lg(ID)^2$	0.015	0.040	0.370	0.014	0.088	0.024	3.595
$lg(CD)^2$	0.560	0.117	4.786	0.560	0.056	0.086	0.653
$lg(EMP)^2$	-0.014	0.003	- 3.626	-0.013	0.001	0.003	0.316
lg(CR)*lg(ID)	0.141	0.092	1.526	0.141	-0.047	0.061	-0.769
lg(CR)*lg(CD)	-0.119	0.094	- 1.253	-0.119	-0.095	0.071	-1.337
lg(CR)*lg(EMP)	-0.219	0.065	- 3.324	-0.219	0.105	0.058	-1.785
lg(ID)*lg(CD)	-0.932	0.150	- 6.176	-0.932	-0.084	0.125	0.671
lg(ID)*lg(EMP)	0.261	0.080	3.238	0.261	-0.060	0.064	0.924
lg(EMP)*lg(CD)	-0.001	0.040	- 0.040	-0001	-0.071	0.035	2.012
Time				**0.530**	**0.963**	**-0.020**	**4.901**

Sourced: Calculated.

In Translog Production Function with Constant and Neutral Technological Change (with MLE) (TPF with Time-invariant), the elasticity associated with the Interbank Deposit is the largest. The sum of the four production elasticity (0.269 + 0.582 + 0.153 + 0.137) is 1.141 suggesting increasing, returns

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to scale at the sample mean data point. The coefficient of time is 0.963, which indicates mean technical progress of 1 % per year.

Table.4 Technical Efficiency and Technical Inefficiency Score for Eurozone

Countries	TE Result of CD Production Function	TE Result of Translog Production Function
Netherlands	0.716	0.723
Spain	0.527	0.537
Slovenia	0.825	0.809
Slov.Rep.	0.756	0.703
Lüxembourg	0.865	0.742
Italy	0.980	0.977
Ireland	0.967	0.929
Germany	0.575	0.590
France	0.777	0.781
Fınland	0.944	0.978
Estonia	0.945	0.929
Belgium	0.765	0.739
Austria	0.822	0.815
Technical Efficiency Mean	**0.805**	**0.788**

Sourced: Calculated.

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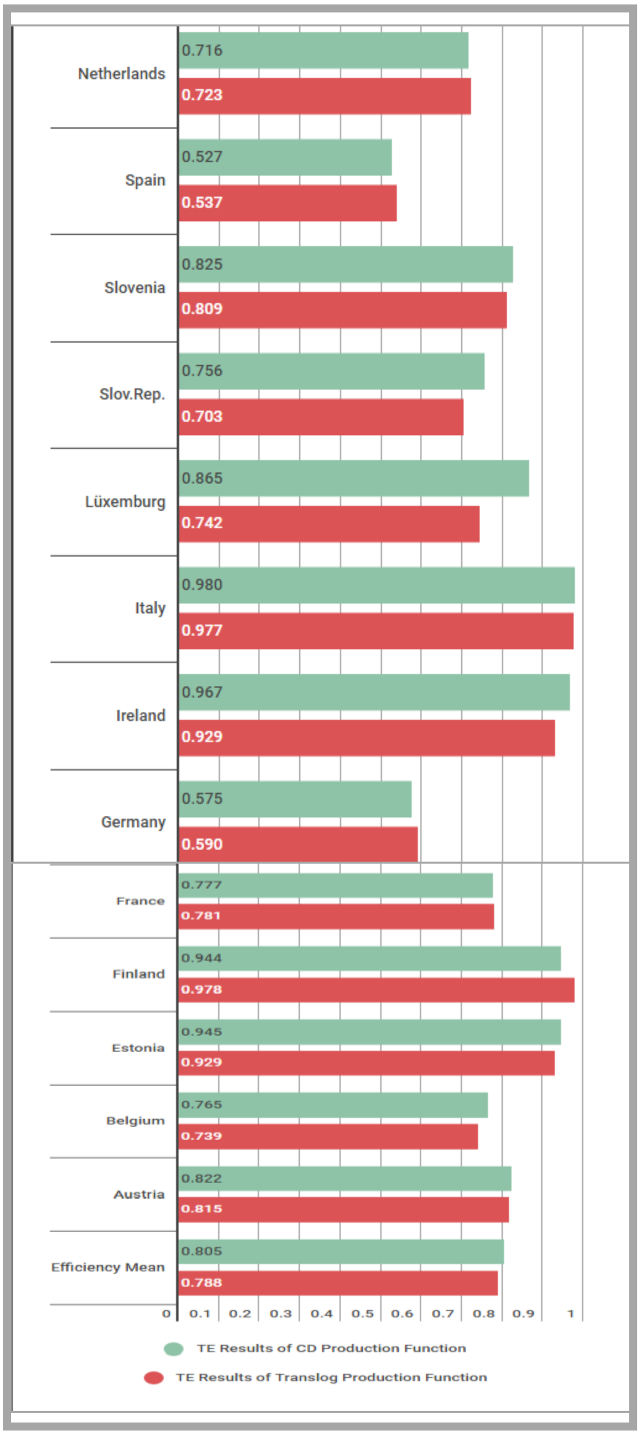
The result of Cobb Douglas Production Function in [Table 4] indicate that about half of the sample countries seem to have been brought about mainly by a positive technical efficiency, suggesting that sampled countries seem to have been able to exploit also some catching up effect. Then, the Spain is the lowest technical efficiency score in all of the Eurozone. So, the Italy is the highest technical efficiency score in all of the Eurozone. The six different countries are under the average score of the banking sector, and the eight different countries are over the average score of the banking sector.

On the other hand, the result of Translog Production Function in [Table 4] indicate that about half of the sample countries seem to have been brought about mainly by a positive technical efficiency, suggesting that sampled countries seem to have been able to exploit also some catching up effect. Then, the Spain is the lowest technical efficiency score in all of the Eurozone. So, the Finland is the highest technical efficiency score in all of the Eurozone. The seven different countries are under the average score of the banking sector, and the six different countries are over the average score of the banking sector.

4. CONCLUSION

The banking sector of Eurozone brought together deregulation policy, output diversity and technological change in the 2000s.This has caused the whole industry to grow very impressive and unbalanced. The efficiency score of Eurozone banking sector was influenced by all these factors. Main aim of this paper is to reveal the efficiency score in this period and make comparisons between member countries of Eurozone. It show that the banking sector of Eurozone has increasingly returns to scale at the sample mean data point. Then, it indicates mean technical progress of 1 % per year. We see that the technical progress very strongly for the period covered. When we compare countries, efficiency score of Spain has the lowest efficiency all of the Eurozone. On the other hand, efficiency score of Italy and Finland share the first place. In general, half of the member countries score are above the average efficiency score [Figure.1]. Then, small countries have more efficient score than bigger countries. One of the main reasons is that the product varieties and product volumes of the major countries are wider. Overall, it is observed that efficiency score of the banking sector of Eurozone region are high in the period covered.



Sourced: Calculated.

Figure.1 Efficiency Score of Eurozone Countries' Banking Sectors

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