Muhasebe ve Finansman Dergisi – Ekim/2020 (88): 331-342

ISSN: 2146-3042
DOI: 10.25095/mufad.801553

The Performance of Deposit Banks in Turkey*

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ABSTRACT

This paper investigates the performance of Turkish deposit banks using Stochastic Frontier Analysis during the period from 2011 to 2018. The study also investigates the effect of four inputs and eight inefficiency effects such as banks size (small or large), ownership (state-owned or privately-owned; domestic or foreign), being established in Turkey, time, TL/active/Total active, Liquid active/Total active, Total Compensation/Number of staff. Battese and Coelli (1995) model was implemented since it is a popular method and it deals with unbalanced panel data and gives the inefficiency effects. The findings indicate that large banks show better performances than their small counterparts, being established in Turkey has a positive effect on the performance of deposit banks, paying more compensation to employees may not increase the efficiency of banks, being state-owned or privately-owned does not have a significant effect on the inefficiency and being a foreign bank decreases the inefficiency of banks. Time has a positive effect on the inefficiency of Turkish banking industry.

Keywords:*Bank Efficiency; Stochastic frontier analysis; Turkish banks*

Jel Classification*: D20; D24; G21.*

Türkiye'deki Mevduat Bankalarının Performansı

ÖZET

Bu çalışma Türkiye'deki mevduat bankalarının 2011-2018 yılları arasındaki performasını Stokastik Sınır analiziyle incelemektedir. Ayrıca çalışma 4 girdi ve etkinsizliğe etki edebilecek banka büyüklüğü, sahiplik (kamu ya da özel; yerli ya da yabancı), Türkiye'de kurulmuş olma, zaman, TL aktif / Toplam aktif, Likit aktif / Toplam aktif ve Toplam ücret / Çalışan sayısı gibi sekiz değişkeni incelemektedir. Modelin popüler olması, verinin dengesiz bir veri seti olması ve etkinsizlik etkilerini verdiği için Battese ve Coelli (1995) model analizde kullanılmıştır. Sonuçlara göre büyük bankalar küçük bankalara göre daha iyi performans göstermektedir. Türkiye'de kurulmuş olmak mevduat bankalarının performansını artırıcı bir etki yapmaktadır. Çalışanlara daha fazla ücret ödemek banka performansının daha iyi olacağı anlamına gelmemektedir, kamu bankası ya da özel banka olmanın etkinsizlik üzerine önemli bir etki yaptığı görülmemektedir, yabancı banka olmak etkinsizliği azaltmakta ve zaman Türk banka endüstrisinin etkinsizliği üzerinde pozitif bir etki yapmaktadır.

Anahtar Kelimeler: *Banka Etkinliği, Stokastik Sınır Analizi, Türk Bankaları*

JEL Sınıflandırması: *D20; D24; G21*

* **Makale Gönderim Tarihi:** 22.10.2019, **Makale Kabul Tarihi:** 13.02.2020 , **Makale Türü:** Nicel Araştırma
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1. INTRODUCTION

Banks have a key role in the financial system of a country. They provide much more services than other financial intermediaries. For example, they provide personal and mortgage loans for individuals, special loans for small and medium sized enterprises, non-cash loans for companies, etc. They have a wide range of consumers.

Since the number of the individuals and organizations using banking services are very high, the performance of banks becomes very important. In case of poor performance of a bank, not only the individuals and companies, but also the other banks and government will be affected by that poor performance.

Besides the importance of bank performance, the performance measuring method also very important. Although profitability and liquidity ratios give an idea for benchmarking, they are inadequate to determine the performance since they do not give enough information about resource utilization. Frontier methods provide a better comprehension for decision makers about the performance of units, since both they consider the resource utilization and compare the whole pool of firms in a single pot.

The ones who use frontier methods also have the opportunity to see what affects the performance of units positively or negatively. Being a domestic firm or a small firm or a private firm can have an impact on the performance of a unit. So the poor performances can be determined by the comparison of a firm with the best firm in the pool. Using the best firm's strategies, the firms in the bottom of the list may become more efficient by increasing the output and keeping the inputs constant.

This study aims to measure the efficiency of banking sector in Turkey using Stochastic Frontier Analysis (SFA). Battese and Coelli (1995) model was used since it is a very popular model and, it deals with unbalanced panel data and provides the inefficiency effects. There are many studies which used Battese and Coelli (1995) model in the performance measurement of banking sector, such as Oteng-Abayie (2017), Abdallah et al. (2014), Ersoy (2009), Westhuizen and Battese (2013), etc. This study has some interesting results such as labor has a negative impact on the output of banks and being a foreign bank decreases inefficiency although being established in Turkey has a negative impact on the inefficiency.

This study is important from two points of view. The first is the number of studies which use stochastic frontier analysis to measure the bank efficiency in Turkey is limited and the second is the study gives the inefficiency effects.

The section 2 continues with the literature review, section 3 provides the data and the methodology, Section 4 includes the empirical findings and section 5 has a conclusion.

2. LITERATURE REVIEW

Since banking sector have a special place in the financial system, there are many studies about banking industry, showing the banks performances. Some of these studies are given below.

Weill (2004) calculated the cost efficiency scores of banks from five European countries, for the period between 1992 and 1998, to make a comparison of frontier methods including stochastic frontier analysis. While the output of the study was loans and investment assets, the inputs were personnel expenses, interest paid and other non-interest expenses. The author implies that the results of different methods is not consistent though there are some similar results in parametric approaches.

Ersoy (2009) investigated the effect of financial crisis on the performance of foreign banks of Turkey for the years 2002 to 2008. Ersoy (2009) used deposits, labor and capital as input variables and loans & total securities as the output variable. The author states that the effect of size on technical efficiency is high, positive and significant. State banks have higher efficiency scores and their efficiency has not decreased during the financial crisis. Ersoy (2009) ascribes that to reforms during restructuring and their size advantage.

Westhuizen and Battese (2013) investigated the technical efficiency of South African four largest banks for the years 1994 to 2010. While the inputs of that study were labor, capital costs, operating costs and deposits, the outputs were interest income and non-interest income individually. Westhuizen and Battese (2013) also used loans & investments, interest costs and financial capital as the inefficiency effects of the production function. They showed the implementation of alternative methods including output distance functions and state that while deposits do not have a significant effect on the interest income and non-interest income of banks, it is significant in the output distance function.

Abdallah et al. (2014) investigated the effect of size and ownership structure on the performance of 21 commercial banks in Tanzania for the period 2003 to 2012. They calculated the cost and the revenue efficiencies. For the cost function they used deposits, personnel expenses as input variables, and total loans as the output variable. For the revenue function, they utilized deposits and personal expenses as input variables and revenue as the output variable. They state that large banks are more cost and revenue efficient than their smaller counterparts. They also state that government banks are more cost and revenue efficient than private banks.

Baten et al. (2014) made a research about efficiency of 14 banks traded on Kuala Lumpur Stock Exchange for the years 2005 to 2009. They used market data instead of the values on the financial statements. While the output of the study was individual banks return, the input variables were market return, market capitalization and book to market ratio. The study results suggest that the inefficiency level of those banks is low. The overall efficiency is 96.2% that means the banks in the study wasted only 3.8% of their resources.

Parinduri and Riyanto (2014) made a research about ownership and the cost efficiency of Indonesian banking industry for the years 2000 (last quarter) to 2005 (second quarter).

They state that state-owned banks are the least efficient banks, however, joint venture and foreign owned banks have higher efficiency scores. They used labor, deposits & purchased funds and capital as input variables, and loans, government bond holdings, securities holdings and other assets as output variables.

Oteng-Abayie (2017) estimated the technical efficiency and total factor productivity of the rural banks in Ghana for the years 2009 to 2012 (using quarterly data). Oteng-Abayie (2017) used deposits, fix assets and time as the input variables, and net loans as the output variable. The mean technical efficiency of Ghanaian rural banks was 80.12%, indicating that 19.88% of the resources were wasted in the industry. Oteng-Abayie (2017) also states that the rural banking industry have a significant potential for efficiency improvement.

Osuagwu et al. (2018) measured the technical efficiency of 12 Nigerian banks for the years 2005 to 2014. They adopted intermediation approach and implemented two models. In the first model, they used total deposits, staff cost and total equity as input variables, and loans as the output variable. In the second model, they utilized total deposits, staff costs, total equity and operating expense as input variables, while they preferred operating income as the output. They state that as long as banks seek for non-interest income, the efficiency of banks tends to decrease.

Sadalia et al. (2018) measured the efficiency of 10 conventional and Sharia banks for the years 2011 to 2015. As input variables they used total deposits, operational costs and other operational costs and as the only output variable, total financing was preferred. Although the efficiency scores of conventional and Sharia banks are 0.85 and 0.84 respectively, they state that the efficiency scores of conventional and Sharia banks do not show much distinction.

Dimitras et al. (2018) measured the efficiency of European Union (EU) banks using stochastic frontier analysis to understand the effect of transition to International Financial Reporting Standards (IFRS). They calculated both cost and revenue efficiency scores for 141 banks in 15 EU member countries in terms of both General Accepted Accounting Principles (GAAP) and IFRS. They assert that IFRS implementation affected the efficiency of banks significantly. While in terms of profit efficiency the scores change but the ranking was similar, in terms of cost efficiency both efficiency scores and the ranking of banks changed.

Also, Samad (2019) measured Bangladeshi banking sector efficiency using two stage Data Envelopment Analysis for the years 2008 to 2012. In the first stage Samad (2019) calculated technical efficiency scores and in the second stage the author used a Tobit regression to see the factors which affect the efficiency scores. Samad (2019) adopted capital, labor and deposits as the input variables and loans & advances as the only output variable. The mean efficiency score of Bangladeshi banking sector was ranged between 96.7 and 98.6.

A study was made by Fernández et al. (2019) to put forward the effect of Brexit on the efficiency of 56 leading banks in United Kingdom and Ireland. The authors used input oriented distant function to measure the performances of the banking sector of these countries. While loans and turnovers were used as the output variables, number of employees, fixed assets and deposits were used as the input variables. The authors state that Brexit has negatively affected the performances of the banks.

Liu (2019) compared the efficiency of US and Canadian banks for the years between 2008 and 2017. Employing both stochastic frontier and data envelopment analysis, Liu (2019) states that the bank efficiency scores are not significantly different between US and Canada.

3. DATA AND METHODOLOGY

3.1 Data

The bank Association of Turkey[1] is the data source for this study. Many balance sheet and Income statement information can be downloaded from the website of that organization.

The study period of this article is from 2011 to 2018. Although some bank information starts from 2005 in the Banks Association of Turkey, to see the performance of banks in regular periods, not in the crisis period, 2011 was selected as the first year of the study. Since the average life of banks in Turkey shorter than the banks in Europe, the data is unbalanced. 37 deposit banks' data was included in the analysis. The development and investment banks were not included since their activities were not similar to deposit banks. All the data which is in terms of Turkish Liras was inflation-adjusted using the inflation measured by consumer price indices (CPI) given in the web site of OECD[2], 2018 was accepted as the base year.

3.2 Methodology

In this study, efficiency of Turkish banks was measured using SFA. SFA was developed by Aigner et al. (1977) and Meeusen and Van den Broek (1977) separately. In Stochastic Frontier Analysis, the error term is decomposed into two parts. The first one is the inefficiency term, which is not negative, and the other one is the noise, which can be positive or negative. The inefficiency component means that firms can decrease their inputs or increase their outputs keeping the outputs or inputs constant. The noise represents the factors, which is not related to managerial skills of the management. Coelli et al. (2005, 243) state the SFA production function in Cobb-Douglas form as follows:

$$\ln Y_i = \beta_0 + \beta_1 \ln X_i + v_i - u_i \quad (1)$$

Here Y is the output of firm i, X is the input(s) of firm i, β is a vector of parameters to be estimated. V is the noise and u represents the inefficiency.

As the data in this study is panel and unbalanced, many models can be implemented. For example Battese and Coelli (1992) model can be implemented to that kind of data and measures the effect of time besides calculation of efficiency scores. Battese and Coelli (1995) is a model, which also shows the inefficiency effects of a production function.

[1] https://www.tbb.org.tr/tr/ (Accessed on 31st of July 2019)
https://verisistemi.tbb.org.tr/index.php?/tbb/report_mali (Accessed on 16th of July 2019)

[2] https://data.oecd.org/price/inflation-cpi.htm (Accessed on 31st of July 2019)

There are two popular approaches to determine the input and output variables. While production approach regards just physical inputs such as labor and capital, intermediation approach also takes the input of funds into account since it considers banks as intermediaries. Berger and Humphrey (1997) state that while the production approach may provide better results in the performance measurement of bank branches, the intermediation approach[3] is more appropriate in evaluating the whole efficiency of a financial institution (Berger and Humphrey, 1997, p.197). In this study, besides capital and labor, the deposits and interest expense were also regarded as input variables.

The stochastic production function estimated using Battese and Coelli (1995) model is as follows:

$$\ln(Y_{it}) = \beta_0 + \beta_1 \ln(deposit_{it}) + \beta_2 \ln(equity_{it}) + \beta_3 ln(labor_{it}) + \beta_4 ln(intexp_i \quad 2)$$

The Inefficiency effects are defined as follows:

$$U_{it} = \delta_0 + \delta_1 ln\left(\frac{TLactive}{totalactive_{it}}\right) + \delta_2 ln\left(\frac{liquidactive}{totalactive_{it}}\right) + \delta_3 ln\left(\frac{totalcompe}{numberoj}\right. \quad 3)$$
$$+ \delta_4(year_{it}) + \delta_5(private_{it}) + \delta_6(large_{it}) + \delta_7(foreign_{it})$$
$$+ \delta_8(establishedinTurkey_{it}) + W_{it}$$

Y is the loans and receivables, which represent the output variable. In the literature Loans were one of the most used outputs for measuring the efficiency of banking industry, as stated above, Abdallah et al. (2014), Oteng-Abayie (2017), Osuagwu et al. (2018), Samad (2019) preferred loans as the only output variable.

Based on the literature, deposits, equity and labor and interest expense were preferred for the input variables. Capital and labor are the main inputs of a production function. In this study, Equity represents capital. Deposit is the amount deposited into bank accounts, equity is the total shareholder's equity, labor is the number of employees, intexp is the interest expense incurred by banks. V is the noise and U represents the inefficiency.

TL active/total active is a balance sheet structure indicator and it shows the proportion of assets in terms of Turkish Liras in the total active. The liquid active/ total active is a liquidity indicator. The total compensation/ number of staff is the gross salary plus severance pay paid per employee. Year is a variable, which start from 1 and ends at 8. Private is a dummy variable and takes the value 0 if the bank is a state-owned banks, and 1 if it is a privately-owned bank. Large is a dummy variable and takes the value 0 if the bank's deposits does not exceed %5 (small bank) of all deposits of deposit banks, and 1 if it exceeds %5 (large bank). Foreign is a dummy variable, which takes the value 0 if the bank is a domestic bank, takes the value 1 if it is a foreign bank. EstablishedinTurkey is a dummy variable and take the value 1 if the banks is established in Turkey, otherwise 0. W is a random variable. Maximum likelihood estimates of parameters were obtained from the Stata program. The results are as follows.

[3] You may see Sealey and Lindley (1977)

4. EMPIRICAL FINDINGS

The maximum likelihood estimates can be seen in Table 1 below. In the Model 1, all the input variables are significant and five out of eight firm specific inefficiency variables are significant at a significance level 0.05. Among the inefficiency effects, total compensation/number of staff and private variables are insignificant. TL active/ total active can be accepted as significant at 0.10 significance level, but since in many studies 0.05 is the accepted level, that variable may be accepted as insignificant. To decide which model is the best, a few models were compared using likelihood-ratio tests. The results are shown in table 2.

Table 1. The Maximum Likelihood Estimates

	Model 1					Model 2				
Variable	**Parameter**	**Coefficient**	**Std. Err.**	**z**	**p>|z|**	**Parameter**	**Coefficient**	**Std. Err.**	**z**	**p>|z|**
lnloans&Receivables										
lndeposit	β1	0.1448	0.0163	8.88	0.000	β1	0.1500	0.0155	9.66	0.000
lnequity	β2	0.7201	0.0217	33.14	0.000	β2	0.7175	0.0219	32.81	0.000
lnlabor	β3	-0.1190	0.0238	-5.01	0.000	β3	-0.1164	0.0235	-4.96	0.000
lnintexp	β4	0.1550	0.0243	6.39	0.000	β4	0.1487	0.0235	6.32	0.000
constant	β0	0.6721	0.1345	5.00	0.000	β0	0.6744	0.1362	4.95	0.000
ln(tlactive/totalactive)	δ1	0.4443	0.2451	1.81	0.070	δ1	0.0000	(omitted)		
ln(liquidactive/totalactive)	δ2	3.7178	0.4611	8.06	0.000	δ2	3.8818	0.4782	8.12	0.000
ln(totalcomp/nofstaff)	δ3	-0.0125	0.2710	-0.05	0.963	δ3	0.0000	(omitted)		
year	δ4	0.1222	0.0596	2.05	0.040	δ4	0.1015	0.0498	2.04	0.041
private	δ5	3.5021	2.3968	1.46	0.144	δ5	0.0000	(omitted)		
large	δ6	-2.0913	1.0514	-1.99	0.047	δ6	-3.2668	1.2947	-2.52	0.012
foreign	δ7	-0.8245	0.4040	-2.04	0.041	δ7	-0.9146	0.4011	-2.28	0.023
estinturkey	δ8	-1.3746	0.2538	-5.42	0.000	δ8	-1.3610	0.2493	-5.46	0.000
constant	δ0	-17.0051	5.7134	-2.98	0.003	δ0	-7.5457	2.3125	-3.26	0.001
Usigma	constant	-0.5115	0.1892	-2.70	0.007	constant	-0.4446	0.1888	-2.35	0.019
Vsigma	constant	-4.5241	0.2617	-17.28	0.000	constant	-4.4970	0.2646	-16.99	0.000
sigma_u		0.7743	0.0733	10.57	0.000		0.8007	0.0756	10.59	0.000
sigma_v		0.1041	0.0136	7.64	0.000		0.1056	0.0140	7.56	0.000
lambda		7.4357	0.0762	97.61	0.000		7.5852	0.0785	96.61	0.000
Log-likelihood		**-29.4097**					**-32.8013**			

The tested null hypotheses are as follows[4]:

1- H_0: $\gamma = \delta1=\delta2=\delta3=\delta4=\delta5=\delta6=\delta7=\delta8=0$, the first null hypothesis states that there is no technical inefficiency effects in the model for the set of deposits banks in Turkey. The test results indicate that the first null hypothesis is strongly rejected.

2- H_0: $\delta1=\delta2=\delta3=\delta4=\delta5=\delta6=\delta7=\delta8=0$, the second null hypothesis means that the inefficiency effects are not a linear function of the variables specified in the third equation.

[4] For the gamma parameterization, you may see Battese and Corra (1977).

According to the test results, the second null hypothesis is also rejected. The joint effect of these eight variables on the inefficiency is significant.

3- H_0: $\delta1=\delta3=\delta5=0$, the third null hypothesis is that the coefficients of ln(tlactive/totalactive), ln(totalcomp/nofstaff) and private variables are zero. The test results indicate that the third null hypothesis is accepted. In other words, these variables can be omitted from the model.

4- H_0: $\gamma=\delta2=\delta4=\delta6=\delta7=\delta8=0$, the fourth hypothesis specifies that the inefficiency effects are absent in the Model 2. That hypothesis is also rejected.

5- H_0: $\delta2=\delta4=\delta6=\delta7=\delta8=0$, the fifth hypothesis is the inefficiency effects are not a linear function of the remained variables in the Model 2. This is also rejected.

The coefficients and the standard errors of the variables of the preferred model can be seen as Model 2 in Table 1.

Table 2. Tests for Hypothesis for Parameters of the Inefficiency

	H0 LLH	**X^2-statistic**	**$X^2_{.050}$**	**Decision**
H0: $\gamma=\delta0=\delta1=\delta2=\delta3=\delta4=\delta5=\delta6=\delta7=\delta8=0$	-258.19	**457.56**	**18.30**	H0 reject
H0: $\delta1=\delta2=\delta3=\delta4=\delta5=\delta6=\delta7=\delta8=0$	-176.55	**294.29**	**15.51**	H0 reject
H0: $\delta1=\delta3=\delta5=0$	-32.80	**6.78**	**7.82**	Accept
Restrcition $\delta1=\delta3=\delta5=0$				
H0: $\gamma=\delta2=\delta4=\delta6=\delta7=\delta8=0$	-258.19	**450.78**	**12.59**	H0 reject
H0: $\delta2=\delta4=\delta6=\delta7=\delta8=0$	-176.55	**287.50**	**11.07**	H0 reject

Based on the preferred model, the efficiency scores were calculated as seen in table 3. The general level of average efficiency scores of state-owned banks are high. Türkiye Cumhuriyeti Ziraat Bankası A.Ş., Türkiye Halk Bankası A.Ş., and Türkiye Vakıflar Bankası T.A.O. have mean efficiency scores 0.87, 0.93 and 0.94 respectively. Among privately-owned banks, the mean efficiency of some banks are equal to or higher than 0.90 such as Alternatif Bank A.Ş, Fibabanka A.Ş., ING Bank A.Ş., Bank China of Turkey, MUFG Bank Turkey A.Ş., QNB Finans Bank A.Ş., Türk Ekonomi Bankası A.Ş., Türkiye İş Bankası A.Ş., Yapı ve Kredi Bankası A.Ş.

It is difficult to say that there is an increasing or decreasing trend in the performance of banking sector. The mean efficiency score is 0.63 in 2011 and 0.69 in 2018.

Table 3. Bank Efficiency Scores

	Banka	2011	2012	2013	2014	2015	2016	2017	2018	Mean
1	Akbank T.A.Ş.	0.69	0.71	0.88	0.86	0.86	0.85	0.79	0.71	0.79
2	Alternatif Bank A.Ş.	0.92	0.91	0.96	0.89	0.93	0.88	0.86	0.90	0.91
3	Anadolubank A.Ş.	0.62	0.52	0.67	0.66	0.62	0.70	0.72	0.51	0.63
4	Arap Türk Bankası A.Ş.	0.33	0.26	0.42	0.34	0.31	0.29	0.33	0.27	0.32
5	Bank Mellat	0.23	0.02	0.03	0.01	0.01	0.01	0.00	0.00	0.04
6	Bank of China Turkey A.Ş.								0.92	0.92
7	Bank of Tokyo-Mitsubishi UFJ Turkey A.Ş			0.04	0.49	0.79	0.91			0.56
8	Burgan Bank A.Ş.		0.54	0.89	0.82	0.88	0.93	0.91	0.81	0.83
9	Citibank A.Ş.	0.39	0.39	0.24	0.26	0.35	0.34	0.35	0.25	0.32
10	Denizbank A.Ş.	0.86	0.84	0.95	0.94	0.89	0.86	0.87	0.83	0.88
11	Deutsche Bank A.Ş.	0.18	0.11	0.31	0.28	0.47	0.34	0.44	0.29	0.30
12	Eurobank Tekfen A.Ş.	0.45								0.45
13	Fibabanka A.Ş.	0.91	0.88	0.95	0.95	0.90	0.91	0.93	0.94	0.92
14	Finans Bank A.Ş.	0.81	0.80	0.88	0.89	0.92	0.90			0.87
15	Habib Bank Limited	0.13	0.14	0.18	0.14	0.14	0.13	0.10	0.11	0.14
16	HSBC Bank A.Ş.	0.74	0.75	0.87	0.85	0.92	0.77	0.76	0.60	0.78
17	ICBC Turkey Bank A.Ş.					0.86	0.91	0.86	0.70	0.83
18	ING Bank A.Ş.	0.91	0.89	0.94	0.95	0.95	0.91	0.90	0.72	0.90
19	Intesa Sanpaolo S.p.A.				0.42	0.65	0.79	0.95	0.89	0.74
20	MUFG Bank Turkey A.Ş.							0.94	0.90	0.92
21	Odea Bank A.Ş.		0.54	0.89	0.96	0.97	0.85	0.67	0.62	0.79
22	Portigon AG		0.03							0.03
23	QNB Finans Bank A.Ş.							0.93	0.91	0.92
24	Rabobank A.Ş.				0.13	0.13	0.88	0.70	0.92	0.55
25	Sociéte Générale (SA)	0.60	0.51	0.09	0.33	0.16	0.03	0.44	0.49	0.33
26	Şekerbank T.A.Ş.	0.73	0.73	0.88	0.83	0.86	0.87	0.89	0.90	0.84
27	Tekstil Bankası A.Ş.	0.62	0.58	0.61	0.60					0.60
28	Turkish Bank A.Ş.	0.21	0.29	0.38	0.53	0.50	0.57	0.65	0.45	0.45
29	Turkland Bank A.Ş.	0.52	0.61	0.58	0.53	0.59	0.52	0.43	0.42	0.52
30	Türk Ekonomi Bankası A.Ş.	0.88	0.87	0.94	0.94	0.94	0.92	0.92	0.86	0.91
31	Türkiye Cumhuriyeti Ziraat Bankası A.Ş.	0.80	0.66	0.91	0.84	0.92	0.93	0.94	0.95	0.87
32	Türkiye Garanti Bankası A.Ş.	0.80	0.75	0.89	0.89	0.90	0.91	0.89	0.83	0.86
33	Türkiye Halk Bankası A.Ş.	0.92	0.86	0.91	0.93	0.94	0.95	0.96	0.96	0.93
34	Türkiye İş Bankası A.Ş.	0.87	0.84	0.93	0.91	0.92	0.92	0.92	0.89	0.90
35	Türkiye Vakıflar Bankası T.A.O.	0.91	0.89	0.95	0.95	0.95	0.96	0.96	0.96	0.94
36	WestLB AG	0.02								0.02
37	Yapı ve Kredi Bankası A.Ş.	0.92	0.80	0.91	0.94	0.94	0.94	0.94	0.87	0.91
	Mean	**0.63**	**0.60**	**0.68**	**0.67**	**0.71**	**0.72**	**0.73**	**0.69**	

5. CONCLUSION

In this study the performance of Turkish deposit banks were measured for the period between 2011 and 2018 using SFA. The Battese and Coelli (1995) model was adopted since it is a very popular model, and it copes with unbalanced panel data and provides the technical inefficiency effects.

First of all the mean efficiency of banking sector in Turkey is between 0.60 and 0.73 during the study period. The results indicate that banks in Turkey waste from 27% to 40% of their resources and have a great potential to improve their efficiency levels.

Deposits, equity, labor and interest expense were used as input variables. All input variables are significant. While deposits, equity and interest expense have a positive effect on the output amount, labor has a negative effect. Probably, the banks in the analysis employ more employees than they should employ.

TL active/ total active ratio increase inefficiency, though it is insignificant. Due to the economic crisis in the recent years and the appreciation in the foreign currency, the banks which have assets in terms of Turkish Liras tend to be more inefficient. The liquid active/ total active ratio has a positive effect on the inefficiency. That is inconsistent with Nitoi and Spulbar's (2015) results. The results indicate that the banks should make investments instead of preferring liquid items.

Total compensation/ number of staff ratio is expected to affect the inefficiency negatively. That result has a meaning that even if the banks pay more to their employees, the efficiency will not change significantly. In other words, high salaries per person does not mean high efficiency in the banking industry in Turkey. Time has a positive effect on the inefficiency during the study period between 2011 and 2018. The vivid decline in the efficiency scores of some banks such as Bank Mellat, Societe Generale (SA), and Citibank A.Ş. may have caused those results.

Being state-owned or privately-owned has not a significant effect on the inefficiency. The results are inconsistent with Ersoy's (2009) and Abdallah et al.'s (2014) results that state-owned banks are more efficient than their privately-owned counterparts. Being a large bank has a negative effect on inefficiency. This result is consistent with Abdallah et al. (2014). Also Samad (2019)'s results show that bank size has a positive effect on the efficiency. It is a possible result for economies of scale.

Being a foreign bank decreases the inefficiency. The result indicate that the foreign banks are more efficiently managed than domestic banks. Being established in Turkey is also decreasing the inefficiency. This shows that instead of opening branches in Turkey, foreign banks may prefer purchasing a large bank from Turkey if they need higher efficiency scores.

A new study is needed to understand the negative impact of labor on the outputs of banks. The lack of motivation, lack of education, overpopulated structure of banks or some other factors may have caused these results. Another important issue is although establishing in Turkey is decreasing the inefficiency, foreign banks become more efficient than domestic banks. These issues are the ones to be investigated using alternative SFA models.

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