Determinants of Bank Efficiency in Turkey: A Two Stage Data Envelopment Analysis

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Abstract: Financial industry plays an important role in the economy and banks are indispensable players in the financial industry. Therefore, the evaluation of banks' performance became a popular research topic in all over the world, and also in Turkey. There are different techniques to determine the banks' performance. Among those techniques, Data Envelopment Analysis (DEA), which is a non-parametric technique, has been widely used in the banking sector. In this research, we analyzed the efficiency of Turkish Banking Industry with Data Envelopment Analysis (DEA) methodology between 2002 and 2007. All the banks that constantly operated in the years between 2002 and 2007, excluding investment and development, participation banks, get into the analysis. So there are four groups of banks in the research, those are state-owned deposit banks, privately-owned deposit banks, foreign banks founded in Turkey, and foreign banks having branches in Turkey. In the research model, number of employees, interest expenses, non-interest expenses and total deposit are determined as input, total credits, interest revenue and non-interest revenue are determined as output. This analysis aims to explain the variation in efficiency scores with a set of explanatory variables, such as size, ownership type, nationality, being publicly held. According to results, the efficiency levels do not change very much between 2002 and 2007. The efficiency scores reached top level in 2005 and 2006. The results of regression application denote that all of the explanatory variables have a significant effect on banks' efficiency levels. According to regression analysis results, size negatively affects the efficiency levels of banks. Publicly listed banks operate more efficient than not publicly listed banks. Foreign owned banks operate more efficient than their domestic peers. Furthermore, state owned banks are less efficient than non-state banks.

Keywords: Efficiency, Data Envelopment Analysis, Tobit Regression Model, Turkish Banking Sector.

1. Introduction

With the changes in economical environment, financial institutions have an essential role in the developing countries' economy. Especially banks are fundamental players in the financial industry. So the evaluation and assessment of banks' performance, efficiency, and effectiveness have attracted considerable attention. Measurement of efficiency of banking institutions serves two important purposes. It helps to benchmark of an individual bank against the "best practice" banks and secondly, it helps to evaluate the impact of various measures on the efficiency and performance of these institutions (Das et al. 2009). But the performance measurement in banking sector is not so straightforward, because there are some difficulties in determining inputs and outputs of a bank for efficiency measurement. There is not consensus on that subject. Furthermore, banks may not be homogeneous with respect to types of output they produced.

In Turkey context, some reforms were applied in banking industry after 1980s. The banking industry experienced some financial crises in November 2000 and February 2001. The efficiency level of banking sector decreased in those years. This situation required restructuring of banking sector in Turkey. There are some researches that investigate the performance of banking sector after liberalization policies in 1980s or the effects of financial crises on banking sector. There is not much study that investigates the recent efficiency of Turkish Banking Industry.

There are a lot of techniques to determine the banks' performance. One of them is ratio analysis. In ratio analysis, measures such as return on assets (ROA), return on investment (ROI), liquidity ratios give only one dimension of performance. In this type analysis, different measures can give contradictory results. The regression analysis eliminates this disadvantage but it can only handle one output at a time. In the most of industries corporations especially in banking operate with many inputs and many outputs. Therefore there exists a requirement for efficiency measurement method besides ratio and regression analysis. Data envelopment analysis which was originally introduced by Charnes et al. (1978) is capable of solving multiple inputs and outputs and enables to see complete picture of performance of a company.

This paper examines the efficiency of Turkish banking sector for the period 2002-2007. In this study the effects of size, ownership type, being publicly held on performance are also analyzed. There are two stages of this research. First stage is the analysis of efficiency levels of banks with Data Envelopment Analysis methodology and the second stage is determination of the effects of bank size, ownership type, nationality and being publicly held on bank efficiency scores by Tobit Regression.

The paper is structured in the following way. Section 2 includes a brief review of the literature about bank performance and explanatory variables' effects on banks' efficiency levels. Section 3 denotes the research sample of this study, input and output variables that are used, and outlines the non-parametric Data Envelopment Analysis methodology. In the fourth section the results of the study are charted and the findings are discussed. And in the fifth section the conclusions of the study are presented.

2. Literature Review

In a rapidly changing financial market worldwide, bank regulators, managers, and investors are concerned about how efficiently banks transform their expensive inputs into various financial products and services (Işık & Hassan 2002). So the investigation of the financial institutions has been motivated by academics, policy makers, bankers. There a lot of studies Sufian (2008), Işık (2008), Rezitis (2006), Işık and Hasan (2002), Das et al. (2009), Mercan et al. (2003) that examine the efficiency levels of banks with different methods.

Some researchers investigated also the effects of some explanatory variables on bank efficiency, such as, size, type of ownership, bank configuration, being publicly traded or not.

Bank size is generally measured by banks' amount of assets. Jackson and Fethi (2000), Mercan et al. (2003), Rezitis (2006) analyzed the effect of the bank size on efficiency found a positive relationship between size and efficiency. Işık and Hassan (2002) determined a negative relationship between bank size and efficiency. Chen et al. (2005) indicated that large and small banks are more efficient than medium banks. Aly et al. (1990) investigated the effect of size on the overall efficiency, technical efficiency, allocative efficiency and pure technical efficiency of banks and they measured size as total deposits in thousand of dollars and number of bank branches. They found that size is positively related to efficiency, regardless of whether size was measured as total deposits or number of branches. There is no consensus on how bank size affects bank efficiency, but general view large banks are more efficient than small and medium sized banks.

Hypothesis 1. Large sized banks are more efficient than small sized banks.

The market hypothesis supposed that publicly traded banks should operate more efficient than not publicly traded. But studies that analyze the relationship between being publicly listed or not and bank efficiency generally indicate there is not a significant relationship. Sufian (2009) investigated the effect of being publicly listed on bank performance and did not find evidence of higher efficiency levels of the publicly listed banks. Havrylchyk (2006) studied on being publicly traded effect the performance of banks, but observed no impact of publicly traded on banks efficiency. Mamatzakis et al. (2008) discriminated the banks as publicly listed or not and analyzed the effect of being publicly listed on efficiency, the results do not reveal significant differences between publicly traded or not traded banks.

Hypothesis 2. Being publicly held has no affect on bank's performance.

Jackson and Fethi (2000) analyzed the effect of ownership type on banks' performance and according to their results state ownership worsens efficiency. Işık and Hassan (2002) found that private banks operate more cost efficient than banks in public sector. Mercan et al. (2003) classified the banks according to type of ownership as state-owned, private and foreign. State-owned banks had lowest performance in their study. Sufian (2009)'s study showed that the foreign banks are likely to be more efficient than domestically owned banks. Jackson et al. (1998) analyzed the performance of banks during the period 1992-96 in Turkey. Among three ownership types, private and foreign banks showed greater productivity growth compared to state owned banks. Chen (1998), Chen and Yeh (2000) analyzed the efficiency differences between private and public banks in Taiwan. The results indicated that private banks operate more efficient than public banks. Havrylchyk (2006) assessed the efficiency of foreign and domestic banks, showed that foreign banks are operating in a higher level of efficiency than domestic banks. Also, his study showed that state banks are more efficient than other domestic banks. Chen et al. (2005) grouped the Chinese banks as state owned commercial banks, national-joint

equity banks, regional-joint equity banks and investment banks to determine the relation between efficiency level and type of ownership. State banks showed a relatively higher efficiency level. Lensink et al. (2008) analyzed 2095 banks in 105 countries over the years 1998-2003 and found that foreign ownership negatively affects bank efficiency. Bonin et al. (2005) suggested that foreign-owned banks are more cost-efficient than other banks.

Hypothesis 3. Private banks operate more efficiently than public banks.

Hypothesis 4. Foreign ownership positively affects bank efficiency.

3. Research Methods

3.1. Sample

The research sample of this study includes all the banks that operated in Turkey constantly between 2002–2007, excluding investment and development, and participation banks. This data set should be as homogeneous as possible to be meaningful for relative efficiency measurement for DEA application. So there are four groups of banks in the research, state-owned deposit banks, privately-owned deposit banks, foreign banks founded in Turkey, and, foreign banks having branches in Turkey. Total thirty-one banks from those groups are determined and get into the analysis.

Table 1: The Banks in the Analysis

B1	ABN AMRO Bank N.V.	**B17**	ING Bank A.S.
B2	Adabank A.S.	**B18**	Societe Generale (SA)
B3	Akbank T.A.S.	**B19**	Sekerbank T.A.S.
B4	Alternatif Bank A.S.	**B20**	Tekstil Bankası A.S.
B5	Anadolubank A.S.	**B21**	Turkish Bank A.S.
B6	Arap Türk Bankası A.S.	**B22**	Turkland Bank A.S.
B7	Bank Mellat	**B23**	Türk Ekonomi Bankası A.S.
B8	Citibank A.S.	**B24**	Türkiye Cumhuriyeti Ziraat Bankası A.S.
B9	Denizbank A.S.	**B25**	Türkiye Garanti Bankası A.S.
B10	Eurobank Tekfen A.S.	**B26**	Türkiye Halk Bankası A.S.
B11	Finans Bank A.S.	**B27**	Türkiye İs Bankası A.S.
B12	Fortis Bank A.S.	**B28**	Türkiye Vakıflar Bankası T.A.O.
B13	Habib Bank Limited	**B29**	Unicredit Banca di Roma S.P.A.
B14	HSBC Bank A.S.	**B30**	WestLB AG
B15	JPMorgan Chase Bank N.A	**B31**	Yapı ve Kredi Bankası A.S.
B16	Millennium Bank A.S.		

3.2. Measurement of Variables

The necessary data set from the income statements and balance sheets of the banks is obtained from the annual issues of the Bank Association of Turkey.

In the banking performance literature, there is no definite consensus on the determination of bank inputs and outputs. But there are two main approaches to determine the inputs and outputs that can be used for efficiency measurement; production approach and intermediation approach (Thanassoulis 1999; Sealey & Lindley 1977; Anthanassopoulos 2009). According to production approach, banks are regarded as using labor and capital to generate deposits and loans, and according to intermediation approach deposits are regarded as being converted into loans (Avkıran 2006). Avkıran (2006) summarized two approaches, and showed inputs and outputs for two approaches. Under production approach, number of employees, occupancy, furniture and equipment, other non-interest expenses are determined as input, number of demand deposits, time deposits, real estate loans, installment loans and commercial loans are determined as output. Under intermediation approach, deposits, debentures, other liabilities, shareholder equity, number of employees, physical capital, non-interest expenses are regarded as inputs, loans, securities, deposits with other banks, except central bank, non-interest income are regarded as outputs. Sufian and Majid (2007) employed DEA method to investigate the effects of merger and acquisitions on Singaporean domestic banking groups' efficiency. They estimate two alternative models and they used total deposits as input, total loans and non-interest income as output in the first model, non-interest and interest income as output and interest and non-interest expense as input in the second model. Aysan and Ceyhan (2008) determined the inputs as labor, capital and loanable funds, outputs as short- and long-term

credits, off-balance sheet items, and other earning assets. Jackson et al. (1998) used number of employees and the sum of non-labor operating expense, the direct expenditure on buildings and amortization expenses as inputs, loans, demand deposits and time deposits as output under value-added approach. Wheelock and Wilson (1999) investigated the technical progress, inefficiency and productivity change between 1984 and 1993. They employed three inputs: labor, physical capital, purchased funds, five outputs: real estate loans, commercial and industrial loans, consumer loans, all other loans, total demand deposits by adopting intermediation approach. Oral and Yolalan (1990), Ayadi et al.(1998) determined inputs as interest paid on deposits, expenses on personnel, administration etc. and total deposits, outputs as total loans, interest and non-interest income. Aly et al. (1990) employed a non-parametric frontier approach in their study to calculate the overall, technical, pure technical, allocative and scale efficiencies of a sample of 322 independent banks. And, they determined the inputs as labor, capital, loanable funds, outputs as real estate loans, commercial and industrial loans, consumer loans, all other loans and demand deposits. Bergendahl (1998) applied DEA to Nordic Banks by using loan volumes, deposit volumes, and gross revenues as output, costs of personnel, cost of material and the volume of credit losses as input. Işık (2008) investigated the technical X-efficiency and productivity growth of novo banks and established banks by using a non-parametric frontier method. By employing intermediation approach the outputs that are used in his research are, short-term loans, long-term loans, and other earning assets, the inputs are labor, capital, and loanable funds. Havrylchyk (2006) investigated the efficiency of the Polish Banking industry between 1997 and 2001, and under intermediation approach he determined the inputs as capital, labor and deposits, outputs as loans, government bonds, and off-balance sheet items. Chen et al. (2000) analyzed the operating efficiency of 34 commercial banks in Taiwan banking sector. Under intermediation approach they determined outputs as provision of loan services, portfolio investment, and non-interest income, inputs as bank staff, assets and bank deposits for this analysis. Liu (2009) used slack-based efficiency measures to measure the efficiency of 24 banks in Taiwan; he employed deposits, interest and non-interest expenses as input, loans, interest income and non-interest income as output in his study.

By taking into consideration the literature intermediation approach is used in the analysis. Number of employees, interest expenses, non-interest expenses, and total deposits are determined as input; total loans, interest income, and non-interest income are determined as output. All variables are measured in thousands of Turkish Liras, except number of employees.

3.3. Measurement of Efficiency

The efficiency measurement is generally performed in several methods such as ratio analysis, parametric and non-parametric methods. In the ratio analysis, efficiency is measured with the calculation of several ratios of financial units. The financial unit with the highest output over input or lowest input over output is determined as efficient. But for the calculation of efficiency of financial units which operate multi-input and multi-output ratio analysis is not suitable. Another criticism about the ratio analysis is that some ratios denote that the firm has a successful level of performance but other may show the opposite. The regression analysis does not suffer from that disadvantage, but it assumes a priori form of functional relationship between inputs and outputs, in addition regression analysis can only handle one output at a time (Manadhar & Tang 2002). In the most of industries corporations especially in banking operate with many inputs and many outputs. Therefore there exists a requirement for efficiency measurement method besides ratio and regression analysis. There are another two techniques called as parametric and non-parametric enable efficiency measurement with many input many output. One of the nonparametric techniques which is widely used to measure efficiency is Data Envelopment Analysis (DEA).

3.3.1. The Data Envelopment Analysis (DEA) Model

Data envelopment analysis (DEA) is a linear based programming model which was first proposed by Charnes et al. in 1978 twenty years after Farrell's seminal work for evaluating activities of not-for-profit entities participating in public programs. Recent years a variety of DEA applications have been seen for evaluating the performances of different kinds of entities engaged in many different activities in many different contexts in many different countries (Cooper et al. 2004). DEA assess the comparative efficiency of homogeneous organizational units, such as bank branches, schools, tax offices, and hospitals (Thanassoulis 1999). DEA responds to the need for satisfactory procedures to assess the relative efficiencies of multi-input multi-output production units (Cook & Seiford 2008). The efficiency score is usually denoted as either a number between zero and one or 0 and 100 percent. The efficiency score of one or 100 percent of a decision making unit shows that decision making unit is efficient relative to other units in the research sample. In addition to providing meaningful scalar efficiency values, DEA is designed to determine the sources and estimate the amounts of inefficiencies that might present in the various output and input vectors (Charnes et al. 1991). The most important advantage of DEA over other traditional econometric frontier method is that it does not require prior

assumption (such as standard forms of statistical regression analysis) about the analytical form of the production function (Avkıran 1999; Banker 1984; Cooper et al. 2004). In addition, DEA enable to calculate the efficiency of decision making units that operates multi-input and multi-output. DEA is a valuable benchmarking tool, because it identifies inefficiencies in decision making units by comparing them with similar decision making units regarded as efficient (Avkıran 2006). Unlike other benchmarking tools that rely on the managers' observation, comparison, DEA enables to identify best practices that are too complex to be identified (Sherman & Ladino 1995). On the other hand, the main problem about DEA model is that, it is a non-parametric method, so it is sensitive to the measurement problems (Al-Sharkas et al. 2008).

The relative performance measurement of DEA is a two-staged process (Mercan et al. 2003):

(i) Determining the best performing decision making units that produces greatest output with the least input. Assigning a DEA performance-index value of unity (1) to such decision making units and placing them on the efficient frontier.

(ii) Determining the DEA performance-index values for all other decision making units in the set. Such values are represented by the distance of the less efficient units from the above defined efficient frontier. The decision making units in this subset use more inputs given an output level or produce less output for a specific level of inputs.

DEA determines, the most productive decision making unit, the amount of excess resources used by inefficient decision making units, the amount of excess capacity or ability to increase service outputs in less-productive units, the set of best-practice service units most similar to the less-productive units, referred to as the best-practice reference set (Sherman & Ladino 1995).

Mathematical formulation of DEA model can be stated as:

$$Max \ \ Z_o = \frac{\sum_{r=1}^{m} u_{ro} y_{ro}}{\sum_{i=1}^{n} v_{io} x_{io}} \qquad (1)$$

Subject to the constraints:

$$\frac{\sum_{r=1}^{m} u_{rj} y_{rj}}{\sum_{i=1}^{n} v_{ij} x_{ij}} \le 1 \qquad \text{for } j = 1, 2, \text{k} \qquad (2)$$

$$u_{ro}, v_{io} \ge 0 \qquad \text{for } r = 1, m; \text{ and } i = 1, n \qquad (3)$$

Where:

Z_o : Efficiency score of o[th] decision making unit.

x_{ij} : Observed value of input *i* for the decision making unit *j*.

y_{rj} : Observed value of output *r* for the decision making unit *j*.

u_{rj}, v_{ij} : Weights of input *r* and output *i* of decision making unit *j* respectively.

k : Number of decision making units.

m : Number of outputs.

n : Number of inputs.

Linear programming expression of the DEA model is like that:

$$Max Z_o = \sum_{r=1}^{m} u_{ro} y_{ro} \qquad (4)$$

Subject to the constraints:

$$\sum_{i=1}^{n} v_{io} x_{io} = 1 \qquad (5)$$

$$\sum_{r=1}^{m} u_{rj} y_{rj} \leq \sum_{i=1}^{n} v_{ij} x_{ij} \qquad \text{for } j = 1, 2, \text{k} \qquad (6)$$

$$u_{ro}, v_{io} \geq 0 \qquad \text{for } r = 1, m; \text{ and } j = 1, n \qquad (7)$$

4. Results

The efficiency scores of each bank included in the sample are shown in Table 2. The efficiencies of the banks are examined between the years 2002-2007 with input oriented CCR model. The banking sector operated higher than 0.8 of efficiency scores in the whole research period. The average scores are 0.87 in 2002, 0.89 in 2003, 0.84 in 2004, 0.91 in 2005, 0.92 in 2006, 0.88 in 2007. The efficiency levels increased after the 2002 and reached 0.92 point in 2006, and again decreased 0.88 in 2007. There is a recovery phase in banking industry performance. There are six banks that operated efficiently in the whole research period. So the 19% percent (six of thirty-one banks) operated constantly efficient from 2002 through 2007. Also, there are thirteen banks that operated inefficiently during all analysis period. So the 41% (thirteen of thirty-one banks) operated inefficiently between 2002 and 2007.

Table 2: CCR-I Efficiency Scores (2002-2007)

	2002	2003	2004	2005	2006	2007	Frequency of Efficiency
B1	1,00	0,88	1,00	1,00	1,00	0,75	3
B2	0,76	1,00	0,55	1,00	1,00	1,00	4
B3	1,00	1,00	1,00	1,00	1,00	1,00	6
B4	0,86	0,79	0,99	0,90	1,00	1,00	2
B5	0,79	0,99	0,83	0,78	0,82	0,85	0
B6	1,00	1,00	0,77	0,87	0,78	0,60	2
B7	1,00	1,00	1,00	1,00	1,00	1,00	6
B8	0,63	0,65	0,66	0,98	0,97	0,67	0
B9	0,77	0,91	0,75	0,90	0,91	0,81	0
B10	0,73	0,66	0,62	0,65	0,75	0,99	0
B11	1,00	0,90	0,86	1,00	0,96	0,85	2
B12	0,72	0,83	0,78	0,83	0,87	0,69	0
B13	1,00	1,00	1,00	1,00	1,00	1,00	2
B14	0,94	1,00	0,78	1,00	0,98	0,80	2
B15	1,00	1,00	1,00	1,00	1,00	1,00	6
B16	0,81	0,49	0,40	0,68	0,86	1,00	1
B17	0,78	0,84	0,86	0,86	0,85	0,82	0
B18	1,00	1,00	1,00	1,00	1,00	1,00	6
B19	0,64	0,59	0,84	0,92	0,77	0,73	0
B20	0,77	0,91	0,72	0,85	0,88	0,87	0
B21	0,85	0,85	0,82	0,81	0,85	0,66	0
B22	0,76	0,87	0,66	0,79	0,68	0,67	0
B23	0,79	0,97	0,76	0,88	0,85	0,77	0
B24	0,94	0,99	1,00	1,00	1,00	1,00	4
B25	0,97	1,00	0,83	0,96	0,98	1,00	2
B26	1,00	1,00	1,00	1,00	1,00	1,00	6
B27	0,75	0,75	0,82	0,94	0,91	0,86	0
B28	0,72	0,90	1,00	1,00	1,00	1,00	4
B29	1,00	1,00	0,91	0,93	1,00	1,00	4
B30	1,00	1,00	1,00	1,00	1,00	1,00	6
B31	0,88	0,99	0,80	0,78	0,87	0,83	0
Average	0,87	0,89	0,84	0,91	0,92	0,88	

The total efficiency, technical efficiency and scale efficiency of the banks are also analyzed and the findings are showed in Table 3. Input oriented CCR efficiency scores give the total efficiency of banks. Input oriented BCC results give the technical efficiency of banks. As CCR scores are divided by BCC scores, the outcome will give the scale efficiency of banks.

The average technical efficiency levels of banks are higher than average scale efficiency levels within this period. It is observed that the increase in total efficiency level is mainly resulted from the increase in technical efficiency level. Given our results that Turkish banking sector suffered from scale inefficiency.

Table 3: Total Efficiency, Technical Efficiency and Scale Efficiency of the Banks

	Total Efficiency	**Technical Efficiency**	**Scale Efficiency**
B1	0,94	1,00	0,94
B2	0,88	0,97	0,91
B3	1,00	1,00	1,00
B4	0,92	1,00	0,92
B5	0,84	0,89	0,95
B6	0,84	0,98	0,85
B7	1,00	1,00	1,00
B8	0,76	1,00	0,76
B9	0,84	0,92	0,91
B10	0,73	0,80	0,91
B11	0,93	1,00	0,93
B12	0,79	0,98	0,80
B13	1,00	1,00	1,00
B14	0,92	1,00	0,92
B15	1,00	1,00	1,00
B16	0,70	0,83	0,85
B17	0,83	0,93	0,90
B18	1,00	1,00	1,00
B19	0,75	0,92	0,81
B20	0,83	0,95	0,87
B21	0,81	0,85	0,95
B22	0,74	0,87	0,85
B23	0,84	0,95	0,88
B24	0,99	1,00	0,99
B25	0,96	1,00	0,96
B26	1,00	1,00	1,00
B27	0,84	0,99	0,85
B28	0,94	0,95	0,98
B29	0,97	0,98	1,00
B30	1,00	1,00	1,00
B31	0,86	0,99	0,87
Average	0,89	0,96	0,92

Table 4: Tobit Regression Results (n=176)

	Coefficient	Standard Error	t-ratio	P-value
Size	-0.0697283	0.0231161	-3.02	0.003
Nationality	-0.0762108	0.0217101	-3.51	0.001
Ownership	0.1843663	0.0341993	5.39	0.000
Publicly Listed	0.0757398	0.0248959	3.09	0.003
Constant	0.9239495	0.0145359	63.56	0.000

The effects of bank size, ownership type, nationality and being publicly held on total efficiency are analyzed with Tobit Regression by STATA. Ownership type, nationality, size and being publicly held are employed as dummy variables. In this analysis, DEA efficiency score of a bank is determined as dependent variable. If the coefficient of an explanatory variable is positive, it increases the efficiency level of the bank. In spite of that if the coefficient of an explanatory variable is negative; it decreases the efficiency level of the bank. Significance level of the regression is 95%. The findings imply that all explanatory variables are significantly different from zero and have a significant effect on efficiency score of banks.

Banks are grouped as large and small according to their assets levels in this study. Size has a negative effect on efficiency levels of banks, suggesting that the smaller the bank, the more efficient bank will be. There is a scale problem in Turkish banking sector, the banks can not use economies of scale advantage. There may be decreasing return to scale in Turkish banking sector. 1% percent increase in inputs results less than 1% increase in outputs. As the banks grow they become less efficient. Larger banks have lower efficiency which could be due to complex organizational structure and moral hazard behavior (Sufian & Abd. Majid 2007). In Turkey, smaller banks are typically newer and generally specialize in trade and finance and wholesale corporate banking and employ more professional and astute management teams (Işık & Hassan 2002). Because of competition small banks should operate efficient to survive especially in metropolitan markets. The results are accordance with Işık and Hassan (2002) on Turkish banking sector.

To analyze the relationship between publicly traded and Turkish banks' efficiencies a dummy variable is introduced as an explanatory data. Being publicly traded has a positive effect on efficiency levels of banks. So, the publicly traded banks operate more efficient than not publicly traded banks. That finding supports the market discipline hypothesis. According to this hypothesis banks whose shares are publicly traded should exhibit higher efficiency. Thus, the easily transferable ownership structure of firms creates incentives for both shareholders to monitor management performance and for bank management to improve their performance as it contains risks associated with moral hazard practices (Mamatzakis et al. 2008).

Banks of different nations may have different outcomes with the same inputs. Thus, in this section the effect of ownership type and nationality on efficiency levels of banks are analyzed.

Ownership dummy is determined as state and non-state banks. The positive sign of the coefficient on non-state ownership binary variable implies that non-state ownership improve the efficiency level of the banks. Non-state banks operate more efficient than state banks. There are two major reasons behind the efficiency difference between public and private firms. The first is while all private firms are profit maximizing, public firms would pursue whatever objectives the government demands. The second is while private firms are subject to relatively hard budget; public firms are subject to relatively soft budgets (Işık & Hassan 2002).

Nationality has a positive effect on efficiency levels. The positive sign of the coefficient on foreign ownership binary variable implies that foreign ownership improve the efficiency level of the banks. Foreign banks operate more efficient than their domestic counterparts. This may be because of foreign owned banks have better risk management, operational, technological techniques which they enable from their parent banks abroad. The empirical observation that foreign banks perform better compared to domestic banks in developing countries. This suggests that technical ability of banks from developed countries overcomes the home field advantage in developing countries (Jeon & Miller 2005). Berger et al. (2000) explained the differences between home field advantages and global advantages. The global advantage hypothesis denotes that foreign banks might benefit from competitive advantages relative to their domestic banks. Foreign banks may also become more competitive when compared to domestic banks due to an active market for corporate control in the home country, and because they have access to an educated labor force that is able to adapt new technologies (Lensink et al. 2008). The results are accordance with Sufian (2008) on Malaysian banks, Jackson et al. (1998) on Turkish banks, Işık and Hassan (2003) on Turkish banks, Havrylchyk (2006) on Polish banks, Bonin et al. (2005) in transition countries.

5. Conclusion

This paper aims to determine the efficiency of Turkish banks between 2002 and 2007. So, the efficiency levels of Turkish banking sector are analyzed during the period 2002-2007 with Data Envelopment Analysis. Then, multivariate regression analysis have been employed in order to detect the determinants of banking efficiency in Turkey.

The sample includes thirty-one banks that continuously operated during this period. According to results, the efficiency level of Turkish banking did not change very much in the analysis period. The banking sector operated at stable efficiency level. The average performance values between 0.84 and 0.92 in this period. Additionally, the findings reveal that the average technical efficiency scores of banks are higher than average scale efficiency scores. There is a scale inefficiency problem in Turkish banking sector.

The effects of some explanatory data on the banks' efficiency levels are also analyzed in this research. Size, ownership type, nationality, being publicly listed are improved as dummy variables. Findings imply that

smaller banks are more efficient than larger banks. As the banks grow they become less efficient. The Turkish banking sector may experience decreasing returns to scale. Publicly listed banks are more efficient than not publicly listed banks. This finding is compatible with market discipline hypothesis which suggests stockholders of the banks can exert market discipline over bank management, so the publicly traded banks are expected to be more efficient. Non-state banks operate more efficient than their state counterparts. This may be because of the goals of those two banks differentiate. Private entities always aim to maximize their profit. The regression analysis results also denoted that foreign banks are more efficient compared to their domestic peers. Foreign banks might profit from better risk management and take advantage of technological improvements.

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