EVALUATING THE EFFECTS OF CAPITAL STRUCTURE IN THE EFFICIENCY OF TURKISH BANKING SYSTEM RELATED WITH 2008 GLOBAL CRISIS: A DATA ENVELOPMENT ANALYSIS APPLICATION[1]

Can Deniz Köksal
Akdeniz University
Faculty of Economics and Administrative Sciences
Department of Business
07058, Campus, Antalya
TURKEY
e-mail: candeniz@akdeniz.edu.tr
telephone: 0090 242 310 18 03

Abstract

Efficiency in the services sectors is a significant issue in global business. As one of the major sectors in services industry, banks have the pioneering role in finance sector in Turkey as they have the same role in the world. With the effect of globalization, Turkey accepts considerable amount of foreign capital via its banking system from year to year. In banking system, it is thought that being under operation with a foreign capital structure together with the managerial skills makes an important effect for the overall performance of the banks in comparative business environment. In the literature, it has been claimed that the banks operated with foreign capital are usually more successful than the ones which operated with domestic capital. The reason for this can be explained with global knowledge, having broader vision and using more different professional applications in banking operations. On the other hand, to be familiar with its society's culture and having more branches throughout the country can be the opportunities for domestic banks. In this study, Turkish banks have been evaluated using their number of branches, number of staffs, total assets and total interest expenses as input variables and net profit for the period as output variable. The banks have also been ranked according to their efficiency scores by years and than; these scores were grouped into two subgroups in order to be re-analyzed with statistical methods.

Keywords: *Turkish banking system, capital structure, data envelopment analysis*

JEL codes: *G21, G39, C14*

1. Introduction

The banking sector in most economies is so critical that it attracts much attention from the domestic financial institutions, governmental regulatory authorities and international

[1] The author gratefully acknowledges the financial support for this research by Akdeniz University research projects fund.

financial institutions. Banking system in Turkey usually acts as a bridge to provide a major source of financial intermediation and consequently influences the level of money stock through its managerial ability to create deposit liabilities within the strict rules of governmental institutions. This financial structure has gained more importance since the opening of the doors of Turkey's banking system into the international financial markets in the mid of 1980s.

During 80s, together with the establishment of new economic reforms for the reel sector, there were also continuous legal, structural and institutional changes in the Turkish financial system, too. With these reforms, the Turkish economy has been integrated into the world economy, and then foreign capital and investments are beginning to enter into this newly regulated market. At the beginning, foreign capital entry was done by transferring necessary capital as syndication credit to Turkish banks while the public banks were controlling bulk of the banking sector's capital structure. In this period banks were facing with the strong competition of privately owned domestic brokerage companies which were bankrupted at the end 80s and some of their owners were jailed. In 90s, there were many domestic banks appeared as mushrooms which offer incredibly higher interest rates with the wind of high inflation even for the short term accounts. But, most of these banks have been bankrupt with the effects of fierce and unfair competition. 90s were characterized as a non-stationary macroeconomic period for Turkey, despite the rest of the banking industry in Turkey has showed success with the return on asset ratio compared with the average of the OECD countries (Denizer, 1997).

At the last years of this decade, impacts of political pressure were felt considerably in the banking sector and the motivation behind banking activities such as opening up new banks and doubling the number of bank branches through the country. All of these growing processes were done without giving much importance to managerial issues and efficiency of resource allocation for the services given. And when the time came to the mid of 2001, Turkey was faced with a political crisis mainly triggered by domestic political challenges between the politicians. The confidence on political system and structural stability of economy has begun to be discussed by economists and investors yielding the account holders' withdrawals their money and shares from banks before their maturities completed. This unexpected situation has suddenly turned into a financial crisis with shadowing political crisis and many weak banks have announced their bankruptcy.

As a result of these, monetary policies and exchange rate regime have been changed

from top to toe and loose monetary policy with flexible exchange rate regime was declared as a solution to these chronic problems (Aysan and Ceyhan, 2007). Together with these changes in system, a rehabilitation program was also launched by the Turkish Banking Regulation and Supervisory Agency (BRSA) to recover banks and to regulate the bank operations (Al and Aysan, 2006). With the help of these regulations on collapsed system, the operations of public-owned and private-owned banks have been restructured. Thus, the profitability and stability of the Turkish banking system have shown a visible increase. From that time now on, in a rapidly changing financial arena of Turkey, emerging markets have opened up to direct participation of foreign capital with not only the way of transferring capital, also with the way of buying and being owner of these weak banks. After this crisis experience, beside the managers and investors, academicians are also concerned about the inputs, outputs and efficiencies of the banks which are operated nationwide and internationally. As a result of this growing interest, academicians have started to search the argument about negative and positive effects of foreign participation on banking system and economy (Tufan et al, 2007).

This paper proceeds as follows. The following section contains objectives of the study. Section three is related with data and methodology which presents the specifications of variables and time period of gathered data. And this section also presents the Data Envelopment Analysis briefly. Section four summaries the empirical findings and the conclusions are made in section five.

2. Objectives of the Study

Turkey, as an emerging economy and as being financially integrated to the world economy deserves to be studied with its banking sector. The contemporary banking structure in Turkey is constructed with the side by side operation of public, private and foreign owned banks. Turkey operates a multiple branch banking system. Thus, most of the banks operate throughout the country through their multiple branching networks. Due to this distributed structure, the capital and managerial structures of the banks are attracted the researchers to conduct new studies on the possible impacts of these structural differences. With the help of non-parametric techniques rather than some statistical techniques and traditional ratio analysis methods, increasing number of studies have begun to be made for the detection of productivity developments in public, private and foreign banks.

The study of Grigorian and Manole (2002) is one of the pioneering studies that estimate the efficiency of the banking sector in transition countries by running research

models of the efficiency scores on variables related to macroeconomic environment, regulatory environment and bank specific variables. In Turkey, some studies have been applied on these issues with different analysis techniques by Aysan and Ceyhan (2007), Gungor (2007), Tufan et al (2007), Ozkan-Gumay and Tektas (2006), Isik and Hasan (2002), Jakson and Fethi (2000).

In view above information, the objective of this study is to measure and compare the technical efficiency of commercial banks in Turkey before and during crisis period. And it will be investigated if the capital structure has an effect in efficiency.

3. Data and Methodology

3.1 Data

Central Bank, commercial banks, investment and development banks construct the Turkish banking system. These banks are under operation for the different purposes and they should not be evaluated for same goals. While the commercial banks dominate the system, the data used in this study with the some selected financial characteristics were chosen from these which engaged multi-branch banking. Although there are 31 commercial banks in Turkish banking system by the end of 2008, only 22 of them are included in this study, because 9 banks out of 31 are not operating nationwide and they have less than 10 bank branches within their ownership.

The commercial banks included in this study are public-owned banks, private-owned banks and foreign-owned banks representing with the counts 3, 10 and 9 respectively. The financial characteristics of these banks are; Y1: Net Year-End Profit, X1: Number of Branches, X2: Number of Employees, X3: Total Assets and X4: Total Interest Expenses. The sample contains these inputs and outputs are from 2006 through 2008 periods. In this paper, a bank is referred to as a decision making unit (DMU) and each DMU operates by transforming a set of ***m*** different inputs into ***s*** different outputs. Variables are denoted Y1 as output and X1, X2, X3 and X4 as inputs. The data for this study were obtained from the official site of Banks Association of Turkey.

3.2 Methodology

Data Envelopment Analysis (DEA) was chosen as the analysis technique for this study for a number of reasons, including the fact that; there is no restriction on the type of variables

will be used. In DEA studies, variables can be measured in different units and there is no need to convert them into a common scale (Coelli and Perelman, 1998). The technique, which is referred to as DEA, is able to compare the efficiency of multiple service units that provide similar services by considering their use of multiple inputs and to produce multiple outputs (Bosetti et al, 2003). Besides being more comprehensive and reliable than a set of operating ratios or profit measures, the DEA measure has the ability to incorporate multiple inputs and multiple outputs into both the numerator and denominator of the efficiency ratio without the need for converting to a common scale basis (Fitzsimmons and Fitzsimmons, 1998).

DEA is a linear programming model that attempts to maximize a service unit's efficiency with the performance of a group of similar service units that are delivering the same service. In the process, some units achieve 100% efficiency and are referred to as the relatively efficient units, whereas other units with efficiency scores of less than 100% are referred to as inefficient ones (Norman and Stoker, 1991). Efficiency is defined as the ratio of weighted sum of outputs to weighted sum of inputs in the model and components of this model can be explained as follows (Metters et al, 1999):

Efficiency = Weighted Sum of Outputs / Weighted Sum of Inputs (1)

Efficiency of Unit (j) = $(u_1.y_{1j} + u_2.y_{2j} + \ldots) / (v_1.x_1j + v_2.x_2j + \ldots)$ (2)

Variables in equation indicate;

u_1 = weight of output i
y_{1j} = quantity of output-1 derived from unit j
v_1 = weight of input j
x_{1j} = quantity of input-1 used by unit j

An efficiency model simplified as the above equation can be solved as a Linear Program by means of the following maximization approach (Yolalan, 1993).

$$\text{Max } h_k = \sum_{r=1}^{s} u_{rk} . Y_{rk} \quad (3)$$

Subject to;

$$\sum_{r=1}^{s} u_{rk} . Y_{rj} - \sum_{i=1}^{m} v_{ik} . X_{ij} \leq 0; \quad (4)$$

For k and j = 1,2,..., n Decision Making Units

$$\sum_{i=1}^{m} v_{ik} . X_{ik} = 1 \quad \text{weighted sum of inputs set to unity} \quad (5)$$

$$U_{rk} \geq 0 \quad ; r = 1, 2, ..., s \quad \text{outputs} \quad (6)$$

$$V_{ik} \geq 0 \quad ; i = 1, 2, ..., m \quad \text{inputs} \quad (7)$$

A question of sample size is often raised concerning the number of Decision Making Units that are required to compare with the number of input and output variables selected for the analysis. In the formulated relationship as ($K \geq 2 (N + M)$, the number of DMU, the number of inputs and the number of outputs are symbolized with K, N and M respectively by DEA practitioners (Nooreha et al, 2000). Here, we do not attempt to describe the methodology of DEA with details. The theory, formula, advantages and disadvantages of the technique can be examined from the book of Norman and Stoker (1991) and Ray (2004). Kruskall Wallis Variance Analysis was applied as a non-parametric statistical method in order to compare the efficiency score means of bank groups.

4. Empirical Findings

The performance of commercial banks in Turkey is examined in terms of their efficiency to provide the necessary output with using minimum input composition. The Input Oriented and Constant Returns to Scale method of DEA was applied to the selected variables of Banks from the years 2006 to 2008. The CRS (Constant Returns to Scale) assumption allows comparing large banks with the smaller ones (Zaim, 1995).

The computations were conducted by Deap2.1 software. It is not only aimed to calculate each bank's efficiency score in order to reduce their inputs to make higher the output as the referenced ones with a competitive way, it is also mainly aimed to see the average efficiency results of the bank groups to be compared each other. While the number and the ownership of the banks are changing from year to year, it is aimed to calculate the average scores of the bank groups as Public-owned, Private-owned and Foreign-owned ones.

Table1 Descriptive Statistics in General for the Variables by Years

Input and Output Variables	***Years and Descriptive Statistics***		
	Year2006 ***Mean*** ***St. Deviation***	***Year2007*** ***Mean*** ***St. Deviation***	***Year2008*** ***Mean*** ***St. Deviation***
*Y1: Net Year-End Profit**	473.251,27 590.157,33	606.771,50 793.086,15	529.818,18 679.402,93
X1: Number of Branches	308,59 324,67	343,18 332,99	395,68 367,05
X2: Number of Employees	6.252,35 6.048,56	6.913,82 6.315,68	7.506,68 6.740,06
*X3: Total Assets**	21.107.210,73 24.588.433,03	24.430.302,36 27.897.546,23	30.803.909,09 35.358.943,90
*X4: Total Interest Expenses**	1.507.206,18 1.834.627,02	1.941.180,59 2.291.178,34	2.579.318,18 3.330.126,01

** These variables are measured in Turkish Lira (x1000) and 1 USD is the equivalent of 1.5 Turkish Lira.*

Table1 presents the descriptive statistics of input and output variables by related years. The sample consists of 22 commercial banks which have at least 10 or more branches through the country. These extractions were done, because the banks which have less than 10 branches were operated mainly in Istanbul as doing local banking. Table2 summaries the descriptive statistics calculated from the technical efficiency scores of three types of bank groups including minimum and maximum technical efficiency scores.

In the initial analysis of 22 banks related with their average efficiency scores, bank groups as being public-owned, private-owned and foreign-owned could be able to produce outputs with approximately 0,188, 0,374 and 0,437 percent fewer inputs for the year 2006, respectively. The results are found worst than former year for the data of 2007 as 0,211, 0,419 and 0,539 fewer percentages for the public-owned, private-owned and foreign-owned bank groups respectively.

Table2 Descriptive Statistics of Technical Efficiency Scores by Years and Capital Structures

Year	*Capital Structure*	*Mean*	*St. Deviation*	*Min. TE**	*Max. TE**
2006	*Public-Owned*	0,812	0,171	0,665	1,000
	Private-Owned	0,626	0,271	0,356	1,000
	Foreign-Owned	0,563	0,342	0,025	1,000
2007	*Public-Owned*	0,789	0,043	0,744	0,829
	Private-Owned	0,581	0,255	0,246	1,000
	Foreign-Owned	0,461	0,331	0,007	1,000
2008	*Public-Owned*	0,890	0,148	0,722	1,000
	Private-Owned	0,730	0,259	0,178	1,000
	Foreign-Owned	0,442	0,277	0,042	0,811

** TE: Technical Efficiency*

Table3 Kruskall Wallis Test Results for Efficiency Scores

Year	*Capital Structure*	*n*	*Mean Rank*	*Kruskall Wallis Chi-Square Value*	*df*	*Asymp.Sig.*
2006	*Public-Owned*	3	16,00	1,773	2	0,412
	Private-Owned	10	11,20			
	Foreign-Owned	9	10,33			
2007	*Public-Owned*	3	16,67	2,668	2	0,263
	Private-Owned	10	11,65			
	Foreign-Owned	9	9,61			
2008	*Public-Owned*	3	17,17	7,640	2	**0,022***
	Private-Owned	10	13,75			
	Foreign-Owned	9	7,11			

** Denotes the statistically significance within 95% confidence limits.*

Finally, for the year 2008 which was thought still under the impact of Global financial crisis, the efficiencies of bank group were examined. The fewer input percentages are found

as 0,110, 0,270 and 0,558 for the public-owned, private-owned and foreign-owned bank groups respectively. According to 2008 results, public-owned and private-owned bank groups are shown as rehabilitated them compared with the results of year 2006 and 2007. But, the result for foreign-owned bank group is found contrary. As seen from Table2, it is obviously said that, there is more to do for the foreign-owned banks in order to be compatible in Turkish financial markets. And, this conclusion is supported with the results of Kruskall Wallis Variance Analysis applied to the efficiency scores of the banks.

5. Conclusion

While the Turkish Banking sector gained a performance improvement after the restructuring process from top to toe just after the 2001 financial crisis triggered by a political crisis, this study was attempted to find out how the capital structure (public, private or foreign owned) made effect on the efficiencies of the commercial banks related with ongoing Global financial crisis. To do this, a non-parametric technique known as DEA for measuring and comparing the relative efficiencies of commercial banks was applied.

The results of DEA analysis provided evidence that there were differences between the efficiencies of bank types by the figures of 2006, 2007 and 2008. Despite the differences in figures between efficiency scores by bank groups, no statistical differences were found for the years 2006 and 2007. But, according to the results of Kruskall Wallis Variance Analysis, this situation was clearly changed for the figures of year 2008.

Overall our results indicate that, despite the Global financial crisis, public-owned and private-owned bank groups are shown as rehabilitated their scores compared with the results from year 2006 to 2008. But, the results for foreign-owned bank group are found contrary. These results are shown similarity with Tufan *et al's* study, in which, it was concluded that the Turkish depository banks were relatively more successful than foreign depository banks. As related with Global financial crisis, it can be said that, the main capital of foreign banks in their overseas branches was weakened because of the crisis which was originally triggered in these countries and the effects of this great stress of having capital shortage have made them unreliable and ineffective in Turkey.

It is obvious that, multi-branch banking services should be given across the country with the operation of effective bank branches, having enough capital and knowing the

contemporary determinants of efficiency. Together with these, conducting regular studies on this issue may assist to be successful in a compatible banking arena.

References

[1] AL, H. and AYSAN, F., *Assessing the Preconditions in Establishing an Independent Regulatory and Supervisory Agency in Globalized Financial Markets: The Case of Turkey*, International Journal of Applied Business and Economic Research, 2006, 4(2):125-146.

[2] AYSAN, A. F. and CEYHAN, S.P., *Why Do Foreign Banks Invest in Turkey?* Asian and African Journal of Economics and Econometrics, 2007, 7 (1): 65-80.

[3] BOSETTI V., CASSINELLI M. and LANZA, A., *Using Data Envelopment Analysis to Evaluate Environmentally Conscious Tourism Management*, Conference for Tourism and Sustainable Development, September, 19-20, 2003, Chia, Sardegna.

[4] COELLI, T.J. and PERELMAN S., *A Comparison of Parametric and Non-parametric Distance Functions with Application to European Railways*. European Journal of Operations Research, 1998, 117:326-339.

[5] DENIZER, C., *The Effects of Financial Liberalization and New Bank Entry on Market Structure and Competition in Turkey*, 1997, Working Paper No: 1839, World Bank Development Research Group, November.

[6] FITZSIMMONS, J. A. & FITZSIMMONS, M. J., S*ervice Management Operations, Strategy and Information Technology*, 1998, New York, Irwin McGraw-Hill.

[7] GRIGORIAN, D. A. and MANOLE, V., *Determinants of Commercial Bank Performance in Transition: An Application of Data Envelopment Analysis*, 2002, World Bank, Europe and Central Asia Region, Private and Financial Sector Development Unit, Policy Research Paper, No. 2850.

[8] GUNGOR, B., *Türkiye'de Faaliyet Gösteren Yerel ve Yabancı Bankaların Karlılık Seviyelerini Etkileyen Faktörler:Panel Veri Analizi*, İktisat-İşletme ve Finans Dergisi, Eylül, 2007, Vol:258, pp.40-63.

[9] ISIK. I., and HASSAN. M. K., *Cost and Profit Efficiency of the Turkish Banking Industry: An Empirical Investigation*, 2002, The Financial Review, Vol: 37, pp.257-280.

[10] JAKSON, M.J., and FETHI, D.M., *Evaluating the Technical Efficiency of Turkish Commercial Banks: An Application of DEA and Tobit Analysis*, 2000, International DEA Symposium, University of Queensland, Brisbane, Australia, 2-4 July.

[11] METTERS, R.D., FREI, F.X. and VARGAS, V.A., *Measurement of Multiple Sites in Service Firms with Data Envelopment Analysis*, Production and Operation Management, 1999, Vol.8, No.3, Fall.

[12] NORMAN, M. and STOKER, B., *Data Envelopment Analysis, the Assessment of Performance*, 1991, John Wiley and Sons, New Jersey.

[13] NOOREHA, H., MOKHTAR, A. and SURESH, K., *Evaluating Public Sector Efficiency with Data Envelopment Analysis (DEA): A Case Study in Road Transport Department*; 2000, Selangor, Malaysia., Total Quality Management, Vol. 11, No. 4, s830-836.

[14] OZKAN-GUNAY, E.N. and TEKTAS, A. *Efficiency Analysis of the Turkish Banking Sector in Pre-crisis and Crisis Period: A DEA Approach*, 2006, Contemporary Economic Policy, 24, 3, p.418-431.

[15] RAY, S.C., *Data Envelopment Analysis-Theory and Techniques for Economics and Operations Research*, 2004, Cambridge University Press, Cambridge.

[16] TUFAN, E., HAMARAT. B., CRISTEA. M. and VASILESCU, G. L., *Evaluation of Turkish Domestic and Foreign Banks by using Financial Ratios", 11th International Conference on Finance and Banking: Future of the European Monetary Integration*, 2007, Karvina, Czech Republic, 17-18 October, pp.814-829.

[17] YOLALAN, R., *İşletmeler Arası Göreli Etkinlik Ölçümü*, 1993, MPM Yayinlari No: 483, Ankara.

[18] ZAIM, O., *The effect of Financial Liberalization on the Efficiency of Turkish Commercial Banks*, 1995, Applied Financial Economics, 5, 257-264.