ESSAYS ON DETERMINANTS OF EFFICIENCY FOR COMMERCIAL BANKS IN TURKEY

Thesis submitted to the

Institute for Graduate Studies in the Social Sciences

in partial fulfillment of the requirements for the degree of

Master of Arts

in

Economics

by

Seçil Öztürk

Boğaziçi University

2009

Essays on Determinants of Efficiency for Commercial Banks in Turkey

The thesis of Seçil Öztürk has been approved by:

Assistant Professor Ozan Hatipoğlu _____
(Thesis Advisor)

Associate Professor Ahmet Faruk Aysan _____

Assistant Professor Levent Yıldıran _____

September 2009

Thesis Abstract

Seçil Öztürk, "Essays on Determinants of Efficiency for Commercial Banks in Turkey"

The main motivation of this study is to assess potential determinants of bank efficiency in commercial banks operating in Turkey for post crisis period. Post crisis period is taken only in order to catch the macro economic homogeneity. Hence banks will be able to focus on the bank specific characteristics to improve their performances. Two-step procedure is applied as the methodology in which efficiency scores calculated in the first step are regressed on certain variables to see their affect on bank performance.

Recently, the banks shifted their resources to alternative ways of banking like other earning asset and off balance sheet items. Hence we attempt to understand how these changes in commercial banks' operations affect their efficiencies. In the first part of this study interbank funds will be concentrated on as an untraditional way of banking. In the second part, the components of off balance sheet items will be assessed whether their increasing volume improves bank performance. In the last chapter, certain bank specific variables are regressed on the efficiency scores with a focus on size variables in order to see if increasing bank size contributes to scale economies.

Tez Özeti

Seçil Öztürk, "Türkiye'deki Mevduat Bankalarının Verimliliğini Belirleyen Faktörler Üzerine Makaleler"

Bu çalışmanın temel amacı Türkiye'de yer alan mevduat bankalarının, 2001 krizi sonrası dönem için, verimliliklerini belirleyen potansiyel faktörleri değerlendirmektir. Çalışmada sadece kriz sonrası dönemi almamızın nedeni tüm bankalar için aynı makro ekonomik koşulları elde etmektir. Böylece bankalar sadece kendilerinin kontrol edebildiği değişkenlere odaklanarak performanslarını geliştirebileceklerdir. Metod olarak kullanılan iki aşamalı prosedürede, ilk aşamada Veri Zarflama Analizi yöntemi ile verimlilikler hesaplanır ve ikinci aşamada bağımlı değişken olarak kullanılır. Bu aşamada, seçilmiş bağımsız değişkenler kullanılarak regresyon analizi yapılır.

Son zamanlarda, bankalar daha fazla kaynağını alternatif bankacılık yöntemlerine ayırmaya başlamışlardır. Bunlar arasında nazım hesaplar ve bankalararası alacaklar bulunmaktadır. Dolayısıyla, finansal sektörde gerçekleşen bu değişikliklerin bankaların verimliliklerini nasıl etkilediğini anlamayı hedefliyorum. Bu çalışmamın ilk kısmında bankalararası alacakların banka performansı üzerindeki etkisine odaklanıyorum. İkinci kısımda bilanço dışı işlemleri oluşturan kalemlerin hacminde görülen artışın bankaların verimliliklerine olan etkisini değerlendirdim. Son kısımda ise, bankaların kontrol edebildiği diğer değişkenlerle birlikte banka büyüklüğünü gösteren iki değişkenin banka verimliliği ile aralarındaki ilişkiye baktım.

ACKNOWLEDGEMENTS

I would like to express my special thanks to my advisor Assoc. Prof. Ahmet Aysan for his great contributions and patience during completion of my thesis. Additionally, I would like to thank Assist. Prof. Ozan Hatipoğlu and Assist. Prof. Levent Yıldıran for participating in my thesis committee and their support for my work. Without their guidance, experience and kindly approach, it would not be possible for me to complete my master thesis.

I would like to acknowledge The Scientific and Technological Research Council of Turkey (TÜBİTAK) for its support by granting me graduate scholarship.

I would like to thank my dear family for their endless support and love, this thesis is dedicated to them. I would like to express my deep appreciation and love to Erman Ekler for being with me in good and bad time. I would also thank to my friends Ferhat, Serhat, Caner, Orhan and Gültekin for being so much helpful and fun. Their friendship is one of the most valuable things that I gained from Boğaziçi University.

CONTENTS

FIGURES

TABLES

CHAPTER 1

HOW DOES THE INCREASING VOLUME OF INTERBANK FUNDS AFFECT BANK EFFICIENCY?

Introduction

The aim of this paper is to assess the effects of ratio of interbank funds to other earning assets on the efficiency scores of the banks. Together with investment securities, interbank funds are among the major components of other earning assets which constitute one of the outputs used commonly in measuring the banks' efficiency. This paper has two steps in analyzing the role of interbank funds on efficiency. First, the efficiency scores are calculated with a non-parametric estimation, namely through Data Envelopment Analysis (DEA). Later, the efficiency scores obtained in the first stage are regressed on the potential determinants of bank efficiency discussed heavily in the literature. In addition to the existing determinants of efficiency, this paper particularly focuses on the role of interbank funds in explaining the efficiency scores. The regression specifications have also other independent variables like the profitability ratio, number of branches and loan ratio which are shown to have a relationship with the efficiency of a bank in the existing studies.

The reason why this paper especially focused on this component of other earning assets is attributable to the developments in Turkish banking sector especially after 1994 and 2001 crises. Banking industry in Turkey was strictly regulated before 1980. The government had restrictions on the foreign exchange

reserves, interest rates paid by banks to depositors, market entry and even on the number of branches. Even though this closed system appears to provide a safe environment for the banks in the financial sector, it hindered the financial system to develop through competition and innovation. After 1980's a financial liberalization program was initiated in which limitations on foreign exchange reserves and market entries from abroad were removed. Together with these regulations, domestic banks also started to open new branches abroad and became able to borrow and lend among themselves by the establishment of Interbank Money Market in 1986. However, the financial system was still subject to government interventions and later this resulted in a financial crisis in 1994. These government interventions to the domestic debt market caused the system to be more prone to liquidity risk because of increased maturity mismatches between assets and liabilities. In the restructuring period of the crisis, monetary policies mainly aimed at shifting domestic borrowing from the Central Bank of Turkey to commercial banks. Starting from 1996, public debt was financed through short term government bonds and treasury bills with high interest rates. The main motivation of commercial banks in purchasing the government securities was to be immune to the credit risk while receiving high profits. However, this way of financing the public debt increased the vulnerability of the financial sector and together with other factors like currency risks and maturity mismatches, ultimately led the Turkish economy to more severe crises[1]. (Özatay and Sak, 2002; Turhan, 2008)

Interbank money market is a useful intermediary between banks when they have liquidity shortages. Figure 1 shows the change in the amount of interbank funds between 2001 and 2006. For each period, the averages of the amount of interbank

[1] Also see Al and Aysan (2006), Aysan and Ceyhan (2008-b), Aysan and Ceyhan (2008-c).

funds are taken. The initial observations point out that except 2001, interbank funds have an increasing trend and this fact confirms the increasing importance of interbank funds for recent years. In Figure 2, the real change in interbank funds is represented by the growth rate of it and the results confirm the idea that interbank funds level shows an increasing trend from 2001 to 2006. Hence, we investigate whether this increase in the volume of interbank funds has an effect on efficiencies of banks in Turkey. The main problem with interbank money market is the volatility of its overnight rates. This volatility was attempted to be reduced in 1996 and 1997 to maintain the financial stability. However the consequences were not as expected. In 2001, the government abandoned the strict monetary policy pursued and shifted to the floating exchange rate regime. The monetary policy before the crisis aimed at reducing the inflation and interest rates. Nevertheless, in November of 2000 an economic volatility shook this stable environment while the political tension erupted. The stabilization program adopted suffered from lack of credibility issue. In only one day, 7.5 billion dollar was drawn from Central Bank of Turkey and the overnight interest rates rose up to 7500 percent. The financial crisis also accounts for the decline in the interbank funds in 2001 since the overnight interest rates showed a dramatic hike.

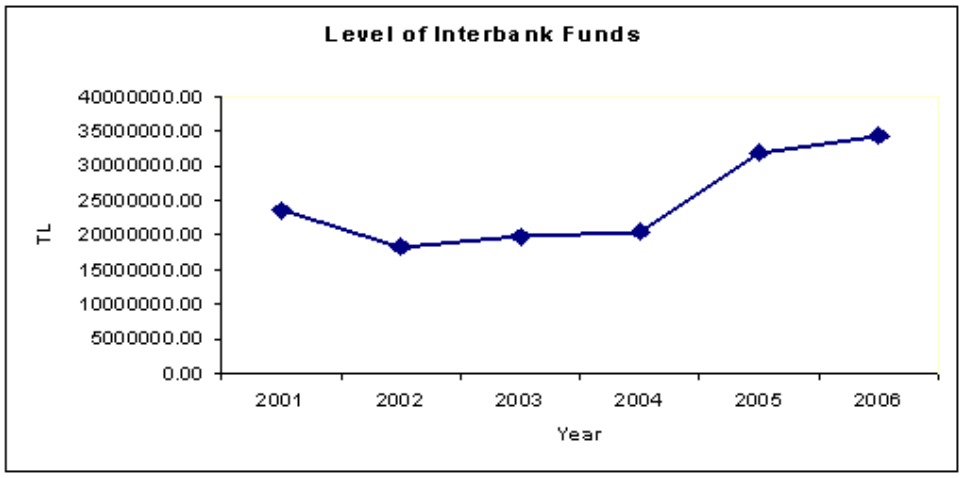

Figure 1. Change in Interbank Funds between 2001 and 2006
(Source: Authors' calculation)
(Data Source: Banks Association of Turkey)

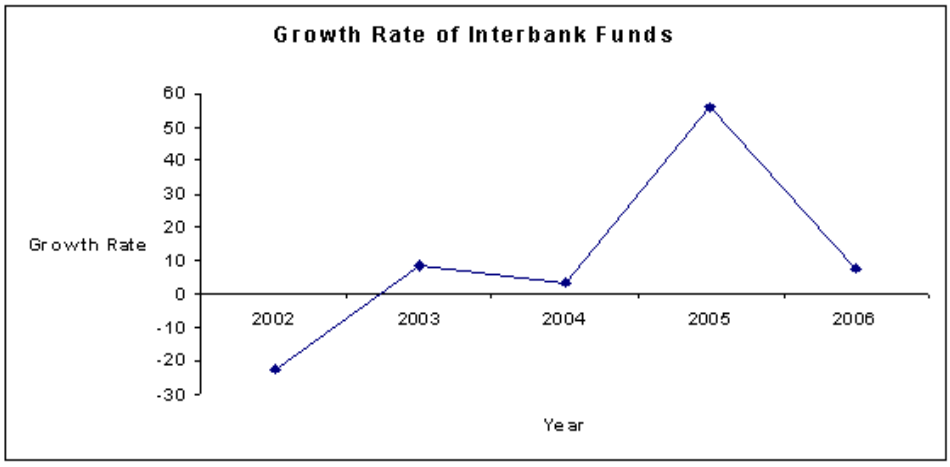

Figure 2. Change in Growth Rate of Interbank Funds between the years 2001 and 2006
(Source: Authors' calculation)
(Data Source: Banks Association of Turkey)

The 2001 economic crisis caused especially small and medium scale businesses around Turkey to be shut down and many people to lose their jobs. After the crisis, banks changed the way they report their balance sheets and started to use inflationary accounting. Due to this change, balance sheet items before 2001 are not consistent with those after 2001. In addition, political and macroeconomic environment is more stable since then. Hence taking pre- and post-2001 periods together may bias the efficiency scores given that the conditions changed dramatically. Due to this reason, this paper only focuses on the post-crisis period.

As the system gets more open to abroad and free from government interventions, a more competitive environment was achieved. Previously, it was sufficient for banks to establish a good reputation for keeping their existing clients or reaching potential ones. However, after the liberalization efforts they need to offer more branches and become more technologically developed to compete with their rivals and survive in the market. Another major change was the improvements in how the banks operate. The main cash flow of banks is from loans, since banks invest the sizable fractions of the deposits collected in loans to the individuals and firms. Alternative ways of utilizing deposits are through government and other securities transactions and interbank funds. Hence, banks operating in Turkey shifted some of their resources from the traditional way of banking to these alternatives.

The aim of the new banking laws such as Turkish Privatization Law and institutions like Istanbul Stock Exchange and Interbank Money Market is to foster competition and efficiency in Turkey's financial sector. However, the country suffered from the macroeconomic and political instability during 1980s. Hence, the end product of the program was not as expected. Chronically high inflation rates and operational risks like military intervention diverted the banks to short term lending

such as treasury bills, to assure themselves and maintain their operations during the political and economic turmoil.

In modeling the efficiency and choosing the set of inputs and outputs, this paper relies essentially on the study of Stavarek (2003). The paper also improves this study by incorporating off-balance sheet items and other earning assets into analysis. Other earning assets are critical in measuring the efficiency of banking in Turkey since its components play a considerable role in the banking operations in Turkey. The establishment of Interbank Money Market for Turkish Lira in 1986 enables banks to fund each other so that they can meet their liquidity needs in the short term. Hence interbank funds emerge also an alternative way of investing the available deposits. Another alternative to extending the loans as mentioned before is dealing with investment securities, that is, giving loan especially to the government or to other institutions through buying their issued papers. Off-balance sheet items need to be included among the list of outputs since their ignorance results in miscalculation of the efficiency scores.

Methodology

The paper has two phases in terms of the methodology used. In the first step, efficiency scores are estimated with and without other earning assets in the output set where the nonparametric technique of Data Envelopment Analysis (DEA) is used. DEA measures the relative efficiencies of a set of entities, namely decision making units (DMUs), as compared to each other. An efficient DMU, a DMU with an efficiency score of 1, is not necessarily efficient compared to the universal set of

entities, but is efficient only when compared with the group of entities selected for the model. Input oriented BCC (Banker, Charnes, Cooper, 1984) model is selected from various types of DEA models, because it can handle negative values in the output set, which is the case for our data set. Aforementioned negative values exist in the data set of net interest income which is one of the outputs used for the estimation of efficiency scores in DEA. Net interest income of the banks represents the difference between interest revenues and interest expenses. When the amount of interest expense is greater than that of interest revenue, negative values of net interest incomes emerge in the data. That is why for some banks in certain years we have negative values in the data set of net interest income and hence we use BCC version of DEA.

The difference of BCC from other DEA models is that it assumes variable returns to scale, which means that its production frontier is piecewise linear and concave. Figure 3 illustrates the variable returns to scale nature of BCC model.

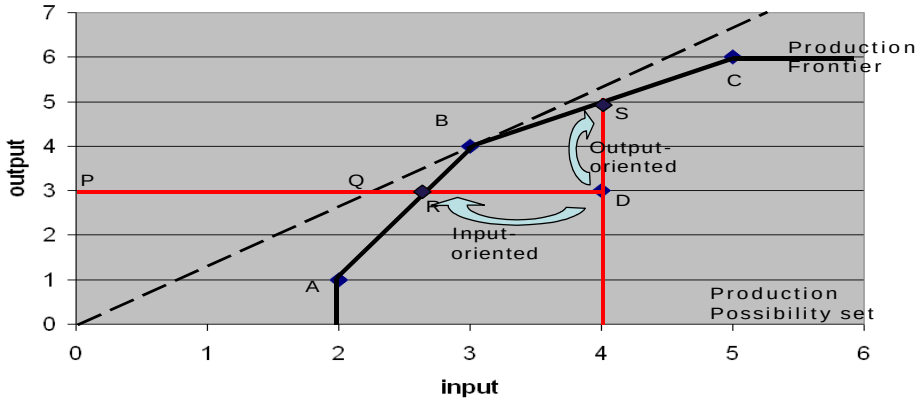

Figure 3. Efficiency Frontier for the BCC model, illustrated for a hypothetical model with one input

In Figure 3, there are four decision making units (A, B, C and D) and three of them (A, B, and C) are efficient since they are enveloping the inefficient one (D) with the polyline connecting them. R and S are the projections of decision making unit D on the efficient frontier. R is the input-oriented projection while S is the output-oriented one. The uppermost DMUs are the most efficient ones because the output/input ratio is maximized and hence productivities are maximized at these points. The productivity of an inefficient DMU such as D is given by the ratio PR/PD. The reference set for D is composed of B and C, which means in order to be efficient, D should set these two DMUs as benchmark. The critical issue here is the shape of the efficient frontier. It is not linear, since it is not exhibiting constant returns to scale at all points; rather it is a concave curve where it has increasing returns to scale in the first solid line segment, followed by decreasing returns to scale in the second part and at the intersection of two, there is constant returns to scale.

The model was first proposed by Banker, Charnes and Cooper (1984). The mathematical model for the input-oriented BCC Model (Cooper et al., 2006) is given below and is solved for each DMU to compute its efficiency:

$$
\begin{aligned}
(BCC_o)\ \max \quad & \theta_B \\
& \theta_B \mathbf{x_0} - [X]\boldsymbol{\lambda} \geq 0 \\
& [Y]\boldsymbol{\lambda} \geq \mathbf{y_0} \\
& \mathbf{e}\boldsymbol{\lambda} = 1 \\
& \boldsymbol{\lambda} \geq 0
\end{aligned}
\qquad (1)
$$

where $[X]=(\mathbf{x_j})$ is the matrix of input variables and $[Y]=(\mathbf{y_j})$ is the output matrix of variables, $\boldsymbol{\lambda}$ is a column vector and **e** is the raw vector of 1's. θ_B is the input oriented efficiency score for the DMU that the model attempts to find out.

In order for a DMU to be efficient, there are two conditions that should be satisfied:

i. $\theta_B=1$

ii. There should not be input excesses and output shortfalls.

In this study, after obtaining efficiency scores using DEA, a balanced fixed effects panel regression[2] is run in the second stage of the empirical analysis. The dependent variable is the efficiency scores with and without other earning assets obtained in the first step, such that the effect of different variables on efficiency and their significance can be observed. The set up for the fixed effects panel analysis is:

$$[Y]_{it}=\alpha+\beta.[X]_{it}+\varepsilon_{it} \quad (2)$$

$$\varepsilon_{it}=u_i+v_{it} \quad (3)$$

$$i=1,...,N \text{ and } t=1,\ldots,T$$

where $[Y]_{it}$ stands for the efficiency scores, α is the constant for the regression model, $[X]_{it}$ is the matrix of independent variables and ε_{it} is the random error in the

[2] Before applying fixed effects panel regression, variables were checked for autocorrelation . The result of the test show that there exist no autocorrelation hence we continued with the Hausman test to compare fixed effects versus random effects regressions. According to the result of the test, there is no significant difference between two models in terms of consistency of the estimates. Therefore, we are indifferent between two models. In the literature using this two-step procedure fixed effects panel regression is used so we give the results of this analysis. In the appendix, the results of random effects regression will be presented as well.

regression. u_i represents the individual-specific, time-invariant effects, which are assumed to be fixed over time for each bank in this model.

This two step empirical methodology emerges to be widely used in recent studies[3]. For example, a similar study was conducted by Arestis et al. (2006) where they assessed the relationship between financial deepening and efficiency in some non-OECD countries. They have used a two-step procedure. After measuring the efficiency scores, they regressed them on several variables representing financial deepening. The rationale behind using this two-step procedure was explained by Arestis et al.(2006) as to prevent any measurement error that may exist in the DEA since it is a non-parametric method for efficiency calculation. Additionally, this procedure deepens the analysis by presenting effects of other variables on efficiency scores as well as the variable of concern.

Data and Empirical Setting

In this study, decision making units in DEA are commercial banks operating in Turkey including those owned by the Turkish state and foreign entities within the years 2001 through 2006, whose data for inputs and outputs are obtained from the Banks Association of Turkey. The input combination is as follows:

i. Personnel expenses: Represents the cost of labor, covering wages and all associated expenses

ii. Fixed assets: Stands for the cost of capital

[3] Also see [Aysan and Ceyhan, 2007], [Aysan and Ceyhan, 2008-a]

iii. Total deposits: The sum of demand and time deposits from customers and interbank deposits

The outputs used in the data set are as follows:

i. Net interest income: The difference between interest income and interest expenses

ii. Off balance sheet items: Guarantees and warranties (letters of guarantee, bank acceptance, letters of credit, guaranteed pre-financing, endorsements and others), commitments, foreign exchange and interest rate transactions as well as other off-balance sheet activities

iii. Total loans: The net value of loans to customers and other financial institutions

iv. Other earning assets: Interbank funds (sold) and investment securities (treasury and other securities)

In the literature, different studies use different models where almost all variables change due to the approach applied. Since there exists no universally accepted set of inputs and outputs, it is crucial to explain why these variables are selected for DEA analysis. The reason why personnel expenses and fixed assets are chosen as inputs is obvious. Without necessary equipment, building and human resource it is not possible for a bank to operate. Therefore, their existence and functioning are vital in determining the efficiency of a bank.

Total deposits are included as well because money collected by banks from their customers is used for investments in the form of instruments like loans, securities or interbank funds. The banks operate as if they convert these inputs, like time and effort of personnel, equipment and deposits from customers into outputs like the loans to firms, to individuals, to government through treasury bills or to other banks. Hence, the loans and other earning assets are also taken as outputs.

The net interest income is the output of a bank where interest expenses and interest income are the inputs. The literature on efficiencies on banking supports the idea that off balance sheet items need to be included in the measurement in addition to balance sheet items. According to Siems and Clark (2002) excluding off balance sheet items leads to an underestimation of the efficiency scores, given that non-traditional ways of banking like the letters of credit, futures or forwards are not taken into account otherwise. Hence by considering off balance sheet items in the output set, we do not ignore banks' asset management activities. DEA is conducted with and without other earning assets to see the difference between these two efficiency scores. The computations are conducted using the DEA-Solver software (Cooper et al., 2006).

The results of DEA are presented in the Appendix where average efficiencies for all banks over the selected time frame are given (see Table A.1). The most obvious outcome in Table A.1 is that the exclusion of other earning assets in the outputs decreases the efficiency scores. There are fifteen banks that are efficient in all periods. Only one of them, Ziraat Bankası, is a state bank. Hence other state banks may take Ziraat Bankası as a benchmark to enhance their efficiency scores. Six banks out of fifteen efficient banks are foreign banks. This result shows that, the foreign banks have not systematically performed better as compared to their domestic counterparts. Based on the average efficiency scores, one can also conclude that more efficient banks usually come from the groups of private banks and foreign banks. This finding supports the idea that these groups of banks have invested more to improve their technology and used their resources more productively in the post crisis period. In the last column of Table A.1, percentage differences between the efficiency scores of including the other earning assets and excluding them are

presented as well. The efficiency scores of Toprakbank and Turkishbank display an extreme difference (194 percent and 100 percent) between these two different calculations, other than these two banks, the percentage differences are always positive and are at most 20 percent.

Figure 4 shows the average efficiency scores of all banks for the years 2001-2006. The time series above in Figure 4 shows the scores with the other earning assets included, whereas the time series below shows the scores with the other earning assets excluded. There is an increasing trend in both series implying that the commercial banks in Turkey improved their productivities in the restructuring period. However, excluding other earning assets in the output set causes efficiency scores to be underestimated.

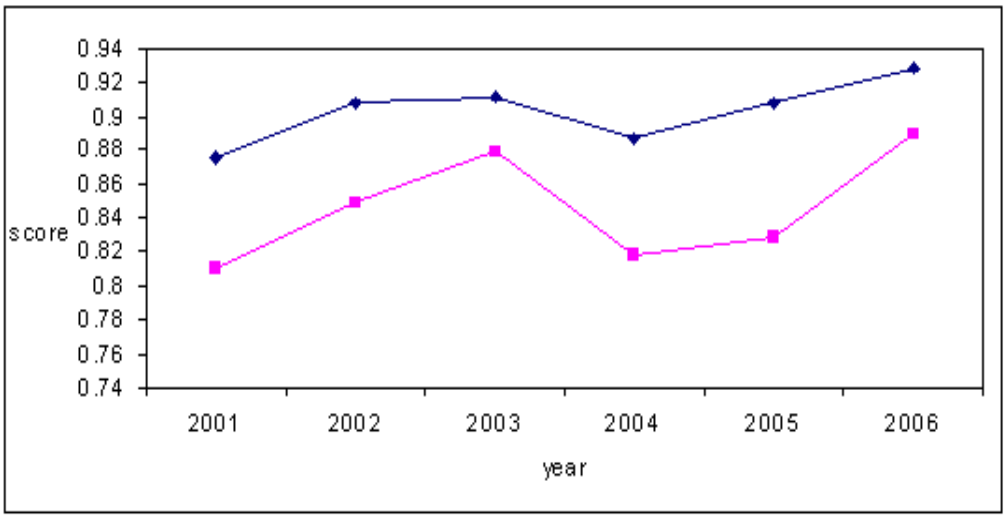

Figure 4. Efficiency Scores between 2001 and 2006
(Source: Authors' calculation)

Having included the other earning assets in the computations, we obtain the efficiencies for every bank over the selected years. Figure 5 shows the improvements in the efficiencies for all the 48 banks that existed for at least one year through 2001-2006, plotted using Miner3D software[4]. In the figure, *Year* is mapped to the X axis, *DMUs* are mapped to the Y axis, and *efficiency scores* are linearly mapped to colors of the glyphs (data points). The light colors denote higher efficiency scores. The darkest colors denote that the bank did not exist in that year. For example, the bank WLG existed in 2001, but did not exist through 2002-2006.

In the second part of the analysis, the efficiency scores are regressed on the following independent variables: interbank funds, bank capitalization, loan ratio, total assets/number of employees, return on assets (ROA), number of branches, foreign/domestic and state/private dummies.

The critical variable that this paper aims to evaluate is the effect of interbank funds/OEA ratio and this ratio is included in the regression specifications. The effect of interbank funds on the efficiency is expected to be negative because high investment in interbank market is an indicator for inefficiency, confirming that the bank could not invest in more profitable assets or loans with greater returns than the interbank funds (Adenso-Diaz and Gascón, 1997). The loans are expected to yield higher returns for the banks. However, the interbank loans tend to offer lower interest rate returns and hence provide less profit opportunities for the banks.

The loan ratio and bank capitalization are expected to have positive impact on efficiencies. The loan to asset ratio indicates how much loan an asset can generate. Therefore, an increase in this ratio implies that the bank uses its assets more efficiently. The bank capitalization is gauged as the ratio of equity to total assets. As

[4] For the details on the computer program see the official web page: www.miner3d.com

this share increases, the amount of assets transferred into equity increases. Since the equity is a vital source for the survival of the bank and its operations, it is expected to have a positive relationship with efficiency. Moreover, it is expected that when the owners of the banks put more capital (equity) into their banks, the banks are expected to run more efficiently while alleviating the moral hazard problem.

The total assets to number of employees is another indicator showing the performance of an employee in asset generating activities and it is tested in the study of Isik and Hassan(2002). For the period of 1988 and 1996, Isik and Hassan(2002) demonstrated its relationship with the efficiency. Hence we attempt to figure out if this relationship exists in recent years as well. If the relationship still remains, it is expected to be positive because per employee asset needs to be higher for the more efficient banks. Among profitability ratios, Return on Assets (ROA) is taken and it is the net income over total assets. As a bank performs better, it becomes more profitable through managing its assets more successfully and increasing its income. Hence there needs to be a positive relationship with ROA and efficiency scores.

The number of branches denotes the accessibility of the banks to the existing and potential customers and directly affects the amount of deposits. Thus this variable is expected to have a positive relationship with the efficiency scores. The effects of state/private and foreign/domestic dummies on the efficiency scores are ambiguous. There are mixed evidence on the effects of different ownership structure on efficiency. However, the private commercial banks and the foreign banks in general tend to be more efficient than the state banks [Isik and Hassan, 2002].

The correlation matrix is presented in Table 3. Even though the bank capitalization and loan ratio have positive impacts on efficiency, they are negatively correlated with each other. Hence, an attempt to increase efficiency through

increasing one of them is likely to cause the other variable to worsen. The same result is also valid for the assets/employee ratio since it is negatively correlated with both the bank capitalization and loan ratio while all of them have positive relationship with efficiency. The interbank to other earning assets ratio is weakly related with the bank capitalization, while their correlations with efficiency are adversely related. The negative correlations between interbank/other earning assets and loan ratio are as expected given that the banks have fewer assets to use for the interbank funds as the loan ratio increases.

Empirical Results

The main contribution of this study is to analyze how the efficiency scores are affected by the increasing volume of interbank funds. The results of the analysis are evaluated in two parts given that the dependent variable is either the efficiency scores with other earning assets or without it.

In Table 4, the results of the regression on the efficiency with two dependent variables are presented. The coefficients and t-values (in the parenthesis) are presented in the table.

Table 1: Number of Efficient Decision Making Units

Year	Total number of banks	Number of efficient banks with OEA	Number of efficient banks without OEA
2001	42	28	23
2002	36	20	18
2003	36	25	23
2004	33	16	11
2005	33	18	15
2006	32	21	19

Source: Authors' calculation

Table 2: Descriptive Statistics

Variables	Number of Observations	Mean	Standard Deviation	Minimum	Maximum
Interbank/Other Earning Assets	212	0.463	0.543	0.001	6.978
Efficiency with Other Earning Assets	212	0.902	0.164	0.150	1.000
Efficiency without Other Earning Assets	212	0.845	0.209	0.138	1.000
Bank Capitalization	212	0.175	0.168	-0.353	0.850
Loan Ratio	212	0.296	0.187	0.000	0.733
Asset/Employee	212	2508	1994	90	16879
Return on Asset	212	-0.008	0.099	-0.641	0.322
Number of Branches	212	149	268	0	1504

Source: The Banks Association of Turkey and Authors' calculation

Table 3: Correlation Matrix

	Interbank	*Efficiency with OEA*	*Efficiency without OEA*	*Bank Capitalization*	*Loan Ratio*	*Asset / Employee*	*ROA*	*Number of Branches*
Interbank	1.000							
Efficiency with OEA	-0.236	1.000						
Efficiency without OEA	-0.197	0.822	1.000					
Bank Capitalization	0.093	0.054	0.160	1.000				
Loan Ratio	-0.174	0.124	0.244	-0.379	1.000			
Asset/Employee	0.070	0.210	0.135	-0.028	-0.214	1.000		
ROA	-0.035	0.171	0.160	0.070	0.105	0.228	1.000	
Number of Branches	-0.205	0.171	0.183	-0.171	0.059	-0.033	0.105	1.000

Source: The Banks Association of Turkey and Authors' calculation

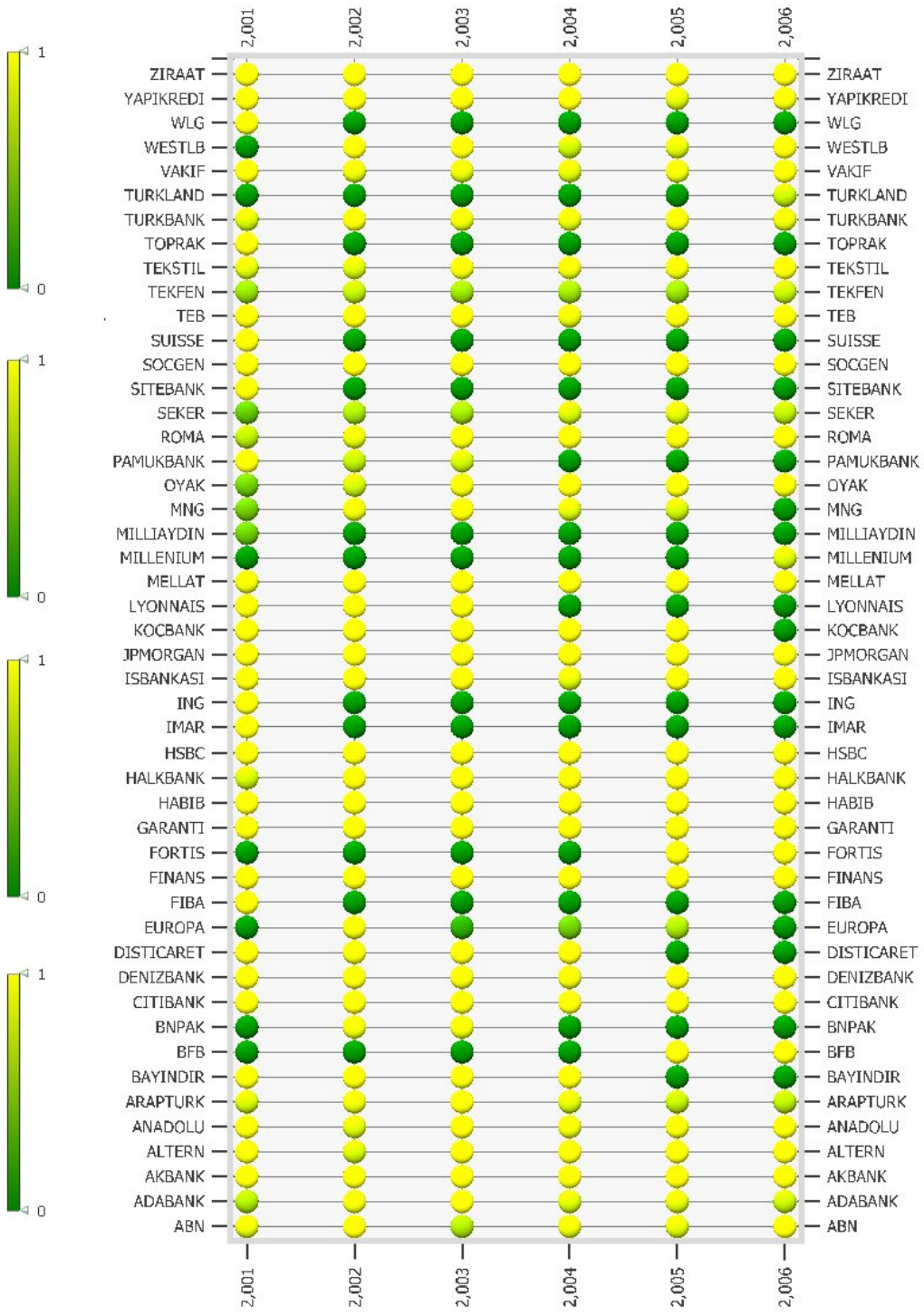

Figure 5.Change of Efficiency Scores over 2001-2006 for Turkish Banks
(Other Earning Assets is included in the DEA model)

Table 4: Fixed Effects Panel Regressions

Independent Variables	Dependent variable *Efficiency with Other Earning Assets*	Dependent variable *Efficiency without Other Earning Assets*
Interbank/Other Earning Assets	-0.068	-0.049
	(-4.44)***	(-2.47)**
Bank Capitalization	0.251	0.457
	(2.89)***	(4.01)***
Loan Ratio	0.239	0.432
	(3.69)***	(5.16)***
Assets/Employees	0.00001	0.00001
	(1.74)*	(0.61)
Return on Assets	0.015	-0.149
	(0.14)	(-1.09)
Number of Branches	-0.00002	-0.00002
	(-0.12)	(-0.29)
Foreign/Domestic	-0.022	-0.007
	(-0.28)	(-0.07)
Constant	0.804	0.656
	(19.48)***	(12.31)***
R-square	0.736	0.729
Number of Observations	212	212

* indicates significance at the 10% level, ** indicates significance at the 5% level, *** indicates significance at the 1% level

Table 5: Results of Cluster Analysis for the Year 2006

ClusterNo	AVG(2006_Interbank/OEA)	AVG(2006_BankCapitalization)	AVG(2006_LoanRatio)
1	0.19	0.10	0.55
2	0.67	0.15	0.63
3	0.62	0.13	0.35
4	0.45	0.12	0.57
5	0.67	0.12	0.12
6	0.13	0.17	0.39
7	0.11	0.12	0.33
8	0.93	0.83	0.00
9	0.73	0.59	0.01
AVG(Column	0.44690625	0.17871875	0.4091875

ClusterNo	AVG(2006_Eff_Excluding)	AVG(2006_Eff_Including)	PercOfForeign	PercOfPrivate	NoOfBanks
1	0.97	0.99	0.17	0.83	6
2	1.00	1.00	0.71	1.00	7
3	0.56	0.92	0.00	1.00	2
4	0.67	0.70	0.00	0.33	3
5	1.00	1.00	1.00	1.00	4
6	0.61	0.63	0.50	1.00	2
7	0.93	0.98	0.20	0.40	5
8	0.68	0.68	0.00	1.00	1
9	1.00	1.00	0.50	0.50	2
AVG(Column	0.88984375	0.92809375	0.34	0.79	

In the first fixed effect panel regression specification, the explanatory variables are regressed on the efficiency scores with other earning assets included as output. The interbank/other earning asset is significant and affects the efficiency scores adversely, as expected. The loan ratio and bank capitalization are significant in explaining efficiencies and they have a positive relationship with efficiency. This supports the view that when the banks turn their assets into more lucrative investments, their efficiency scores improve. Interestingly, the ROA and asset-employee ratio are not significant in explaining the dependent variable. Finally, number of branches and foreign domestic dummies are not significant, either.

In the second panel, the dependent variable stands for the efficiency scores without the other earning assets. The aim of this second regression specification is to uncover whether the other earning assets drastically alter the main findings. The results are not much different from the findings of the previous regression. The interbank funds, the bank capitalization and loan ratio are still significant. The interbank funds variable has a negative relationship with efficiency while the bank capitalization and loan ratio are positively correlated with the efficiency scores. Similar to earlier results, other variables are found to be insignificant in explaining the banks' efficiencies.

Cluster Analysis

In section 4, the interbank funds, banks capitalization and loan ratio were determined to be highly significant in determining the average efficiency scores over the years 2001-2006. In this section, a cluster analysis is carried out for the year 2006

using the above factors, and efficiency scores for 2006 computed with and without OEA, with a total of five variables. The cluster analysis results are combined with the data on two other attributes of the banks, namely data regarding the status of the bank, being State/Private and Foreign/Domestic.

Table 5 shows the results of cluster analysis, which was carried out using the k-means clustering algorithm implemented within Miner3D software. Table A.1 lists the clusters that each of the banks that exist in 2006 belong to.

Banks in clusters 1 and 2 (first two rows in Table 5) exhibit similar characteristics as can be seen from similar bar levels under each column. These are also the two clusters with the most elements (last column), and are almost all efficient in both DEA models (with and without OEA). These two clusters mainly differ from each other with respect to their interbank funds/OEA values, as can be seen from the large difference in the bars under the column AVG(2006_Interbank/OEA). After combining data on the ownership status of banks, it is also observed that these two clusters differ significantly with respect to their Foreign/Domestic ownership. 71 percent of the banks in cluster 2 are foreign, whereas only 17 percent of banks in cluster 1 are foreign. Thus a careful analysis of clustering results revealed that among efficient banks that operate similarly (low bank capitalization, high loan ratio), domestic banks have low interbank/OEA values, whereas foreign banks have high interbank/OEA values.

Two clusters are composed of a small percentage of private banks: Cluster 4, which is composed of three banks, contains two state banks and one private bank (hence the percentage of private value of 33 percent). Cluster 7 is composed of five banks, three of them state banks, and two of them private banks (hence the percentage of private value of 40 percent). Even though these two clusters are

characterized by the felt presence of state banks, their average efficiency scores differ significantly: average efficiency for cluster 4 is 0.70 in the second DEA model, whereas average efficiency for cluster 7 is 0.98. A curious investigation of the values under other tables reveals differences that can explain this significant difference. The banks in cluster 4 have a high average value of 0.45 for interbank/OEA for 2006, whereas banks in cluster 7 have a low average value of 0.11. The values under the bank capitalization column are the same. However, the values under average loan ratio column also differ significantly (0.57 vs. 0.33). The interbank/OEA values and loan ratios were proven to have negative effect on efficiency scores by the panel regression in section 4. Thus, it is only natural that cluster 7 has a higher average efficiency compared to cluster 4.

Conclusion

Starting from the beginning of 1980s, the banking sector in Turkey was liberalized through the new banking laws and the establishments of regulatory financial agencies. The traditional way of banking where loans are the main output of the banking operations started to change in this process. Banks began to lend other banks through Interbank Money Market and to give loans to the government through treasury bills. Therefore, this paper aims to find out the developments in the interbank funds and its effect on the bank efficiencies for the periods 2001-2006. Turkish economy suffered from major financial crises in 2000 and 2001. In the post-crisis episode, the banking sector in Turkey has better performed its intermediatory role between borrowers and lenders. Hence, the focus is on post-crisis period to find out the effects of increasing volume of interbank funds in recent years.

After conducting Data Envelopment Analysis to find efficiency scores, fixed effects panel regressions are carried out to uncover the role of certain selected factors on the efficiencies of the banks in Turkey. Besides showing the statistically significant factors that affect efficiency including the interbank funds, a historical summary of efficiencies of banks operating in Turkey and the results of a cluster analysis for the year 2006 are presented.

The effect of interbank funds stands to be negative and statistically significant. This result supports the idea that the higher amount of investment in the interbank funds is an indicator of inefficiency. The bank capitalization and loan ratio are other significant variables and they are positively correlated with efficiency. The profitability and efficiency are not significantly associated to each other, confirming the earlier findings of [Abbasoğlu et al., 2007]. The asset-employee ratio, measuring the amount of asset an employee can create, and the number of branches are found to be insignificant in affecting efficiency. Finally, foreign/domestic dummy is found to be insignificant as well. Overall, this paper uncovers the adverse effects of the interbank funds on the efficiencies while the loan ratio enhances the efficiency scores. Hence, the empirical findings of this paper confirms the argument for an emerging market economy that the bank efficiency is enhanced through extending relatively longer term loans as opposed to extending shorter term loans to other banks.

CHAPTER 2

A COMPARATIVE STUDY ON THE RELATIONSHIP BETWEEN COMPONENTS OF OFF BALANCE SHEET ITEMS AND BANK EFFICIENCY

Introduction

This part attempts to assess the effect of the components of Off Balance Sheet items on banks' efficiency scores. Efficiency scores are calculated using the non parametric approach called DEA and then Tobit model is used in the second step to determine the relationship of OBS items with bank performance. Other independent variables are potential determinants of bank efficiency like total assets, loan ratio or foreign/domestic dummy. The variables of interest are guarantees, commitments, derivatives and custodies and collaterals which will be regressed on efficiency scores separately and together for comparison purposes. This paper aims to differentiate from other studies by specifically concentrating on these components and to determine their separate and combined effect on efficiency scores.

As the financial market evolves in an emerging market like Turkey, the banks operating in the sector starts to search for new banking activities other than granting loans through collecting deposits. These non-traditional approaches to banking for higher profitability in the sector usually do not take place on the balance sheets of the banks since they can be categorized as neither assets nor liabilities. Hence, derivative instruments, collaterals or letters of credit which are named as off balance sheet items in the financial statements of banks, represent a unique way of banking

affecting the activities of banks through profit and loss accounts of financial statements.

Increasing usage of off balance sheet items especially the derivatives in the international financial sector is a hot issue with the break out of recent subprime mortgage crisis that demolished US markets. Default risk of AIG for its credit default swaps (CDS) that depended on the losses incurred from subprime real estate related investments is one of the factors that forced FED to support AIG by extending $85 billion loan for its liquidity need. Credit default swaps is an off balance sheet instrument in which the buyer of this contract pays a premium to the seller for the default risk of underlying financial instrument. Hence it is like an insurance contract between these two parties to cover any loss on the face amount of a corporation's or sovereign's bond or loan. The important point is that, this derivative instrument which is honored for its profitability is part of the chain effect that led to financial crisis and it almost caused AIG to declare bankruptcy. Therefore, there is an ongoing debate for the trade off between profitability of collecting commission fees versus undertaking default risk for the referenced financial tool. Apparently, growing size of off balance sheet items increases the volatility of financial sector since the chain in Off Balance Sheet items makes the depth of this market more blurred especially with the inclination for over-the-counter instruments. (Amerman,2008)

Parallel to international arena, off balance sheet activities show an increasing trend for the banks in Turkey as well, especially after the liberalization movements in domestic financial sector. Underlying reason of the expanding market size for off balance sheet items is to extract new sources to enhance profitability of the banks. Among them, commission payments earned from collaterals and letters of credits are the most fundamental ones. Another way is derivative transactions which provide

regular premium payments from the buyer of contract for his risk hedging purposes. Besides, off balance sheet activities differ from traditional ways of banking in the sense that it does not involve the cost of holding money. Shifting the resources from huge deposit reserves to off balance sheet items saves the bank from paying tax to government for its assets at hand. On the other hand, as financial sector evolves with the inclusion of new tools, customers become more demanding for different types of financial instruments and banks have to meet their needs to keep their position in this competitive market. Combining these factors contribute to the increasing trend of off balance sheet activities.

Table 6 shows the rate of increase in the size of balance sheet versus the rate of increase in OBS items of commercial banks operating in Turkey for the period between the fourth quarter of 2001 and the fourth quarter of 2008. Starting from the last quarter of 2002 the level of OBS items is greater than the level of Total Assets. This situation continues on level base even though the growth rate of OBS is negative in some of the years.

In the fourth quarter of 2001, the reform movements to stabilize the macroeconomic environment started. These changes affect balance sheet size and the OBS items size differently. In the first row of percentage change columns, the change in Total Assets is positive while the change in the level of OBS items is negative. This reveals when the financial sector is in tough circumstances, the banks prefer to use their resources for traditional ways of banking which they are more experienced and familiar with. Therefore, the banks do not undertake risk by using alternative ways of banking and they shift their inputs to produce other for increasing profitability.

Table 6 :Balance Sheet Size and Off Balance Sheet Items*

Years	Balance Sheet Size (in million TL)	% Change	Off Balance Sheet Items (in million TL)	% Change	OBS Items/ Balance Sheet Size
2001Q4	138707.5		63390.5		45.7
2002Q1	141258.9	1.8	55393.0	-12.6	39.2
2002Q2	158846.7	12.5	71106.7	28.4	44.8
2002Q3	169310.7	6.6	83648.2	17.6	49.4
2002Q4	184666.0	9.1	191009.4	128.3	103.4
2003Q1	192808.1	4.4	217319.5	13.8	112.7
2003Q2	186890.4	-3.1	230282.5	6.0	123.2
2003Q3	200310.3	7.2	261863.1	13.7	130.7
2003Q4	223430.2	11.5	310863.1	18.7	139.1
2004Q1	230456.2	3.1	341505.1	9.9	148.2
2004Q2	246599.4	7.0	406297.8	19.0	164.8
2004Q3	265105.8	7.5	443312.4	9.1	167.2
2004Q4	280204.2	5.7	471706.2	6.4	168.3
2005Q1	287137.1	2.5	618005.0	31.0	215.2
2005Q2	309629.8	7.8	711250.3	15.1	229.7
2005Q3	332956.6	7.5	664528.8	-6.6	199.6
2005Q4	364861.5	9.6	826278.1	24.3	226.5
2006Q1	377932.8	3.6	740053.8	-10.4	195.8
2006Q2	415738.1	10.0	840866.2	13.6	202.3
2006Q3	420203.1	1.1	883397.3	5.1	210.2
2006Q4	464538.8	10.6	1004746.0	13.7	216.3
2007Q1	477163.2	2.7	1071768.2	6.7	224.6
2007Q2	493187.1	3.4	1154497.2	7.7	234.1
2007Q3	502035.6	1.8	1110148.5	-3.8	221.1
2007Q4	537770.9	7.1	1184745.8	6.7	220.3
2008Q1	585114.9	8.8	1368143.6	15.5	233.8
2008Q2	606714.3	3.7	1443803.6	5.5	238.0
2008Q3	628539.5	3.6	1524267.7	5.6	242.5
2008Q4	677673.8	7.8	1625877.8	6.7	239.9

*Data is obtained from the quarterly financial reports announced by Banks Association of Turkey

In our study the subcategories of off balance sheet items are analyzed to see the weights of financial tools in the composition of off balance sheet items. In Turkish banking sector, off balance sheet items are divided into four subcategories:

Guarantees: The bank guarantees the realization of the act agreed in the contract to the third partiers through giving guarantees. These include commercial and stand by letters of credit, letters of guarantee as well as guaranteed pre-financing credits for exports.

Commitments: It is a kind of insurance that the bank pledges for the financing of the investment and since they involve high rate of default risk they are usually given to the credible customers of the bank.

Derivatives: These instruments are used for both risk management and profitability purposes. They include risk hedging instruments like forward, future, swap and option contracts. These contracts aim to minimize the risk through determining the terms of contract like the price of the good or service or the currency at the beginning.

Custodies and Collaterals: Custodies include a wide range of items from the valuable properties of the premium clients to securities held for domestic households or foreign investors in return for a commission payment. Collaterals are kept by the bank usually for legal reasons when opposite parties of the contract fail to fulfill their obligations. Custodies and collaterals are started to be recorded in the financial statements of banks in Turkey in the fourth quarter of 2002 hence the data that we obtained about this variable starts with that time.

Taking a glimpse to the structure of off balance sheet items for the commercial banks operating in Turkey, custodies and collaterals has the greatest share and the highest growth rate. Figure 6 shows the composition of off balance

sheet items and how these components grew for the period between the fourth quarter of 2001 and the fourth quarter of 2008.

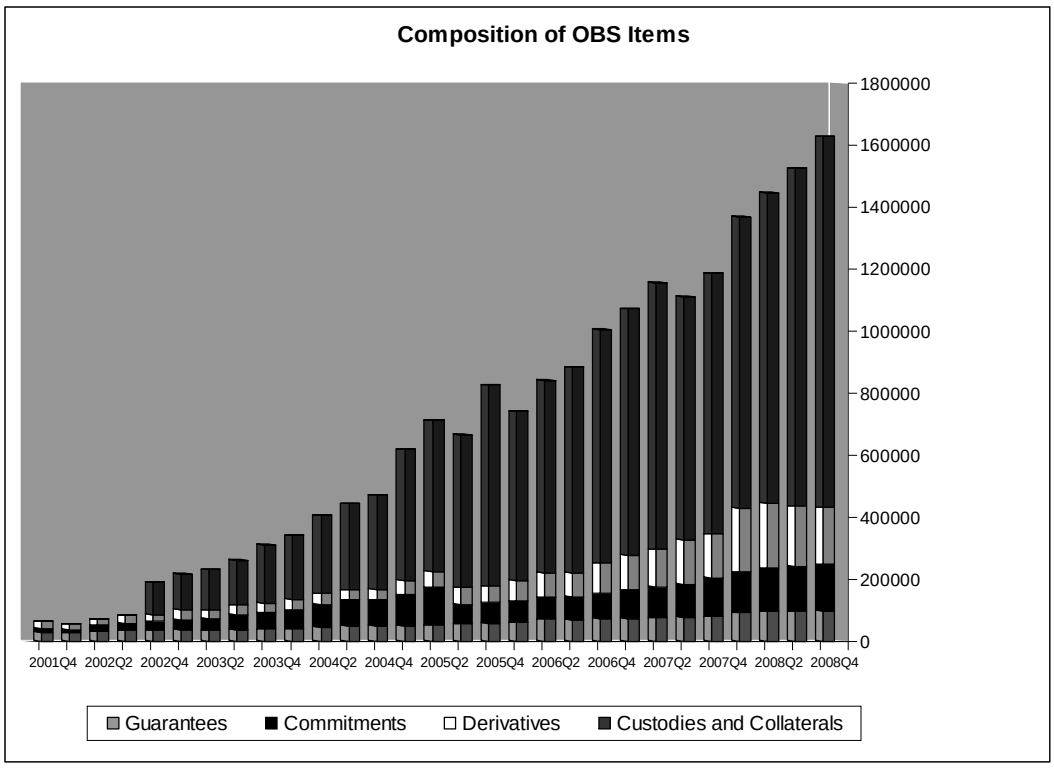

Figure 6.Composition of Off Balance Sheet Items
(Data Source: Banks Association of Turkey)

Figure 6 supports the idea that off balance sheet financing is a growing market in Turkish financial sector as well. However, unlike international financial market, loan instruments are more preferred than derivatives. This might be a favorable situation for the banks when tax free commission payments are considered. However, the default risk still exists. Hence we can not make an inference about relative riskiness of the components of OBS items.

Supported by the similar literature, this paper includes off balance sheet items as an output in the efficiency calculation using a nonparametric estimation technique called Data Envelopment Analysis. This paper, however, differs from the previous studies in the sense that it also uses efficiency scores calculated without using off balance sheet items in the output set to compare the results of the second stage and for robustness check. The analysis will continue with Tobit panel regression in which we attempt to see whether the components of OBS items have an effect on two versions of bank efficiency scores. The analysis will be conducted for the commercial banks operating in Turkey for the post-crisis period.

Background on Efficiency and Off Balance Sheet Items

This paper is related to a variety of literature. Hence, firstly, we have assessed similar studies which tested the importance of inclusion of the Off Balance Sheet items in the efficiency calculation. Then, we reviewed papers applying two-step procedure in which efficiency scores using DEA in the first stage are used as dependent variables to find its determinants.

In their study about a possible regression in US commercial banking sector, Boyd and Gertler (1994) concluded that off balance sheet activities need to be taken into account while assessing the change in the financial sector since a shift of resources from traditional ways of banking to alternative ways of banking is a dominant trend.

The significant changes in banks' balance sheets are reflected in the studies on bank efficiency measurement in the sense that they should be taken into

consideration as a bank output. Siems and Clark (2002) analyzed how inclusion of off balance sheet items affects quantifying X-efficiency in financial sector. They concluded that omitting OBS items underestimates the results of the economic cost and production cost in X-efficiency measurement for banking industry. A similar study conducted by Casu and Girardone (2005) examined whether it is necessary to include off balance sheet activities in the bank efficiency calculations for a number of European countries. The results support the importance of OBS financing for efficiency measurement especially for the technological change. Furthermore, Rogers and Sinkey (1999) concluded that efficiency measurement without inclusion of off balance sheet items as one of the outputs does not give accurate results by comparing cost, profit and revenue efficiencies for US commercial banks estimated with and without OBS.

Rime and Stiroh (2003) assessed the performance of Swiss banks through calculating their relative efficiencies and supported that all the activities of banks like OBS items, brokerage or asset management should be taken into consideration in efficiency estimations. Otherwise the banks seem less efficient than they actually are.

Different uses of two-step procedure exist in the literature. Arestis et al. (2006) used fixed effects panel data regression to analyze technical efficiency in the non-OECD countries. Similarly, Aysan, Ertek and Öztürk (2008) applied fixed effects panel regression in the second stage of their study on efficiencies of commercial banks operating in Turkey for the period between 2001 and 2006. Occasionally, studies that used two-step procedure include other variables than inputs and outputs of efficiency scores as independent variables in the regression. For example, in the study about the efficiency of European airlines, Fethi et al.(2000)

stated that they aimed to explain efficiency scores calculated using DEA with other relevant variables not directly included in the first stage.

On the other hand, Tobit analysis, an extension of Ordinary Least Squares regression, is an alternative for the second step since it handles better with the efficiency scores ranging between 0 and 1. Jackson and Fethi (2000) used Tobit analysis to determine the variables affecting technical efficiencies of Turkish commercial banks. Loikkanen and Susiluoto (2004) applied tobit method to the panel data for the years 1994 and 2002 to figure out determinants of cost efficiencies of Finnish municipalities.

Empirical Model

The analysis begins with estimation of efficiency scores using the non parametric technique called Data Envelopment Analysis. Then, independent variables, defined in the following section, are regressed on these efficiency scores using Panel Tobit model.

The efficiency scores obtained applying DEA falls in the interval of 0 and 1 that is; $0 < \theta_B \leq 1$. Therefore, θ_B is a limited dependent variable making the regression appropriate for using Tobit model (Tobin,1958) since it censors the variables by specifying upper and lower limits. Tobit method is an extension of Ordinary Least Squares which leads to unbiased results for the regressions in which disturbances and the dependent variable do not exhibit normal distribution and homoscedasticity.

In our study we applied Tobit method to the panel data. Hence we have time dimension as well added to the standard Tobit model. There is a latent variable denoted as y_{it}^{*} which is explained by the set of independent variables x_{it} via the parameter vector β. The error term u_{it} in this relationship is distributed normally. The observed variable y_{it} is the outcome of this latent regression which is censored under a certain threshold of latent variable. The only difference from the standard model is α_i term included in the regression which gives unobserved individual specific effect correlated with x_{it}.

(1) $y_{it}^{*} = X_{it}\beta + \alpha_i + u_{it}$ where $u_{it} \sim N(0, \sigma_t^{2})$

(2) $y_{it} = y_{it}^{*}$ if $y_{it}^{*} > 0$

(3) $y_{it} = 0$ otherwise

In the regression specification, dependent variables are the efficiency scores which are censored by determining lower and upper limits as 0 and 1, respectively. It means that observations lower than 0 are left-censored and observations greater than 1 are right-censored. The efficiency scores in-between are uncensored making the latent variable equal to the dependent variable. The likelihood function is maximized using dependent and independent variables to estimate parameter vector; β and standard deviation of the error term; σ. The use of Tobit model better fits to the characteristics of the distribution of efficiency scores since they concentrate on unity.

Selection of Data Set for DEA

In DEA approach inputs and outputs of decision making units are used to solve the linear programming model to obtain efficiency scores. The decision making units are Turkish commercial banks operating in Turkey for the period starting from the fourth quarter of 2001 and ending with the fourth quarter of 2008. These data are obtained from the quarterly financial reports on banks announced by Banks Association of Turkey.

The reason why we have started from at the end of 2001 is that we aim to take the post crisis period since the macroeconomic conditions substantially changed before and after the crisis. In modeling the efficiency and choosing the set of inputs and outputs, the benchmark article is the study of Stavarek (2003) while the paper includes off-balance sheet items into analysis for the reasons mentioned in the second part and other earning assets for its importance in the Turkish financial sector. The variables used in the data set are categorized as inputs and outputs. Inputs are personel expenses, fixed assets and total deposits. Outputs are selected as net interest income, total loans and other earning assets.

The computations for the first phase are conducted using the DEA-Solver software (Cooper et al., 2006).

Selection of Data Set for Panel Tobit Analysis

In the second phase of analysis, certain bank specific variables are regressed on the efficiency scores to determine their effects on efficiency. The main motivation while selecting the variables is to control bank specific characteristics. The banks in the same period are operating under the same environmental conditions in terms of economic atmosphere of the country. Hence by taking the bank specific variables we aimed to present the indicators that banks focus on in order to better perform and increase their efficiencies.

The main variables of interest are the components of Off Balance Sheet Items. Therefore, while selecting other independent variables we have categorized into four groups to evaluate the results more accurately and orderly. These groups are named as ownership variables, size variables, loan performance variables and uncategorized others.

-Off balance sheet items: It is the variable of interest since we aim to precede the analysis by regressing its subcategories separate and jointly on the efficiency scores obtained using Data Envelopment Analysis. When banks prefer off balance sheet items, there is a trade off between their commission gains and default the risk of the contracts undertaken. Therefore, the relationship between efficiency scores and off balance sheet items seems vague in the first place. By including them separately and jointly, we aim to test the dominant variables and their association with bank performance.

-Ownership:

State/Private dummy: The banks being public or private changes the way they operate. We usually observe bureaucratic procedures and internal regulations

intensely applied in publicly owned institutions therefore this variable is expected to be positively related with efficiency scores.

Foreign /Domestic dummy: The effect of the origin of the bank can not be easily analyzed because even though Turkish banking sector is a relatively newly liberalized compared to European or US banks. Turkey has a fast pacing economic environment and a young population and Turkey's domestic banks regularly improve themselves in terms of technological changes, human resources and banking applications. Therefore, there is a tough competition between foreign and domestic banks. Hence it is hard to predict which outperforms the other.

-Size:

Total assets: It represents the size of the bank and by including it in the regression we can make inferences about the relationship between the size of the banks' balance sheets and their efficiencies.

Employee/Branch Ratio: Number of branches represents the network of that specific bank in the country and access to more customers. On the other hand, increase in number of branches brings control problems and their management becomes harder. On the other hand, number of employees is an important factor in the sense that as the number of employees increase employee per client increase as well. Hence the bank can contact and communicate with more clients and the opportunity to inform and sell them more of its products emerges. These two variables go hand in hand. Hence we created a ratio which gives the number of employee per branch displaying the performance of a bank's personnel dependent on the bank's expansion.

-Loan Performance:

Loan ratio: It is an important variable to include since it represents the traditional ways of banking unlike OBS items and OEA. Loan ratio is included in this regression to see the effect of credit size on efficiency scores.

Nonperforming loans ratio: It refers to the failure of banks' clients to fulfill the credit obligations and the bank places them in their loss accounts since the client usually declares default of payment. Therefore, as nonperforming loans ratio increases, the banks' efficiency is affected adversely because it shows that the bank works with clients with low credibility and makes unprofitable investments.

-Other variables:

Return on Assets: ROA is the ratio of net income to total assets which is one of the profitability ratios of the bank. Profitability and efficiency is expected to have a significant relationship. We also aim to test whether this expectation holds or not.

Bank capitalization: It represents equity to total assets ratio which shows the risk taking behavior of the bank. As the bank capitalization ratio increases the bank allocates relatively more resources to equity to insure itself against possible losses. Hence, this variable reveals how risk aversion affects banks' efficiencies.

Liquidity ratio: Liquidity ratio shows the bank's ability to pay its short term debt on time. It involves reputational position of the bank in the sector. It may affect the short term borrowing of banks leading to a decrease in their performance when liquidity ratio falls.

Trend: It is included to see how the efficiency scores evolve over time.

Table 7 and Table 8 show the sample statistics and correlation matrix of variables used in the Tobit model, respectively.

Table 7 - Descriptive Statistics

Independent Variables	Number of observations	Mean	Standard Deviation	Minimum Value	Maximum Value
Efficiency without OBS	611	0.96	0.09	0.25	1.00
Guarantees	611	2528.79	3050.69	6.41	16309.85
Commitments	611	3489.37	5915.33	0	70444.21
Derivatives	611	3468.81	5625.53	0	38545.13
Custodies and Colleterals	611	22667.17	42257.29	0	290185.80
Total Assets	611	15533.48	21907.31	22.16	104412.50
# of Employees/# of Branches	611	26.14	21.35	5.95	155.00
Loan Ratio	611	40.77	19.08	0	81.05
Non-Performing Loans Ratio	611	69.02	878.93	0	15541.40
Return on Assets	611	0.92	2.68	-29.55	5.85
Bank Capitalization	611	14.70	10.17	3.27	81.89
Liquidity Ratio	611	39.04	20.47	2.90	98.72

The data is obtained from the quarterly financial reports of Banks announced on the web site of Banks Association of Turkey.

Table 8 - Correlation Matrix

	Efficiency without OBS	Guarantees	Commitments	Derivatives	Custodies and Colleterals	Total Assets	# of Employees/ # of Branches	Loan Ratio	Non-Performing Loans Ratio	Return on Assets	Bank Capitalization	Liquidity Ratio
Efficiency without OBS	1.00											
Guarantees	0.03	1.00										
Commitments	0.04	0.68	1.00									
Derivatives	0.17	0.58	0.44	1.00								
Custodies and Colleterals	0.08	0.68	0.44	0.46	1.00							
Total Assets	0.14	0.70	0.56	0.49	0.68	1.00						
# of Employees/# of Branches	0.10	-0.15	-0.13	-0.04	-0.11	-0.18	1.00					
Loan Ratio	0.03	0.33	0.26	0.40	0.17	0.07	-0.24	1.00				
Non-Performing Loans Ratio	-0.01	-0.06	-0.04	-0.05	-0.04	-0.05	0.02	-0.15	1.00			
Return on Assets	0.07	0.06	0.05	0.12	0.10	0.12	-0.05	0.20	-0.23	1.00		
Bank Capitalization	0.15	-0.24	-0.13	-0.12	-0.19	-0.22	0.07	-0.34	0.42	-0.43	1.00	
Liquidity Ratio	0.08	-0.34	-0.22	-0.16	-0.18	-0.17	0.37	-0.66	0.12	-0.16	0.44	1.00

Empirical Results

The main aim of this analysis is to see the specific effect of components of OBS items on efficiency scores. Moreover, the same variables are regressed on both efficiency scores calculated including OBS and excluding OBS in the first step, to analyze whether there is a difference between two in terms of the effects of OBS items on efficiency scores. Table 9 presents the results of the Tobit panel specification.

Before comparing two models, we assess the determinants of efficiency for the first and second model, separately. We decomposed off balance sheet items into its four subcategories. In the first model, guarantees are significant affecting the efficiency scores negatively. Guarantees provide commission gain for the banks but the banks undertake too much risk by accepting to pay the whole amount in case of a default by the counter party. Hence the losses incurred from this default risk may offset the commission gains affecting the banks' performance negatively. Custodies and collaterals are negatively correlated with banks' efficiencies since the banks hold these assets like securities for other banks, households or investors, gain a commission fee for keeping them but these are not actually become the banks' property. Therefore the cost of holding them may exceed its gain and lead to a decrease in the banks efficiency because the bank allocates a huge amount of its resources for custodies and collaterals. When we take a look at the ownership and size variables, it is seen that origin and balance sheet size of the banks are more effective on banks' efficiency scores. It seems that private banks are still operating with less input or producing more outputs when compared to the domestic banks under the same conditions. Moreover, as the asset size of the bank increases, it

performs better in terms of input and output efficiency. Loan ratio and nonperforming loans ratio affected efficiency on the opposite ways as expected because the former shows credit size of the bank which is one of its outputs while the latter shows the success of banks on collecting its loans back. The results show that as the ratio of total loans which is one of the outputs defined in DEA to total assets increases the bank efficiency is affected positively. In addition, if the clients of the bank do not return the payments of credit they borrowed regularly, the bank's efficiency scores fall. Among other variables, bank capitalization ratio is significant in explaining bank efficiency and its effect is positive on the efficiency scores. This result shows that risk averse behavior of the banks is positively correlated with the banks efficiency scores. The banks keep more equity relative to their assets to protect themselves from instable or unexpected economical conditions. This safe position increases the bank's efficiency since it creates a bank culture in which fully use of its resources is critical to better accommodate with harder conditions.

In the second model, for robustness check the same variables are regressed on efficiency scores estimated including OBS items in the output set. Even though, this might seem as a little change in efficiency calculation, the results differ in certain ways when we added only one more output while defining the dependent variable. In this version of panel Tobit analysis, none of the components of OBS items are significantly explaining efficiency scores. This conflicting result might arise from the fact that together they are included in the efficiency estimation in the first stage and including them in the second stage as a determinant cause a biased result. Other differences with the first model are that, bank size is not a determinant of efficiency scores while profitability ratio is positively correlated with bank performance which is not a common result in previous studies. These differences mainly arise from the

specification of dependent variable since the definition of left and right censored variables change in the Tobit model.

Table 9 - Tobit Panel Regression

Dependent Variable Efficiency without OBS	Model 1	Model 2	Model 3	Model 4	Model 5
Guarantees	-0.036 *(-5.45)***	-	-	-	-0.019 *(-2.64)***
Commitments	-	-0.002 *(-0.93)*	-	-	-0.001 *(-0.32)*
Derivatives	-	-	-0.002 *(-0.56)*	-	-0.003 *(-0.84)*
Custodies and Colleterals	-	-	-	-0.002 *(-5.35)***	-0.002 *(-4.52)***
State/Private Dummy	0.180 *(4.39)***	-0.078 *(-2.28)***	*-0.081* *(-2.31)***	-0.136 *(-4.18)***	0.044 *(0.97)*
Foreign/Domestic Dummy	0.190 *(7.17)***	0.200 *(6.20)***	0.205 *(6.67)***	0.251 *(8.62)***	0.179 *(6.49)***
Total Assets	0.006 *(3.93)***	0.001 *(1.57)*	0.001 *(1.43)*	0.006 *(5.78)***	0.009 *(3.78)***
# of Employees/# of Branches	0.440 *(0.87)*	0.921 *(1.61)*	0.920 *(1.70)**	0.583 *(1.19)*	0.001 *(1.01)*
Loan Ratio	0.621 *(0.72)*	0.002 *(1.79)**	0.002 *(1.62)*	0.003 *(3.39)***	0.002 *(2.77)***
Non-Performing Loans Ratio	-0.061 *(-4.35)***	-0.051 *(-3.74)***	-0.051 *(-3.93)*	-0.051 *(-3.94)***	-0.050 *(-3.82)***
Return on Assets	0.008 *(1.25)*	0.010 *(1.79)**	0.010 *(1.89)**	0.009 *(1.56)*	0.009 *(1.61)*
Bank Capitalization	0.014 *(5.59)***	0.012 *(4.63)***	0.012 *(5.11)***	0.013 *(5.49)***	0.011 *(4.78)***
Liquidity Ratio	-0.001 *(-1.87)**	-0.856 *(-1.06)*	-0.928 *(-1.27)*	-0.594 *(-0.89)*	0.001 *(0.71)*
Trend	0.712 *(0.41)*	-0.002 *(-0.91)*	-0.001 *(-0.59)*	-0.003 *(-1.57)*	-0.001 *(-0.36)*
Constant	0.715 *(13.39)***	0.911 *(16.53)***	0.910 *(16.27)***	0.927 *(17.65)***	0.751 *(12.22)***
Log Likelihood	-44.97	-50.93	-51.16	-42.44	-38.79
Wald Chi2(11)	157.43	103.45	116.06	159.00	143.57
Prob>Chi2(11)	0	0	0	0	0
Total Number of observations	611	611	611	611	611

* indicates significance at the 10% level, ** indicates significance at the 5% level, *** indicates significance at the 1% level

Conclusion

As the financial sector became more globalized, alternative ways of banking emerged for a variety of purposes like tax advantage, competitive power or customer satisfaction. Therefore, banks started to invest in their resources other instruments than granting loans which are not recorded in the balance sheets of banks. These off balance sheet items are composed of four categories in Turkish banking sector which are; guarantees, commitments, derivatives and custodies and collaterals.

In this study, we attempted to see their separate effect on bank efficiency scores calculated using DEA. Therefore we have regressed the components of OBS items separately and jointly on the efficiency scores to compare how the effect of determinants alter due to changes in the second step of analysis. In the regression, we used Tobit panel model since it handles better with distribution characteristics of efficiency scores as the dependent variable.

The results show that guarantees and custodies and collaterals are negatively affecting efficiency scores while commitments and derivatives are not significant. It is an unexpected results since inclusion of OBS items is critical in the efficiency calculation as an output but it seems that it is not a direct determinant of efficiency and traditional ways of banking still contribute more to the performance of the banks which is supported by the positive correlation of loan ratio with the efficiency scores. On the other hand foreign origin, balance sheet size and risk averse behavior of the bank has positive effect on the performance of banks while with the increasing of non performing loans ratio, banks' efficiencies decline.

CHAPTER 3

DETERMINANTS OF BANK EFFICIENCY: DOES SIZE MATTER?

Introduction

The last part of this study aims to evaluate the effect of certain bank specific variables on efficiency scores while focusing on bank size indicators. Similar studies usually take total assets as bank size variable but total number of employees and branches are indicators of banks size as well. Therefore, we have generated a new variable as employee/branch ratio to cover the expansion of bank. Two-step procedure is used in the analysis in which efficiency scores estimated using DEA in the first step are regressed on four groups of independent variables in the second stage. These are size, ownership, loan performance and other uncategorized variables. The second part consists of three regressions in which size variables are included separately and together to see whether the results change significantly or not.

Turkish banking sector is a fast paced and competitive market for both domestic and foreign banks especially after the liberalization acts in 1980s. Before deregulation of financial sector, the banks operating in Turkey enjoy high market shares without focusing on their managerial, profit or cost efficiencies. Since, the sector was operating inwardly; the banks usually ignore to better perform through technological advances or managerial improvements. However, as the legislation on foreign entry was relaxed, domestic banks were started to be threatened by internationally successful banks because they immediately attempted to enter either directly or through mergers and acquisitions. Turkey is an emerging market in terms

of its young population, growing economy and changing political conditions therefore combining these factors makes Turkey's banking industry attractive to Europe or US originated banks.(Denizer,Dinç,Tarımcılar,2000)

These changes in the sector had positive effects on bank efficiency as expected because the banks do not have any oligopolistic power any more. On the other hand, it is still vague for the banks on which variables they should focus to improve their performance. Therefore, we aim to analyze several bank specific variables to see whether they are determinants of banks efficiency. While making this analysis, we specifically test the effect of bank size measured in two dimensions; total assets and total employees/total branches ratio. Different views on the effect of bank size variables exist in the efficiency literature but there is an absence for their effect on commercial banks operating in Turkey. Considering that, this study may guide these banks in terms of regional expansion through opening new branches and international expansion through M/A's, we have concentrated on the correlation between size variables and bank performance.

This analysis will be conducted for commercial banks operating in Turkey for the period starting from the last quarter of 2001 until the last quarter of 2008. The reason of this selection is 2001 crisis and we have taken the reform period to provide homogeneity in the market and eliminate macro economic variables. The methodology applied will be composed of two stages; in the first step, the efficiency scores will be calculated using the non parametric approach called Data Envelopment Analysis (DEA) and the efficiency scores will be regressed on four types of bank specific variables using Panel Tobit regression model. These categories are bank size, ownership, loan performance and other variables.

Literature Review

There is a substantial number of studies about efficiency calculation and its potential determinants. Different techniques are applied but two-step procedure is quite popular among them. Casu and Molyneux (2003) used the same two-step procedure with our study to determine the changes in European banking efficiency after implementation of Single Market Programme in 1992. Their findings suggest that efficiency differences are dependent upon country specific variables like banking regulation of that particular country. Also, they found little significant relationship for Return on Average Equity- representing profitability- and Bank Capitalization ratio-representing risk taking behavior of bank- with efficiency. Another paper by Fries and Taci (2005) used stochastic frontier method to estimate efficiencies in the first step to figure out the determinants of cost efficiency of banks in post-communist countries. The results of their analysis show that foreign ownership is an improving factor for bank efficiency. A similar work by Bonin, Hasan and Wachtel (2005) about transition countries supports these findings by confirming that privatization itself is not sufficient for bank efficiency, but it has positive effect on efficiency for transition countries.

Several studies conducted on the effect of bank size on bank performance suggest different findings based on the methodology or the data origin. In their paper about the determinants of bank efficiency for Italian banks, Girardone, Molyneux and Gardener (2004) concluded that there is no evidence of relationship between bank efficiency and asset size. They have also found that non performing loans have a negative effect on efficiency scores which is an expected result. Maudos et al.(2002) analyzed variables affecting cost and profit efficiency of European banks

and the results reveal that medium sized banks perform best in terns of both cost and profit efficiency. Moreover, credit size measured as total loans/total assets is positively correlated with cost and profit efficiency.

Taking a glimpse at the studies about the effect of financial consolidation on bank performance, Amel et al. (2004) found that mergers and acquisitions have positive effect on economies of scale but no significant relationship with economies of scope and managerial efficiency for selected countries internationally. Another work by Huizinga, Nelissen and Vennet (2001) supports these findings by confirming that cost efficiency of merging banks is positively correlated with mergers.

Methodology

In this study two-step procedure was applied. In the first stage, efficiency scores are calculated using Data Envelopment Analysis (DEA) and this analysis is followed by Panel Tobit Regression in the second step.

Data Specification

DEA is conducted using the combination of inputs and outputs given as follows; inputs are personnel expenses, fixed assets, total deposits; while outputs are net interest income, off balance sheet items, total loans and other earning assets.

In the second stage efficiency scores are regressed on certain bank specific variables selected based on four criteria: size, ownership, loan performance and general structural features. Size variables are total assets and total employees/total branches ratio. Total assets represent the balance sheet size of the bank while employee/branch ratio shows the expansion and coverage of the bank. Two different size variables are used in the analysis to include all the dimensions and to compare their separate and combined effects on efficiency scores.

Ownership variables are categorized into two: State/private dummy shows whether the bank is publicly owned or not and foreign/domestic dummy reveals the origin of the bank. Variables representing loan performance of the bank works in opposite ways since loan ratio represents the credit size of the bank while non-performing loans ratio shows the failure of banks' to collect the loans they have granted back.

Other variables are uncategorized since they represent different structural features of the bank. Return on Asset ratio (ROA) stands for the profitability, bank capitalization ratio shows the risk taking behavior and liquidity ratio is the ability of bank to pay back its short term borrowings. Trend is included in the analysis as well to see the effect of time on bank performance.

Table 10 and Table 11 shows sample statistics and correlation matrix of variables, respectively.

TABLE 10 - Descriptive Statistics

Independent Variables	Number of observations	Mean	Standard Deviation	Minimum Value	Maximum Value
Efficiency	711	0.96	0.10	0.34	1.00
Total Assets	711	14204.06	20822.19	18.56	104412.50
# of Employees/# of Branches	711	26.03	21.41	5.95	155.00
Loan Ratio	711	37.96	19.45	0	81.05
Non-Performing Loans Ratio	711	62.52	814.92	0	15541.40
Return on Assets	711	0.75	2.86	-29.55	6.54
Bank Capitalization	711	14.48	9.98	-2.68	81.89
Liquidity Ratio	711	39.72	20.75	2.90	98.72

The data is obtained from the quarterly financial reports of Banks announced on the web site of Banks Association of Turkey.

TABLE 11 - Correlation Matrix

	Efficiency	Total Assets	# of Employees/ # of Branches	Loan Ratio	Non-Performing Loans Ratio	Return on Assets	Bank Capitalization	Liquidity Ratio
Efficiency	1.000							
Total Assets	0.138	1.000						
# of Employees/# of Branches	0.122	-0.168	1.000					
Loan Ratio	0.147	0.116	-0.191	1.000				
Non-Performing Loans Ratio	-0.018	-0.045	0.022	-0.134	1.000			
Return on Assets	0.097	0.127	-0.032	0.215	-0.196	1.000		
Bank Capitalization	0.132	-0.201	0.103	-0.285	0.402	-0.335	1.000	
Liquidity Ratio	0.083	-0.193	0.319	-0.615	0.103	-0.142	0.440	1.000

The data is obtained from the quarterly financial reports of Banks announced on the web site of Banks Association of Turkey.

Empirical Results

In the first version of regression, only total assets are included as the bank size variable similar to the previous literature. The findings reveal that total assets are significant and are positively correlated with bank performance. In the data set, Total Assets are in million TL units in order to decrease its sensitivity; Total Assets are taken in thousand TL units in the regression. Hence the results show that one thousand TL increase in Total Assets change efficiency scores 0.002 unit. The effect

of size is expected to be positive in terms of cost efficiency because as the banks grow, they are able to benefit from scale economies and use their resources more efficiently. When we look at the ownership variables, foreign banks show better performance, while being private or publicly owned does not affect bank's efficiency. Turkish banking sector is a newly liberalized market therefore domestic banks are still in the process of developing when compared to its international competitors. Therefore, foreign banks are operating more efficiently with the advantages of technology, infrastructure and human resource capability. Loan performance variables affect efficiency scores in opposite ways as it was expected. As the credit share of the bank relative to asset size increases bank performance increases. This change in loan ratio implies producing more output-that is total loans-which has a positive effect on bank efficiency. Non-performing loan ratio is negatively correlated with efficiency scores because it shows that the bank wasted its resources by producing and selling those loans. As bank capitalization ratio increases the bank shows more like a risk averse behavior and it has a positive effect on bank efficiency. Because this risk averse behavior results in lower leverage which in turn brings lower borrowing costs and better bank performance. Similar to the previous studies no significant relationship between profitability and efficiency is found. Liquidity ratio and trend does not affect bank performance significantly as well.

In the second part of the analysis, total employees/total branches ratio is included as size variable instead of total assets. The results show that employee/branch ratio is not significant in explaining the efficiency scores. Hence a change in the number of employee allocated a branch does not affect banks performance. The other findings are similar to the previous version of the regression except for the state/private dummy and the liquidity ratio. Surprisingly, state/private

dummy has a negative effect on bank efficiency which is quite different from what we have expected. State banks are usually regarded as more bureaucratic and having more regulations therefore operating slowly and cumbersome. However, as the Turkish banking sector become more open to advances and renovations, the clear cut differences between state and private banks may disappear. Liquidity ratio has positive effect on bank performance since liquidity shortage of a bank causes the bank to shrink and retrieve its resources from certain outputs to cut costs. Therefore the bank's operations are affected negatively.

In the third part both of the size variables are regressed on efficiency scores together with the other categories of independent variables. Similar to the first two versions of the regression, total assets are affecting bank performance positively while employee/branch ratio is not significant. Besides state/private dummy and liquidity ratio are still significant similar to the second version of analysis. Trend is significant in none of the regressions therefore we can conclude that as the financial sector evolves over time efficiency of the banks are not affected significantly.

TABLE 12

PANEL TOBIT REGRESSION ANALYSIS

TA: Total Assets
EB: Number of Employees/Number of Branches
SP:State/Private Dummy
FD: Foreign/Domestic Dummy
LoR: Loan Ratio
NPLR: Non Performing Loan Ratio
ROA: Return on Assets
BC: Bank Capitalization
LiR: Liquidity Ratio
t:Trend

Panel A :Total Assets included as size variable

Equation 1 : $\theta_{it} = \alpha_0 + \beta_1(TA)_{it} + \beta_2(SP)_{it} + \beta_3(FD)_{it} + \beta_4(LoR)_{it} + \beta_5(NPLR)_{it} + \beta_6(ROA)_{it} + \beta_7(BC) + \beta_8(LiR) + \beta_9 t + \alpha_i + u_{it}$

Constant	TA	SP	FD	LoR	NPLR	ROA	BC	LiR	t	# of Observations	Log likelihood	Wald Chi2(9)	Prob>Chi2
0.747	0.002	-0.016	0.304	0.004	-0.026	0.035	0.012	0.684	-0.003	711	-93.67	146.99	0.00
(15.4)* **	**(2.21)** **	**(-0.46)**	**(6.41)*** **	**(4.15)*** **	**(-2.07)** **	**(0.01)**	**(4.86)*** **	**(0.85)**	**(-1.44)**				

Panel B :Employee/Branch ratio included as size variable

Equation 2: $\theta_{it} = \alpha_0 + \beta_1(EB)_{it} + \beta_2(SP)_{it} + \beta_3(FD)_{it} + \beta_4(LoR)_{it} + \beta_5(NPLR)_{it} + \beta_6(ROA)_{it} + \beta_7(BC) + \beta_8(LiR) + \beta_9 t + \alpha_i + u_{it}$

Constant	EB	SP	FD	LoR	NPLR	ROA	BC	LiR	t	# of Observations	Log likelihood	Wald Chi2(9)	Prob>Chi2
0.808	-0.105	-0.108	0.253	0.004	-0.029	0.001	0.012	0.002	-0.001	711	-94.84	109.83	0.00
(14.66)* **	**(-0.10)**	**(-3.38)*** **	**(5.89)*** **	**(4.12)*** **	**(-2.33)** **	**(0.28)**	**(4.95)*** **	**(2.99)*** **	**(-0.57)**				

Panel C : Total Assets and Employee/Branch ratio included as size variables

Equation 3: $\theta_{it} = \alpha_0 + \beta_1(TA)_{it} + \beta_2(EB)_{it} + \beta_3(SP)_{it} + \beta_4(FD)_{it} + \beta_5(LoR)_{it} + \beta_6(NPLR)_{it} + \beta_7(ROA)_{it} + \beta_8(BC) + \beta_9(LiR) + \beta_{10} t + \alpha_i + u_{it}$

Constant	TA	EB	SP	FD	LoR	NPLR	ROA	BC	LiR	t	# of Observati	Log likelihood	Wald Chi2(10)	Prob>Chi2
0.878	0.002	-0.001	-0.136	0.373	0.004	-0.040	0.002	0.016	0.002	-0.003	711	-90.93	183.65	0.00
(16.21)* **	**(2.34)** **	**(-0.93)**	**(-4.11)*** **	**(9.25)*** **	**(4.10)*** **	**(-3.11)*** **	**(0.44)**	**(6.45)*** **	**(2.12)** **	**(-1.52)**				

*** indicates significance at the 10% level, ** indicates significance at the 5% level, *** indicates significance at the 1% level**

Conclusion

The structure of Turkish banking sector changed to a great extent after liberalization movements in 1980's. The financial sector started to operate more outwardly by implementation of new regulations and penetration of foreign banks. These factors affect the way banks use their resources and their inclination toward new approaches to banking. In this paper, we aim to test the potential determinants of efficiency and confirm if size is really important among these bank specific characteristics. Commercial banks operating in Turkey between the fourth quarter of 2001 and the fourth quarter of 2008 are used in the analysis. Two-step procedure is applied as methodology in which efficiency scores are calculated using DEA in the first step and using Tobit model selected independent variables are regressed on the efficiency scores to find their effects on it.

The analysis is composed of three parts. However, the common finding with respect to size variables is that total assets are positively correlated with bank efficiency while employee/branch ratio is not significant in explaining the bank performance. Ownership variables are significant but affect bank performance in the opposite ways. State/private dummy has negative effect while foreign/private dummy has positive effect on bank efficiency. Loan ratio has positive relationship on bank performance and non performing loan ratio is negatively correlated with efficiency scores. Increase in bank capitalization ratio and liquidity ratio results in an increase in efficiency. On the other hand, all of three versions of the regression reveal that ROA and trend do not have a significant relationship with the bank performance.

APPENDIX

Table A.1 Average Efficiency Scores of DMUs (Source: Authors' calculations)

DMU Abbreviation	DMU Full Name	Cluster No (in 2006)	Excluding OEA	Including OEA	Percentage Change in Efficiency
ABN	*ABN Amro Bank*	7	0.7	0.84	0.20
ADABANK	*Adabank*	8	0.74	0.78	0.05
AKBANK	*Akbank*	1	1	1	0
ALTERN	*Alternatifbank*	2	0.94	0.95	0.01
ANADOLU	*Anadolubank*	3	0.76	0.93	0.22
ARAPTURK	*Arap Türk Bankası*	6	0.68	0.77	0.13
ROMA	*Banca di Roma*	2	0.86	0.9	0.05
EUROPA	*Bank Europa*		0.49	0.5	0.02
MELLAT	*Bank Mellat*	2	0.89	0.98	0.10
BAYINDIR	*Bayındırbank*		1	1	0
BFB	*Birleşik Fon Bankası*	9	1	1	0
BNPAK	*Bnp-Ak Dresdner Bank*		0.9	0.92	0.02
CITIBANK	*Citibank*	5	0.99	1	0.01
LYONNAIS	*Credit Lyonnais Turkey*		1	1	0
SUISSE	*Credit Suisse First Boston*		1	1	0
DENIZBANK	*Denizbank*	2	0.89	0.97	0.09
DISTICARET	*Dış Ticaret Bankası*		0.88	0.98	0.11
FIBA	*Fibabank*		1	1	0
FINANS	*Finansbank*	2	1	1	0
FORTIS	*Fortisbank*	1	0.89	0.99	0.11
GARANTI	*Garanti Bankası*	1	1	1	0
HABIB	*Habib Bank*	5	1	1	0
HALKBANK	*Halkbank*	7	0.8	0.95	0.19
HSBC	*HSBC*	2	1	1	0
ING	*ING Bank*		1	1	0
IMAR	*İmarbank*		1	1	0
ISBANKASI	*İşbankası*	7	0.94	0.97	0.03
JPMORGAN	*JPMorgan Chase Bank*	9	0.95	1	0.05
KOCBANK	*Koçbank*		0.99	1	0.01
MILLENIUM	*Millenium Bank*	4	0.75	0.75	0

Table A.1 (continued)

MILLIAYDIN	***Milli Aydın Bankası***		0.31	0.36	0.16
MNG	***MNG Bank***		0.71	0.75	0.06
OYAK	***Oyakbank***	1	0.81	0.82	0.01
PAMUKBANK	***Pamukbank***		0.68	0.78	0.15
SITEBANK	***Sitebank***		1	1	0
SOCGEN	***Societe Generale***	5	0.89	1	0.12
SEKER	***Şekerbank***	6	0.55	0.59	0.07
TEB	***TEB***	1	0.97	0.97	0
TEKFEN	***Tekfenbank***	4	0.49	0.56	0.14
TEKSTIL	***Tekstilbank***	2	0.86	0.87	0.01
TOPRAK	***Toprakbank***		0.34	1	1.94
TURKBANK	***Turkish Bank***	3	0.43	0.86	1.00
TURKLAND	***Turkland Bank***	4	0.66	0.68	0.03
VAKIF	***Vakıfbank***	1	0.76	0.87	0.14
WESTLB	***West LB AG***	5	0.88	0.89	0.01
WLG	***Westdeutsche Landesbank***		1	1	0
YAPIKREDI	***Yapı Kredi Bankası***	7	0.93	0.95	0.02
ZIRAAT	***Ziraat Bankası***	7	1	1	0

Table A.2 Random Effects Panel Regressions (Source: Authors' calculations)

Independent Variables	**Dependent variable** ***Efficiency with Other Earning Assets***	**Dependent variable** ***Efficiency without Other Earning Assets***
Interbank/Other Earning Assets	-0.070	-0.052
	(-4.80)* **	**(-2.72)** **
Bank Capitalization	0.229	0.470
	(3.22)* **	**(5.30)*** **
Loan Ratio	0.199	0.396
	(3.46)* **	**(5.44)*** **
Assets/Employees	0.00001	0.00001
	(2.26)*	(1.47)
Return on Assets	0.009	-0.069
	(0.09)	(-0.58)
Number of Branches	-0.00004	-0.00009
	(-0.76)	(-1.23)
Foreign/Domestic	0.022	0.044
	(0.57)	**(0.95)**
Constant	**0.804**	**0.612**
	(20.23)* **	**(12.82)*** **
R-square	0.736	0.729
Number of Observations	212	212

*** indicates significance at the 10% level, ** indicates significance at the 5% level, *** indicates significance at the 1% level**

REFERENCES

Abbasoglu O.F., A.F. Aysan, A. Gunes, (2007), "Concentration, Competition, Efficiency and Profitability of the Turkish Banking Sector in the Post-Crises Period", *The Banks and Bank Systems, 2,* 106-115.

Adenso-Diaz B., F. Gascon, (1997), "Linking and Weighting Efficiency Estimates with Stock Performance in Banking Firms", The Wharton Financial Institutions Center.

Al H., A.F. Aysan, (2006), "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, 4*, 125–146.

Amel D., C. Barnes, F. Panetta, C. Salleo, (2004), "Consolidation and Efficiency in the Financial Sector: A Review of the International Evidence", *Journal of Banking and Finance, 28,* 2493-2519.

Amerman D.R. (2008), "The Hidden Bailout Of $1.4 Trillion In Fannie / Freddie Credit-Default Swaps", http://www.financialsense.com/fsu/editorials

Arestis P., G.Chortareas, E.Desli, (2006), "Technical Efficiency and Financial Deepening in the Non-OECD Economies", *International Review of Applied Economics, 20*, 353–373.

Arestis P., G.Chortareas, E.Desli, (2006), "Financial Development and Productive Efficiency in OECD Countries: An Explanatory Analysis", *The Manchester School, 74*, 417–440.

Aydın A. (2000) , "*Bilanço Dışı İşlemler*", *Bankacılar Dergisi*, 34

Aysan A.F., G. Ertek, S. Öztürk, (2008), "How Does the Increasing Volume of Interbank Funds Affect Bank Efficiency", *Working Paper as Master Thesis, Boğaziçi University*

Aysan A.F., S.P. Ceyhan, (2008-a), "What Determines the Banking Sector Performance in Globalized Financial Markets: The Case of Turkey?", *Physica A: Statistical Mechanics and its Applications. 387,*1593-1602.

Aysan A.F., S.P Ceyhan, (2008-b), "Globalization of Turkey's Banking Sector: Determinants of Foreign Bank Penetration in Turkey", *The International Research Journal of Finance and Economics. 15*, 90-102.

Aysan A.F., S.P Ceyhan, (2008-c), "Structural Change and Efficiency of Banking in Turkey: Does the Ownership Matter?", *Topics in Middle Eastern and North African Economies, MEEA Online Journal,* 10.

Aysan A.F., S.P. Ceyhan, (2007), "Why Do Foreign Banks Invest in Turkey?", *Asian and African Journal of Economics and Econometrics. 7*, 65-80.

Banker R.D., A.Charnes, W.W. Cooper, (1984), "Some Models for Estimating Technical and Scale Inefficiencies in Data Envelopment Analysis", *Management Science, 30*, 1078–1092.

Bonin J.P., I. Hasan, P. Wachtel, (2005), "Privatization Matters: Bank Efficiency in Transiton Countries", *Journal of Banking and Finance, 29,* 2155-2178.

Boyd J.H., M. Gertler, (1994), "Are Banks Dead? Or Are the Reports Exaggerated?" *Federal Reserve Bank of Minneapolis Quarterly Review* , 2-23.

Casu B., C. Girardone, (2005), "An Analysis of the Relevance of Off Balance Sheet Items in Explaining Productivity Change in European Banking", *Applied Financial Economics, 15,* 1053-1061

Casu B.,P. Molyneux, (2003), "A Comparative Study of Efficiency in European Banking" , *Applied Economics, 15*, 1865-1876.

Clark J.A., T.F.Siems, (2002), "X-Efficiency in Banking: Looking beyond the Balance Sheet", *Journal of Money, Credit and Banking, 34*, 987–1013.

Cooper W.W., L.M. Seiford, K. Tone, (2006), "Introduction to Data Envelopment Analysis and Its Uses", *Springer Science Business Media.*

Denizer C., M. Dinc, M. Tarimcilar, (2000), "Measuring Banking Efficiency in the Pre and Post Liberalization Environment: Evidence from the Turkish Banking System", *World Bank Policy Research Working Paper*

Fethi M.D., P.M. Jackson, T.G. Weyman-Jones, (2000), "Measuring the Efficiency of European Airlines: An Application of DEA and Tobit Analysis", *Efficiency and Productivity Research Unit, University of Leicester*

Fethi M.D., P.M. Jackson, (2000), "Evaluating the Technical Efficiency of Turkish Commercial Banks: An Application of DEA and Tobit Analysis", *International DEA Symposium Conference Paper*

Fries S., A. Taci, (2005), "Cost Efficiency of Banks in Transition: Evidence form 289 Banks in 15 Post-communist countries", *Journal of Banking and Finance,29,*55-81.

Girardone C., P. Molyneux, E.P.M. Gardener, (2004), "Analysing the Determinants of Bank Efficiency: The Case of Italian Banks", *Applied Economics, 36,* 215-227

Huizinga H.P., J.H.M. Nelissen, R. Vander Vennet, (2001), "Efficiency Effects of Bank Mergers and Acquisitions in Europe", *Dutch Ministry of Finance Working Paper*

Isık I., M.K. Hassan. 2002. Technical, Scale and Allocative Efficiencies of Turkish Banking Industry, Journal of Banking and Finance. 26: 719–766.

Loikkanen H.A., I. Susiluoto, (2004), "Cost Efficiency of Finnish Municipalities 1994-2002: An Application of DEA and Tobit Methods", *Revista de economía pública urbana*

Maudos J., J.M. Pastor, F. Perez, J. Quesada, (2002), "Cost and Profit Efficiency in European Banks", *Journal of International Financial Markets, Institutions and Money,12,* 33-58

Ozatay F., G. Sak, (2002), "The 2000–2001 Financial Crisis in Turkey", *Brookings Trade Forum 2002:*Currency Crises Washington D.C.

Rime B., K.J. Stiroh, (2003), "The Performance of Universal Banks: Evidence from Switzerland", *Journal of Banking and Finance, 27*, 2121-2150.

Rogers K.E., J.F. Sinkey, (1999), "An Analysis of Non traditional Activities at US Commercial Banks", *Review of Financial Economics, 8*, 25-39.

Stavárek D., (2003), "Banking Efficiency in Visegrad Countries Before Joining the European Union", *Workshop on Efficiency of Financial Institutions and European Integration, Technical University Lisbon, Portugal*.

Turhan I., (2008), "Why Did It Work This Time?: A Comparative Analysis of Transformation of Turkish Economy After 2002", *Asian African Economics and Econometrics. 8,* 255-280.

Tobin J., (1958), "Estimation of relationships for limited dependent variables", *Econometrica, 26*, 24-36