MARKET DISCIPLINING ROLE OF CRISIS ON THE RESTRUCTURING OF THE TURKISH BANKING SECTOR

Abstract

This paper aims to find the productivity change in the banking sector between 1990 and 2006, with an emphasis to the period after 2001 crisis during which the Turkish banking system experienced a structural change. Using DEA, we find the Malmquist TFP Change Index and its mutually exclusive and exhaustive components of efficiency and technological changes over time. Additionally, we further decompose the technical efficiency change into pure technical and scale efficiency changes. The productivity of the banking sector is found out to have increased, the main reason being technological improvement rather than efficiency increase. For the cases of productivity decline, however, the changes come from the efficiency side rather than technology. An analysis with respect to the ownership status revealed that foreign banks were the most efficient group until 2001 after which state banks captured the first place. We attribute this change to the inflation accounting practice as well as better management of state banks with less political intrusion. The analysis with respect to bank size reveals that before 2000, the most efficient bank group was the medium-scale banks (the banks mainly purchased by foreign banks) followed by small banks while the efficiency scores converged after 2001.

Keywords: Turkish Banking Sector, Data Envelopment Analysis, Efficiency, Productivity, Post-Crises Period

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1. INTRODUCTION

The 2000 and 2001 crises are two events in the Turkish economic history with sizable impacts on the financial system and especially on the Turkish banking sector which occupies around three fourths of the financial system. The period before the crises is marked by problems which were mainly caused by macroeconomic instability reflected in high inflation numbers and a fluctuating growth pattern of the economy. Income distribution was unfair and the informal economy was quite large. High interest rates were keeping banks away from their intermediation duty. The regulatory system was under the influence of political powers, legislation was weak and many banks did not have sufficient capital to cope with financial crises. More and more banks were founded in order to obtain profits without much concern for the quality of the bank management (Steinherr et.al., 2004).

These weaknesses caused many banks with insufficient capital to declare bankruptcy. To deal with this problem, the monetary policy had to be loosened and the exchange rate regime was switched from the crawling peg to the floating. However, the new exchange rate regime resulted in currency depreciation which left the banks with insufficient capital in a difficult situation. Many banks which were not run properly had to be closed down. Hence, the banking sector needed to be restructured and the capital base of the banks needed to be strengthened. The trend in the banking sector was switching from "opening up more and more banks" to "good management" in order to make profit.

After the 2001 crisis, the Turkish Banking Regulation and Supervisory Agency (BRSA) (which was founded in Sep. 2000 after a Banking Act was passed in June 1999) changed its main objective from supervision to restructuring and rehabilitation (Al and Aysan, 2006). The May 2001 Rehabilitation Program carried out by the BRSA was aimed at strengthening the private banks[1], restructuring the state banks which constitute a large part of the Turkish banking sector, resolving the banks taken over by Saving and Deposit Insurance Fund (SDIF) and increasing the quality of supervision in the banking sector. This program helped state banks stop being a significant reason of 'liquidity risk' for the markets (Steinherr et.al., 2004).This restructuring and the liquidation of the sector by the SDIF decreased the costs in the banking sector thanks to alternative delivery channels such as internet and telephone banking, and this is reflected as higher profitability and

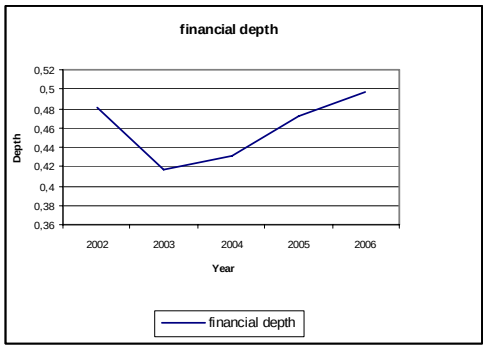
[1] Through strengthening, private banks would comply with the international reporting and prudential standards and improve their capital adequacy ratios.

productivity in the sector. Moreover, the number of branches and personnel decreased due to mergers and acquisitions following the crises such that the number of banks in the sector decreased from 59 banks in 2002 to 50 at the end of 2006 (Çakar, 2003).

The 2001 crisis also increased the desire of foreign banks to take over Turkish banks cheaply and make profits. In fact, foreign banks were the only group of banks that made profits during September 2000-December 2001 period and were the ones with the highest interest margin. After the crisis, Turkey experienced a great amount of foreign bank entry. Some of the reasons of foreign bank entry are the increasing population and per capita income, reforms carried out in the investment environment, improving macroeconomic performance of the Turkish economy and the birth of the mortgage sector. Furthermore, it is now easier to enter into the Turkish market, corporate governance system is improving and there is better auditing and regulation in the banking system (Tatari, 2005). However, the most important reason is the high growth potential of the Turkish banking sector. This can be observed from the fact that the depth of the financial sector increased considerably after the crises period (Graph 1). Moreover, the asset size of the banking sector increased from YTL 171.9 billion in 2001 to YTL 499.7 billion in 2006 reaching 86.7 % of the financial sector. Profits of the sector also increased from YTL 2.90 billion in 2002 to YTL 8.73 billion in 2006 (BRSA, Dec. 2006). Table 1 shows some performance indices for the Turkish baking sector between 2003 and 2006. It can be seen that while the currency risk does not show much improvement, profitability, liquidity and asset quality of the sector improved over the period.

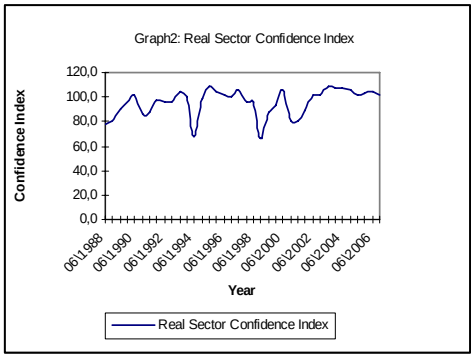
This study analyzes the situation of the Turkish banking industry for the period after 1990, with the primary emphasis given to the period following the 2001 crisis. The preference for the period after 2001 relies partly on the fact that 1990s are characteristically very volatile which makes it hard to examine the period. However, since the crisis period, there has been more stability in the sector, which helps us analyze the economic situation in the sector more easily. The situation can be observed from Graph 2 depicting the real sector confidence index after 2000. In the graph, the confidence to the financial sector is shown to be at a very low value right after the 2001 crisis (BRSA, Dec. 2006). However after the crisis, the index value both increased and became more stable.

Graph 1: Financial Deepening



Source: Turkish Statistical Institute

Graph 2: Real Sector Confidence Index



Source: Central Bank of Turkey

In this study, we attempt to find out how the crisis affected the performance of the Turkish banking sector. Specifically, we look at how the productivity and efficiency[2] of the sector changed especially after 2001.For the efficiency and productivity analysis we utilize a nonparametric method called Data Envelopment Analysis. Defining banks as intermediary institutions in the financial sector collecting deposits and giving out loans, the study employs the intermediation approach. We define efficiency as the proportional reduction in inputs possible for a given level of output in order to obtain the efficient use of inputs. Hence, input minimization approach is used in this study to find out the bank(s) with the greatest input efficiency in the sector.

The data come from the balance sheets of the banks included in our sample, which is provided by the Banks Association of Turkey. Development banks have been excluded due to their different structure and aim in the sector as well as different environment in which they operate.

One major finding of our study is that the performance of different banking groups (either with respect to bank size or with respect to ownership status) in the sector converged after the crisis. All types of banks experienced efficiency gain between 1990 and 2006. The higher efficiency values after 2001 not only result from the inflation accounting practice but also result from clearing the banking system from small and relatively inefficient banks following the crisis. Additionally, state banks which exhibited the worst performance before 2001 became the leading banking group with the highest efficiency values after 2001. This shows that the performance of state banks can be improved considerably if they are managed properly.

[2] With the word "efficiency", we mean “technical efficiency” unless otherwise stated.

Our results show that even though productivity declines at certain times during the sample period, overall, there is productivity improvement in the sector. The main source of this productivity increase is found out to be technological improvement after 2001, which confirms the existence of structural changes in the Turkish banking sector.

We further decompose the technical efficiency change into pure technical efficiency and scale efficiency changes. The scale efficiency increase is dominant during the period before the 2001 crisis while the changes are only slight before 2001. This supports the fact that mergers and acquisitions in the sector is bringing the banking industry closer to its optimal size.

Our analysis with respect to bank size suggests that the efficiency scores converge after 2001. For the period before 2000, however, the results indicate that the most efficient bank group is the medium-scale banks, the banks mainly purchased by foreign banks, followed by small banks. Large banks have been found the least efficient due to the fact that they have the most scale inefficiency.

The plan of this paper is as follows. The following section gives a brief introduction to the related literature. The third and the forth sections explain the methodology and the data used. The fifth section gives the results together with the underlying reasons, and the last section concludes.

2. EFICIENCY AND PRODUCTIVITY MEASUREMENT FOR THE BANKING INDUSTRY: BACKGROUND FOR THE TURKISH CASE

In the efficiency literature, there exist a considerable number of studies with the aim of finding the performance change of economic units over a certain period of time. Many of these examine the efficiency and productivity changes in the banking sector following deregulation, privatization or an economic crisis.

Zaim (1995) analyzes the effects of liberalization on the performance of the Turkish banks in terms of efficiency. However, it does not study the effects on productivity nor does it give the decomposition of this change. The results indicate that the Turkish banks became more efficient during the post-liberalization era.

Isık and Hassan (2003b) later classify the source of productivity changes as efficiency change and/ or technological change during the 1992-1996 period. This study shows that DEA methodology could be utilized to analyze the performance of banks in transition countries. One finding is that following the 1994 crisis, productivity declined mainly due to technological regress, the most affected banking group being the foreign banks. They also look at the relationship between productivity, bank size and crisis, and conclude that large banks were affected the least from the crisis. In Isık and Hassan (2003a), the analysis is divided into two, one using the off-balance sheet items and the other not. Both groups of results indicate that the banking sector experienced productivity growth resulting not from technological improvement, but from efficiency increase, which, in turn, is mainly driven by the better resource management rather than the scale improvement. They find that it was foreign banks followed by private ones whose performance improved the most after the deregulation although the performances of public and private banks converged during the period.

Green et al. (2003) and Naaborg (2003) are other studies analyzing the bank performance in the Central and Eastern Europe in the late 1990s. Green et al. find that, foreign banks are not significantly more efficient than domestic banks, either in terms of cost advantage or in terms of economies of scale/scope. However, Naaborg suggests that in spite of the superiority of foreign banks in terms of profitability, there is convergence in the performances.

Another study for the transition countries is Bonin et al. (2005) which examines the effect of ownership on bank efficiency over the period 1996-2000 using stochastic frontier estimation procedure. They find that government owned banks are not significantly less efficient than privately held banks, and that foreign owned banks are more cost efficient than other banks and provide better service. They suggest, therefore, that privatization on its own is not sufficient to enhance the efficiency of the banking sector. However, in the Gilbert and Wilson (1998) study, which analyze the effects of deregulation and privatization on the productivity of Korean banking sector in the late 1980s, the productivity values are found to have increased during this period. They suggest the reason as Korean banks' altering their input & output mix during this period.

Isık and Hassan (2002) examine the input and output efficiencies in the Turkish banking industry for the period 1988-1996, and try to find a relationship between variables of size, ownership, control and governance and variables of profit, cost, allocative, technical, pure technical and scale efficiency. The intermediation approach is used in this

study which is the first nonparametric efficiency study that takes the off-balance sheet items into account. The results from the DEA analysis indicate that the cost and profit efficiencies of the banking industry increased over time. The main reason of inefficiency is found out to be the technical inefficiency rather than the allocative inefficiency. They find that the production efficiency in the industry fell over time, and that bank size and efficiency are negatively correlated. Private banks are found to be more efficient than public banks. Moreover, banks where the board and the management are independent are more efficient than banks where they are not. Furthermore, banks that operate under a holding company are found to be more efficient than the independent banks.

Yıldırım (2002) studies the efficiency of the Turkish commercial banks during the period 1988-1999. This study looks at the technical and scale efficiencies of the banks using the DEA methodology. Scale efficiency, which is the main source of inefficiency, and pure technical efficiency are found out to be very volatile during the period when there was instability in the Turkish economy. Moreover, efficient banks are found to be more profitable, and bank size is positively related to pure technical and scale efficiencies.

Kasman (2002) examine the cost and scale efficiencies, and technological improvement in the Turkish banking sector over the period 1988-1998 using Fourier-flexible cost function. One finding is that the banking sector was inefficient in spite of the increase in efficiency. However, the sector is found out to be scale efficient, and there was technological improvement during 1988-1991 while technological regress during 1992-1998.

Gamal and Inanoglu (2005) analyze the efficiency of the Turkish banking sector during the 1990-2000 period using a parametric technique and suggest that although state banks are efficient in terms of generating loans, they are inefficient in the sense of labor utilization, which is one reason behind the idea of privatization. Another finding of the paper is that special finance houses are relatively more efficient than conventional domestic banks.

A similar study for the same period of time is conducted by Özkan-Günay and Tektas (2006) utilizing the nonparametric DEA methodology. The study reveals that the number of efficient banks in the sector and the mean efficiency values for different groups of banks declined over time. Moreover, they also look at the sensitivity of the efficiency values to the choice of outputs, and find sensitivity especially for foreign banks. The effects of crises are more obvious if output variables are defined as income rather than as

deposits, loans and securities portfolio. In this study, the sample period is restricted to 1990-2001 due to data insufficiency[3], and the state banks are excluded from the study. Our study attempts to fill in this gap in the literature by analyzing the performance of commercial (private, state and foreign) banks in Turkey between 1990 and 2006[4]. We are especially interested in the time period beginning with 2001 during which the Turkish banking system passed through a radical structural change.

3. METHODOLOGY

Performance evaluation is a significant part of the management process that provides firms with invaluable feedback for the ongoing operations, and helps them keep competitive. One method in performance evaluation to measure productivity is the ratio analysis. However, each ratio reflects the performance of a firm with respect to a specific area of activity, and thus becomes inappropriate for the banking industry which uses multiple inputs and multiple outputs. Moreover, in evaluating performance using the optimization methods, the estimation of the efficient frontier requires that we know the relationship among different efficiency measures, which is usually not possible. However, one can also estimate the efficient frontier empirically by using observations from the firms, i.e. Decision Making Units (DMU), whose performances are to be evaluated (Zhu, 2003).

There exist, therefore, two approaches in the estimation of frontier: (i) parametric (stochastic frontier) methods, (ii) nonparametric (linear programming) methods. In parametric methods, a certain form for the production function has to be assumed, formulating the relationship of the efficient level of outputs to the level of inputs. However, in nonparametric methods, no assumptions have to be made to determine the form of the production function, but the frontier can be estimated empirically using the input and output observations (Yıldırım, 2002). In parametric approaches it is assumed that a single estimated regression line applies to all the observations. However, in nonparametric approaches, each DMU is analyzed separately and has its own efficiency

[3] The application of inflation accounting from 2001 to 2004 after which it was abolished due to declining inflation rates made it hard to conduct performance evaluation for the period after 2001.

[4] Özkan-Günay and Tektas (2006) use personnel expenses, administrative expenses, and interest expenses from the Income Statement as inputs. The financial statement items most affected by the inflation accounting adjustment are the ones from the Income Statement and the "shareholder's equity and securities portfolio" items from the Balance Sheet. Therefore, as opposed to Özkan-Günay and Tektas (2006), , we could use the unadjusted 2005 and 2006 numbers as well as the 2001-2004 adjusted numbers thanks to our definition of inputs as "labor, capital and loanable funds" and the low inflation rates during this period.

value relative to the whole sample (Jemric and Vujcic, 2007). Among other advantages of using nonparametric techniques is that they can easily work with production functions with multiple inputs and multiple outputs and with Variable Returns to Scale. Moreover, they can give the technical and scale efficiencies as well as the source of the scale efficiency without using input prices (Fukuyama, 1993; Favero and Papi, 1995).

One nonparametric method that is widely used in the efficiency literature is Data Envelopment Analysis (DEA). In this model, linear programming is used in order to estimate the efficient frontier from the observations of inputs and outputs. The DEA method works as follows:

Consider n observations on decision making units. Each observation, DMU_j (j=1,2,….n), uses m inputs x_{ij} (i=1,2,…m) in order to produce s outputs y_{rj} (r=1,2,…..s). Efficiency is calculated by the ratio of weighted outputs to weighted inputs. The efficiency, however, is not an absolute efficiency, but a relative one, i.e., a DMU is efficient "compared to" other DMUs in the sample (Yıldırım, 2002). The efficiency of DMU_o is measured in the following way:

$$\max h_o(u,v) = \frac{\sum_{r=1}^{s} u_r y_{ro}}{\sum_{i=1}^{m} v_i x_{i0}} \text{ subject to the constraints;}$$

$$\frac{\sum_{r=1}^{s} u_r y_{rj}}{\sum_{i=1}^{m} v_i x_{ij}} \le 1, j = 1,2,...,j_o,...,n$$

$$u_r \ge 0, r = 1,2,...,s$$

$$v_i \ge 0, i = 1,2,...,m$$

where x_{ij} is the observed amount of input i for the DMUj. $x_{ij} > 0, i = 1,2,...n, j = 1,2,...,n$. y_{rj} stands for the observed amount of output r for DMUj. $y_{rj} > 0, r = 1,2,...s, j = 1,2,...,n$. The variables u_r and v_i are the weights determined by the above equation. Since the above problem has an infinite number of solutions, Charnes-Cooper transformation is used to arrive at a linear programming

problem that is equivalent to the above linear fractional programming problem (Jemric and Vujcic, 2007). Setting $\sum_{i=1}^{m} v_i x_{io} = 1$, the problem becomes:

$\max z_o = \sum_{r=1}^{s} u_r y_{ro}$ subject to the constraints;

$$\sum_{r=1}^{s} u_r y_{rj} - \sum_{i=1}^{m} v_i x_{ij} \le 0,\ j = 1, 2, ..., n$$

$$\sum_{i=1}^{m} v_i x_{io} = 1$$

$$u_r \ge 0, r = 1, 2, ..., s$$

$$v_i \ge 0, i = 1, 2, ..., m$$

In the DEA literature, there exist two approaches for the estimation of the efficient frontier from these n observations. Input-oriented models find out the amount that the inputs are to be proportionally decreased given a certain amount of output while output-oriented models reveal the amount that the outputs are to be proportionately increased given a certain amount of input. Since we define efficiency as the proportional reduction in inputs possible for a given level of output in order to obtain the efficient use of inputs, we do input minimization above to find the most efficient bank(s) in the sector. The dual model for the above linear programming model is as follows (Zhu, 2003):

$\theta^* = \min \theta$ subject to the constraints;

$\sum_{j=1}^{n} \lambda_j x_{ij} \le \theta x_{io}$ i= 1, 2,…., m;

$\sum_{j=1}^{n} \lambda_j y_{rj} \ge y_{ro}$ r=1, 2,……, s;

$$\sum_{j=1}^{n} \lambda_j = 1$$

$\lambda_j \ge 0$ j= 1, 2,……..,n;

where DMU_o represents one of the n DMUs. x_{io} is the ith input and y_{ro} is the rth output for DMU_o. Here, the optimal value satisfies the condition $\theta^* \le 1$. θ^* is the (input-oriented) efficiency score of DMU_o. If $\theta^* = 1$, the input levels can no longer be

reduced proportionally and DMU_o is on the efficient frontier, i.e., there is no other DMUs that operate more efficiently than this DMU. This is an envelopment model with Variable Returns to Scale.

If the condition $\sum_{j=1}^{n} \lambda_j = 1$ is removed from the model, it becomes a Constant Returns to Scale (CRS) model in which the frontier exhibits CRS. If this condition is replaced with $\sum_{j=1}^{n} \lambda_j \leq 1$, then it is called Non-Increasing RTS (NIRS) envelopment model. If the condition is replaced with $\sum_{j=1}^{n} \lambda_j \geq 1$, then it is called Non-Decreasing RTS (NDRS) envelopment models (Zhu, 2003).

Since one of our aims is to find the change in the productivity of banks, we are interested in finding out the Malmquist Total Factor Productivity Change (TFPCH) Index over the sample period. The DEA type Malmquist productivity index originates from the Malmquist Index presented in Malmquist (1953). In this study, the input of a firm at two time periods was compared according to the maximum factor by which the input in one period could be decreased and the firm could still produce the same level of output in the other period. Caves et al. (1982) extended this model to define the Malmquist productivity index, and the DEA type Malmquist productivity index was later developed by Fare at al. (1994) (Zhu, 2003).

This index is defined as the multiplication of the efficiency change (EFFCH) (how closer a bank approaches to the efficient frontier: "catching up" or "falling behind" effect) and the technological change (TECCH) (how much the efficient frontier shifts: technical progress or regress).

Suppose each DMU_j (j=1,2,…..,n) uses a vector of inputs $x_j^t = (x_{1j}^t, ..., x_{mj}^t)$ in order to produce a vector of outputs $y_j^t = (y_{1j}^t, ..., y_{sj}^t)$ at each time period t=1,2,…,T. From *t* to *t+1* DMU_o's efficiency may change and/or the frontier may shift. The following steps are used to calculate the Malmquist productivity change index (Zhu, 2003).

(i) Comparison of x_o^t to the frontier at time *t*, i.e., calculation of $\theta_o^t(x_o^t, y_o^t)$ using the following input-oriented CRS envelopment model:

$\theta_o^t(x_o^t, y_o^t) = \min \theta_o$ subject to the constraints;

$$\sum_{j=1}^{n} \lambda_j x_j^t \le \theta_o x_o^t$$

$$\sum_{j=1}^{n} \lambda_j y_j^t \ge y_o^t$$

$$\lambda_j \ge 0, j = 1, ..., n$$

where $x_o^t = (x_{1o}^t, ..., x_{mo}^t)$ and $y_o^t = (y_{1o}^t, ..., y_{so}^t)$ are the input and output vectors of DMU_o among others.

(ii) Comparison of x_o^{t+1} to the frontier at time *t+1*, i.e., calculation of $\theta_o^{t+1}(x_o^{t+1}, y_o^{t+1})$:

$\theta_o^{t+1}(x_o^{t+1}, y_o^{t+1}) = \min \theta_o$ subject to the constraints;

$$\sum_{j=1}^{n} \lambda_j x_j^{t+1} \le \theta_o x_o^{t+1}$$

$$\sum_{j=1}^{n} \lambda_j y_j^{t+1} \ge y_o^{t+1}$$

$$\lambda_j \ge 0, j = 1, ..., n$$

(iii) Comparison of x_o^t to the frontier at time *t+1*, i.e., calculation of $\theta_o^{t+1}(x_o^t, y_o^t)$:

$\theta_o^{t+1}(x_o^t, y_o^t) = \min \theta_o$ subject to the constraints;

$$\sum_{j=1}^{n} \lambda_j x_j^{t+1} \le \theta_o x_o^t$$

$$\sum_{j=1}^{n} \lambda_j y_j^{t+1} \ge y_o^t$$

$$\lambda_j \ge 0, j = 1, ..., n$$

(iv) Comparison of x_o^{t+1} to the frontier at time *t*, i.e., calculation of $\theta_o^t(x_o^{t+1}, y_o^{t+1})$:

$\theta_o^t(x_o^{t+1}, y_o^{t+1}) = \min \theta_o$ subject to the constraints;

$$\sum_{j=1}^{n} \lambda_j x_j^t \le \theta_o x_o^{t+1}$$

$$\sum_{j=1}^{n} \lambda_j y_j^t \ge y_o^{t+1}$$

$$\lambda_j \ge 0, j = 1, ..., n$$

The input-oriented Malmquist productivity index is then presented below:

$$M_o = \left[\frac{\theta_o^t(x_o^t, y_o^t)}{\theta_o^t(x_o^{t+1}, y_o^{t+1})} \cdot \frac{\theta_o^{t+1}(x_o^t, y_o^t)}{\theta_o^{t+1}(x_o^{t+1}, y_o^{t+1})} \right]^{1/2}$$

M_o shows the change in productivity from time *t* to *t+1*. This value exceeds 1 if there is productivity decline, is smaller than 1 if there is productivity improvement and is equal to 1 if there is no productivity change between the periods.

With the following decomposition, it is possible to measure the change of technical efficiency and the shift of the frontier in terms of a specific DMU_o.

$$M_o = \frac{\theta_o^t(x_o^t, y_o^t)}{\theta_o^{t+1}(x_o^{t+1}, y_o^{t+1})} \cdot \left[\frac{\theta_o^{t+1}(x_o^{t+1}, y_o^{t+1})}{\theta_o^t(x_o^{t+1}, y_o^{t+1})} \cdot \frac{\theta_o^{t+1}(x_o^t, y_o^t)}{\theta_o^t(x_o^t, y_o^t)} \right]^{1/2}$$

The first term on the right hand side measures the magnitude of the change in technical efficiency (EFFCH) between time *t* and *t+1*. EFFCH is greater than, smaller than or equal to 1 if there is efficiency decline, increase or no change, respectively. The second term measures the shift in the frontier (TECCH) from time *t* to *t+1*. TECCH is greater than, smaller than or equal to 1 if there is efficiency decline, increase or no change, respectively (Zhu, 2003).

Fare et al. (1994) used Variable Returns to Scale to further decompose the efficiency change into the pure technical efficiency change (PEFFCH) and the scale efficiency change (SECH). Pure technical efficiency is also known as the managerial efficiency. A decision making unit has managerial inefficiency when the inputs used to produce a given level of output is more than the required amount. Scale efficiency is defined as the potential productivity gain from achieving optimal size of a firm. A scale efficient firm produces where there are Constant Returns to Scale. If there is Increasing Returns to

Scale, it is optimal to expand the scale of production in order to increase productivity. On the other hand, it is optimal to decrease the production level if there is Decreasing Returns to Scale (Isık and Hassan, 2003).

4. DATA

There are two approaches in the literature for performance evaluation: Intermediation approach and production approach. The production approach suggests that inputs such as capital and labor are used in order to "produce" outputs which are defined as services to depositors and borrowers. This approach has one shortcoming which is the problem of measurement of outputs. Although in many studies, the value of these services is used as output, the number of accounts or the number of operations on these accounts can also be utilized. The intermediation approach is less problematic in this respect. Here, banks are defined as DMUs which use deposits collected and funds borrowed from the financial system as inputs in order to provide borrowers with loans. Thus, banks are financial institutions that compete in the market for loans and deposits aiming to make profits from converting deposits into loans (Isık and Reda, 2006; Tarım, 2001).

Production approach is generally used in studies which aim to find the cost efficiency of banks while the intermediation approach is preferred when the total cost of the whole banking sector and the competitive power of banks are concerned. Accordingly, we use the intermediation approach like many other efficiency studies in the literature (Tarım, 2001; Zaim, 1995; Isık and Hassan, 2003, Isık and Reda, 2006).

The inputs and outputs used in this study are as listed below[5]:

Inputs:

1. Labor
2. Capital
3. Loanable Funds

Labor is defined as the number of full time employees on the payroll while capital is the property and equipment. Loanable funds is the sum of deposits, funds borrowed and marketable securities issued.

Outputs:

[5] Except for labor, the inputs and outputs used in this study are in nominal terms.

1. Short term credits
2. Long term credits
3. Off-balance sheet items
4. Other earning assets

Short- and long-term credits are defined as loans with less than and more than a maturity of one year, respectively. Off-balance sheet items are the sum of 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 items. Other earning assets include money market securities, banks and other financial institutions, investments held to maturity, securities available for sale, securities held for trading.

The data come from the bank balance sheets published by the Banks Association of Turkey (BAT). The sample includes all the banks in Turkey except for the development and investment banks because of their different function[6] as well as their small market shares[7] in the banking industry. We also exclude banks with insufficient report of data. Since the period 1990-2000 is one of the most volatile periods in the history of Turkish banking, the number of banks included in this study varies throughout the sample period. Another reason of changing bank numbers is the unavailability of data for some sample years. Sümerbank was privatized in October 1995. This is the reason of the drop by one bank in the number of state banks and increase by one bank in the number of private banks in 1996. Etibank was privatized in December 1997 for the second time, and this is the reason of the decrease by one bank in the number of state banks and increase by one bank in the number of private banks in 1998. Moreover, as of July 2005, Turk Dıs Ticaret Bankasi A.S. changed status from private commercial banks to foreign banks after the acquisition by Fortis of 89.34% of this bank, and thus the number of private banks fell by one while the number of foreign banks increased by one.

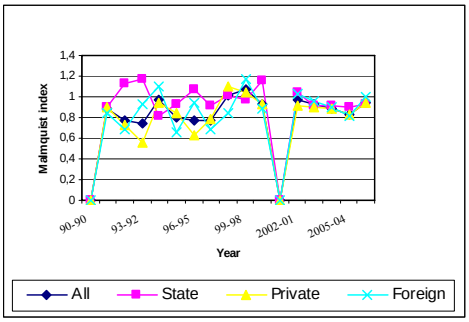
[6] Development and investment banks do not collect deposits. Instead, investment banks focus on corporate finance, foreign exchange, mergers and initial public offerings while development banks provide medium term finance to the industry and give government funds to the sectors with priority for the government. (Etkin et al., 2000)

[7] Development and investment banks constitute 3.1 % of the banking sector as of Dec. 2005.

5. EMPIRICAL RESULTS

We have examined the productivity change in the banking sector not only with respect to fixed time periods[8], but also with respect to changing frontiers[9] (Tables 3 & 4, respectively). Our results indicate that with respect to both 1990 and 2001, there has been productivity improvement in the sector overall, and also for each banking group. The only exception comes from the private bank group which showed a slight performance deterioration the year after the 2001 crisis. For this post-crisis year, state banks showed a slight improvement. However, a bigger improvement comes from the foreign banking group since foreign banks are not as much affected by the crisis in the host country as domestic banks (Tschoegl, 2003). Our analysis with respect to "changing frontiers" can be seen in Graph 3. It shows that except for the periods 1998 and 1999, the overall banking sector experienced productivity increase[10]. Moreover, the number of years of productivity decline is the biggest for the state banks. This shows that state banks are more volatile than both private and foreign banks in terms of performance (Table 4). Furthermore, the reason of different behaviors (productivity decline) in 1998 and 1999 is found out to be the choice of reference points (fixed vs. changing)[11]. In summary, we conclude that even though there may be productivity declines between two successive periods, overall, there is productivity improvement in the sector.

Graph 3: Malmquist Index with respect to Bank Ownership



[8] We take 1990 as the base year for the period before 2000, inclusive, for which there is no inflation accounting adjustment and take 2001 for the period after 2001 for which the data are adjusted according to inflation accounting. We have to divide our sample as such in order to deal with the problem of inconsistency between these two groups of data.

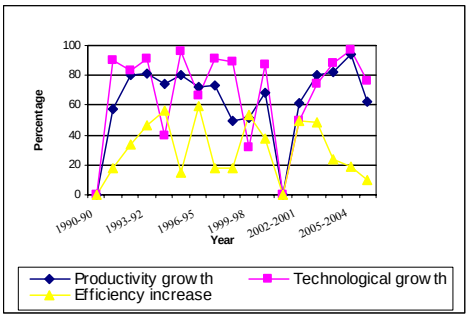
[9] The base year for each period of analysis is the previous year.

[10] According to our definition of the Malmquist index, values smaller than 1 indicate productivity improvement.

[11] The result follows from the fact that both the fixed- and changing-frontier analysis using this time the same banks reveal similar results: improvement in all years in the fixed frontier analysis vs. improvement in all years but 1998 and 1999 in the changing frontier analysis.

The numbers we have found above do not speak much on their own. We also need to look at the source of this change decomposing the TFPCH Index into its mutually exclusive and exhaustive components of efficiency change and technological change (Table 3). The results show that the productivity increases were a composition of technological improvement and efficiency increase except for the years 1991, 1992, 2002 and 2004, in which the increases resulted solely from technology improvement. Similarly, after 2000, for the subgroups of state banks and foreign banks, the productivity increase was solely due to technological improvement. These observations pronounce one more time the existence of structural changes in the Turkish banking sector leading to this technological improvement. Graph 4 supports this argument depicting the percentages of banks experiencing productivity growth, technological growth and efficiency increase. It reveals that over time, more than half of the banks showed productivity increase, and more than half experienced technological improvement (Table 6).

Graph 4: Percentage of Banks with Productivity, Technology or Efficiency Increase

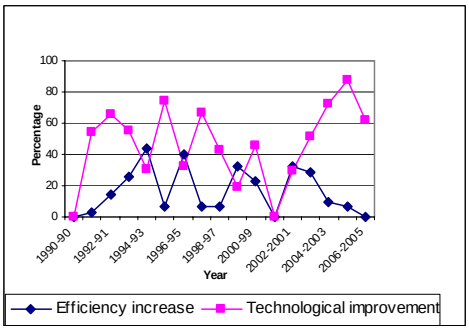


As an additional analysis, we decompose the technical efficiency change into its components of pure technical efficiency and scale efficiency changes. From the data, we observe that the scale efficiency increase is dominant during the period before the 2001 crisis while the changes are only slight before 2001 (Table 3). This result supports the fact that mergers and acquisitions in the sector was bringing the banking industry to its optimal size.

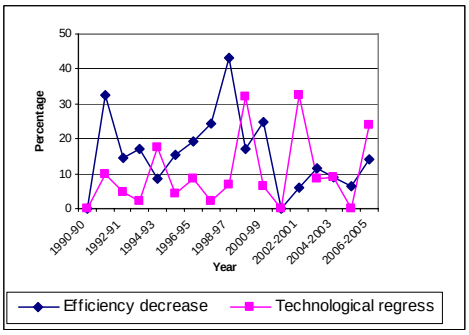
Graph 5 and 6 give information about the main reasons of productivity changes in the banking sector. They show that, except for four years (1994, 1996, 1999 and 2002: pre- and post-crisis periods), most of the banks that experienced productivity increase also experienced technological increase. Therefore, we conclude that technological

improvement, resulting from the structural changes in the sector, is the main reason of productivity increase.

Graph 5: Decomposition of Productivity Growth



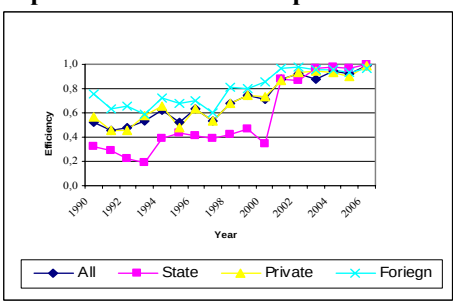
Graph 6: Decomposition of Productivity Decline



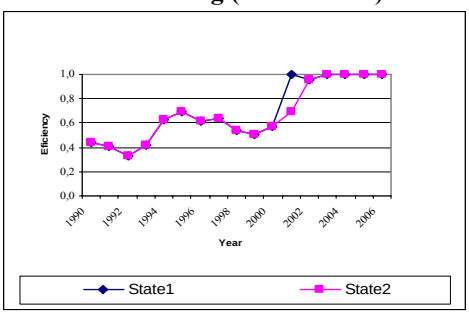
The results are just the opposite with respect to the decline in productivity. We conclude that the main reason behind productivity decline comes from the efficiency side rather than technological deterioration which is in line with the implicit assumption that technology does improve rather than regress over time.

Another dimension of analysis is to compare the technical efficiencies of bank groups of different ownership types (private, state and foreign banks) over the sample period. The classification of banks is such that the groups are mutually exclusive and exhaustive. The results are shown in Graph 7. All the groups are found to have experienced efficiency gain between 1990 and 2006, and the efficiency values converged towards 1. While the sector was 52 % efficient in 1990, the efficiency increased to 98 % in 2006 for the sector in general (Table 5). State banks have been found the least efficient up until 2001, and the main reason of low efficiency scores of state banks is found to be scale inefficiency. In fact, state banks have the lowest scale efficiency (65 % on average) of all as opposed to foreign banks who have the highest (87 % on average). In 2001, however, the efficiency of state banks converged to the industry average with the sharpest increase in efficiency among the bank groups.

Graph 7: Technical Efficiency with respect to Bank Ownership



Graph 8: Technical Efficiency with(out) inflation accounting (State Banks)



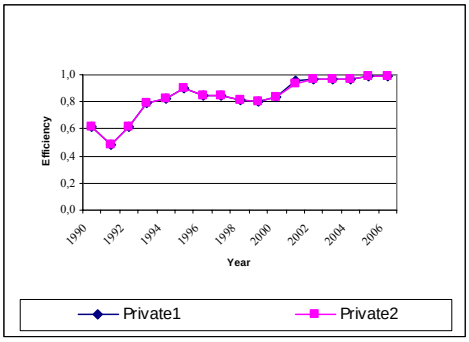
One reason why state banks show the sharpest increase in efficiency in 2001 is found out to be the inflation accounting practice which was in effect beginning with 2002[12]. Our efficiency analyses with respect to both the inflation-adjusted 2001 values and the original 2001 values reveal that the adjustment increased the efficiency figures for all types of banks. However, the difference is the biggest for the state banks as shown in Graph 8[13]. The same argument holds for Graphs 9 and 10 depicting the private and foreign bank efficiencies.

The inflation accounting practice and the resulting standardized financial statements of the banking sector are explanations also for the "convergence pattern among the banking groups". Other reasons are that during the period, bank balance sheets became more transparent, and small and relatively inefficient banks which incorrectly reported losses as profits were cleared from the system.

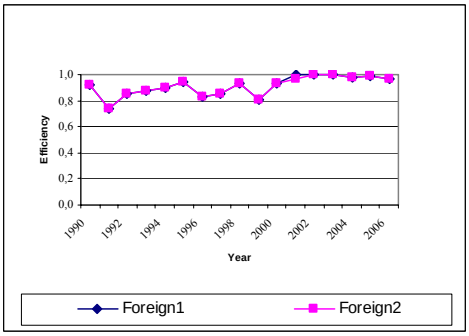
There is also a "convergence towards the maximum efficiency". Before the 2000 and 2001 crises, the trend in the banking sector was to open up banks without much concern for efficiency. Moreover, bank profitability depended to a great extent on the purchases of government bonds during this period. Following the crises, however, the quality of bank management and hence efficiency were given more importance. Foreign bank entries in this period strengthened the capital structure of the sector. Falling inflation rates decreased the interest income from government bonds encouraging banks to find alternative ways to make profits. Therefore, banks started to charge higher commissions for their services which increased their profits (Arolat, 2006).

[12] We were able to use the inflation-adjusted values of 2001 numbers.
[13] State 1 represents the efficiency scores of state banks under the inflation accounting technique while state 2 represents the efficiency figures under no adjustment.

Graph 9: Technical Efficiency with(out) inflation accounting (Private Banks)



Graph 10: Technical Efficiency with(out) inflation accounting (Foreign Banks)



Up until 2001, foreign banks were found to be more efficient than domestic banks as suggested by Kasman et al (2005) and Isık and Hassan (2002). After this year, however, state banks captured the first place in terms of efficiency[14]. In fact, after the 2001 crisis, there was less political influence on the state banks leading to an improvement in their performance. One other reason of increase in efficiency is that state banks would no longer make duty loss payments in the name of the state. Provisions would be recorded in the balance sheet for the loans provided. State banks' accumulated duty losses, which amounted to more than YTL 20 billion at the time, would be financed through government bonds issued by the Treasury. In fact, accumulating the interest income from these bonds, Ziraat Bank and Halkbank became quite profitable. Additionally, there was a fall in the number of bank branches, labor and in operational expenses resulting from the restructuring of the state banks[15]. As a result of this fall, there was an improvement in the asset size per branch and per labor (BRSA, 2003)[16]. Moreover, we observe that the effects of inflation accounting have been on pure technical efficiency rather than on scale efficiency. Furthermore, pure technical efficiency of state banks contributed more to technical efficiency than did scale efficiency except for the periods just before and after the 1994 and 2000 crises. These facts justify state banks' having high efficiency values (Graphs 11, 12 and 13).

A final analysis is conducted with respect to bank size. One more time we observe that the efficiency scores converge after 2001. For the period before 2000, however, the results indicate that the most efficient bank group is the medium-scale banks, the banks

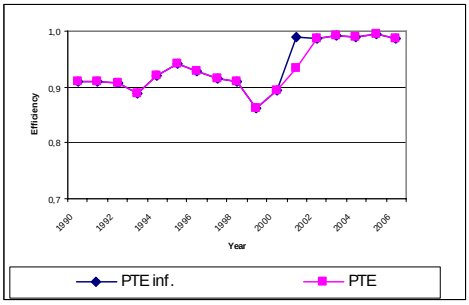
[14] Naaborg et al. also find a convergence pattern among the efficiency scores of foreign and domestic banks.

[15] The number of branches declined from 2.494 in Dec. 2000 to 1.685 in Dec. 2002 while the number of personnel declined from 61.601 in Dec. 2000 to 30.399 in Dec. 2002.

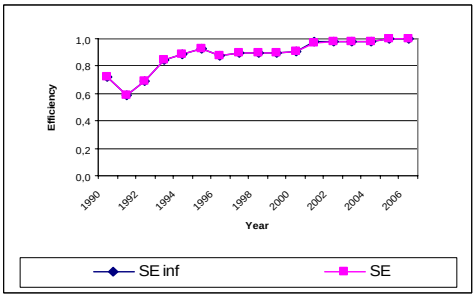
[16] Asset size per branch increased from 13.9 million dollars at the end of 2001 to 20 million dollars at the end of 2002.On the other hand, asset size per labor increased from 0.7 million dollars to 1.1 million dollars during the same periods.

mainly purchased by foreign banks, followed by small banks. Large banks have been found the least efficient with very different efficiency measures from the industry average. The reason of low efficiency is found out to be the fact that they have the most scale inefficiency. In fact; scale inefficiency is what pulls the efficiency scores down in general (Graphs 14, 15 and 16).

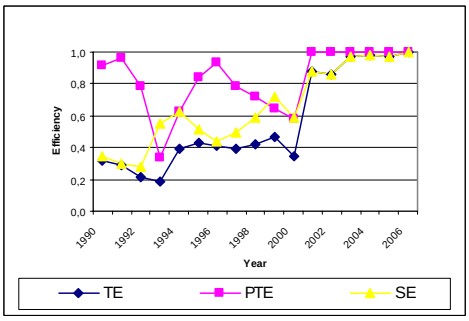
Graph 11: Pure Technical Efficiency with and without inflation accounting



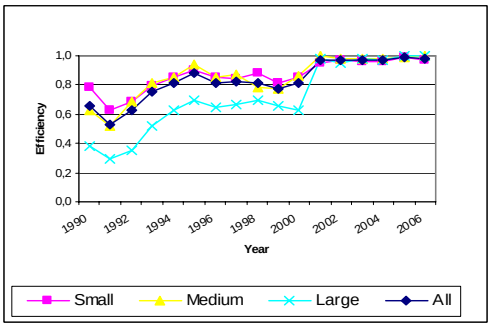
Graph 12: Scale Efficiency with and without inflation accounting



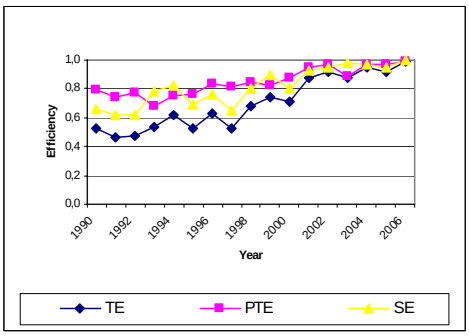
Graph 13: Technical, Pure Technical and Scale Efficiencies-State Banks



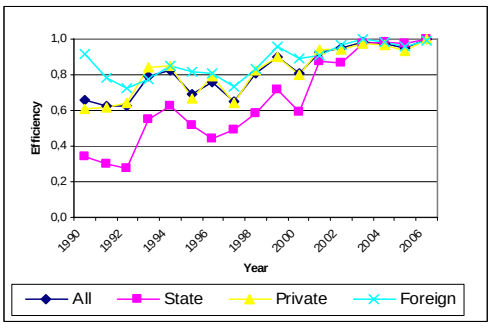
Graph 14: Technical Efficiency with respect to Bank Size



Graph 15: Technical, Pure Technical and Scale Efficiencies-All Banks



Graph 16: Scale Efficiency with respect to Bank Ownership



6. CONCLUSION

The main motivation in carrying out this study is to gain insight about the performance of the Turkish banking sector between 1990 and 2006, especially about how the Turkish economy responded to the 2000 and 2001 crises as well as to the subsequent foreign bank entries. Productivity and efficiency change figures that we have found provide substantial information about the situation in the relevant period.

Despite some cases of productivity decline in the analysis in which the previous years were taken as benchmark periods, the study revealed that the Turkish economy experienced productivity increase when the benchmark years were 1990 and 2001. The productivity improvement was predominantly the result of both technological improvement and efficiency increase. After 2000, however, the productivity increase was solely due to technological improvement reflecting the existence of structural changes in the Turkish banking sector. We also observed that after 2000, pure technical efficiency of the sector increased reflecting the fact that the quality of bank management has been of increasing importance.

More than half of the banks are found to have experienced productivity increase and more than half have experienced technological improvement. Another observation is that the main reason of productivity increase in the sector is technological improvement while the main reason of productivity decline is efficiency decrease.

One other analysis of efficiency is with respect to bank groups of different ownership types. The results show that all the banking groups experienced efficiency increase between 1990 and 2006, and there was convergence among efficiency values towards 1 after 2001. Before the 2000 and 2001 crises, new banks would be founded without much concern for efficiency. However, after the crises, the quality of bank management became more important which led to this convergence towards this maximum efficiency.

Foreign banks, which were the most efficient ones in the sector before 2001, left their places to state banks after this year. In fact, state banks are found to be the least efficient before 2001 and the reason of low efficiency scores is found out to be the scale inefficiency. State banks are also the banks which experienced the sharpest increase in efficiency after 2001. Two reasons are that after the crises, political influence on state banks declined and these banks would no longer make duty loss payments in the name of the state. Moreover, there was a fall in the number of bank branches, labor and in

operational expenses resulting from the restructuring of the state banks. One other reason is the inflation accounting practice which was in effect beginning with 2002 and which mostly affected the state banks. The effects of inflation accounting are found to be on pure technical efficiency rather than on scale efficiency, and pure technical efficiency of state banks contributed more to technical efficiency than did scale efficiency except for the periods just before and after the 1994 and 2000 crises.

The inflation accounting practice and the resulting standardized financial statements of the banking sector are among the explanations also for the "convergence pattern among the banking groups" after 2001. Other explanations are that the bank balance sheets became more transparent, and small and relatively inefficient banks were cleared from the system during the period.

Finally, this study examined the performance of the sector with respect to bank size. Before 2000, the most efficient bank group is found to be the medium-scale banks, the banks mainly purchased by foreign banks, followed by small banks. The least efficient bank group is the large banks, the reason being the scale inefficiency.

7. ACKNOWLEDGEMENTS

We would like to thank Dr. Hüseyin Al, Assc. Prof. Dr. Nurhan Davutyan and Assc. Prof. Dr. M. Cahit Güran for their comments and valuable insights which enhanced the quality of this study.

8. APPENDIX

Table 1: Performance Index of the Turkish Banking Sector

	PI	Liquidity	Equity	Currency Risk	Profitability	Asset Quality
12\2003	100,0	100,0	100,0	100,0	100,0	100,0
12\2004	100,3	100,6	99,6	100,1	99,8	101,3
12\2005	100,5	102,2	99,5	99,8	98,6	102,4
01\2006	100,5	100,2	99,9	99,4	100,7	102,4
02\2006	100,1	100,1	99,9	97,5	100,3	102,5
03\2006	100,4	100,7	99,6	98,3	100,9	102,6
04\2006	99,9	99,5	99,4	97,4	100,7	102,6
05\2006	99,6	98,9	97,9	97,6	100,5	102,8
06\2006	99,9	99,3	97,6	99,2	100,5	103,0
07\2006	100,1	99,1	98,3	99,2	100,6	103,1
08\2006	100,4	99,7	98,7	99,6	100,9	103,1
09\2006	100,4	99,8	98,6	99,8	100,8	103,1
10\2006	100,5	100,1	99,3	99,3	100,9	103,2
11\2006	100,5	99,6	99,4	99,9	100,7	103,3
12\2006	100,9	101,4	99,2	100,1	100,5	103,3

Source: Turkish BRSA, Dec.2006
2006 Figures are as of Sep. 2006.

Table 2: Bank classification with respect to size

Small banks[1]		*Medium sized banks[2]*	*Large banks[3]*
ABN AMRO Bank N.V.	Credit Lyonnais Turkey	Demirbank T.A.Ş.	AK Bank T.A.Ş.
Arap Türk Bankası A.Ş.	Birleşik Türk Körfez Bankası A.Ş.	Finans Bank A.Ş.	T.C. Ziraat Bankası A.Ş.
Bank Europa Bankası A.Ş.	Alternatif Bank A.Ş.	HSBC Bank A.Ş. 2	T. Garanti Bankası A.Ş.
Bank Mellat	Anadolubank A.Ş.	Kocbank A.Ş.	T. Halk Bankası A.Ş.
Citibank A.Ş.	MNG Bank A.Ş.	Yapı ve Kredi Bankası A.Ş.	T. İs Bankası A.Ş.
HSBC Bank A.Ş. 1	Tekfenbank A.Ş.	Fortis Bank A.Ş.	T. Vakıflar Bankası T.A.O.
JP Morgan Chase N.A.	Banca di Roma S.P.A.	Pamukbank T.A.Ş.	T. Emlak Bankası A.Ş.
Oyak Bank A.Ş.	Habib Bank Limited	Etibank A.Ş.	
Sekerbank T.A.Ş.	Societe Generale(SA)	İktisat Bankası T.A.Ş.	
Tekstil Bankası A.Ş.	West LB AG	Osmanlı Bankası A.Ş.	
Turkish Bank A.Ş.	Bayındırbank A.Ş.	Eskişehir Bankası T.A.Ş.	
Türk Ekonomi Bankası A.Ş.	Kentbank A.Ş.	Interbank A.Ş.	
Adabank A.Ş.	Bank Ekspres A.Ş.	Türk Ticaret Bankası A.Ş.	
T. İmar Bankası T.A.Ş.	EGS Bankası A.Ş.	Toprakbank A.Ş.	
Sümerbank A.Ş.	Rabobank Nederland	Denizbank A.Ş.	
Milli Aydın Bankası T.A.Ş.	Credit Suisse First Boston		
Bnp-Ak Dresdner Bank A.Ş.	ING Bank N.V.		

[1]Small banks: Banks with asset share of 1% or less, [2]Medium scale banks: Banks with asset share of 1%-5%, [3]Large banks: Banks with asset share of 5% or more.
Asset share is defined as the average asset share of the banks over the sample period.
HSBC Bank A.Ş. 1 and 2 represent the bank before and after the acquisition of Demirbank T.A.Ş., respectively.

Table 3: Productivity change with respect to fixed frontiers						
All Banks	#	*EFFCH*	*TECCH*	*PEFCH*	*SECH*	*TFPCH*
90-90	-	-	-	-	-	-
91-90	38	1,4255	0,6791	1,0130	1,4072	0,9015
92-90	38	1,1497	0,6754	1,0422	1,1031	0,7377
93-90	38	0,9301	0,6719	1,0588	0,8785	0,6009
94-90	38	0,8224	0,5948	1,0115	0,8130	0,4599
95-90	38	0,7580	0,5252	0,9740	0,7783	0,3635
96-90	38	0,8513	0,3263	1,0084	0,8443	0,2530
97-90	38	0,8633	0,2243	1,0503	0,8220	0,1680
98-90	38	0,8673	0,1767	1,0627	0,8161	0,1410
99-90	38	0,9157	0,1440	1,1466	0,7986	0,1182
2000-1990	38	0,8726	0,1069	1,0732	0,8131	0,0869
91-2000 (mean-ar)		0,9456	0,4125	1,0441	0,9074	0,3831
2001-2001	-	-	-	-	-	-
2002-2001	22	1,0016	0,9869	1,0037	0,9980	0,9922
2003-2001	22	0,9993	0,8544	0,9970	1,0023	0,8569
2004-2001	22	1,0034	0,7537	1,0017	1,0017	0,7536
2005-2001	22	0,9744	0,6731	0,9951	0,9791	0,6548
2006-2001	21	0,9822	0,5916	1,0046	0,9777	0,5798
2002-2006(mean-ar)		0,9917	0,7756	1,0401	0,9647	0,7709
State Banks	#	*EFFCH*	*TECCH*	*PEFCH*	*SECH*	*TFPCH*
90-90	-	-	-	-	-	-
91-90	6	1,2973	0,7060	0,9514	1,3636	0,8587
92-90	6	1,3723	0,6551	1,1239	1,2210	0,8557
93-90	6	1,1339	0,7981	1,4545	0,7796	0,8740
94-90	6	0,7155	0,7882	1,0591	0,6756	0,5614
95-90	6	0,6889	0,6623	1,0479	0,6575	0,4341
96-90	5	0,7646	0,4722	1,0003	0,7644	0,3218
97-90	5	0,8046	0,3546	1,3115	0,6135	0,2464
98-90	4	0,8968	0,1997	1,3556	0,6616	0,1605
99-90	4	0,8288	0,1448	1,5286	0,5422	0,1134
2000-1990	4	1,1335	0,0958	1,7978	0,6305	0,1022
91-2000(mean-ar)		0,9636	0,4877	1,2631	0,7909	0,4528
2001-2001	-	-	-	-	-	-
2002-2001	3	1,0532	0,9310	1,0000	1,0532	0,9777
2003-2001	3	1,0000	0,8575	1,0000	1,0000	0,8575
2004-2001	3	1,0000	0,7663	1,0000	1,0000	0,7663
2005-2001	3	1,0000	0,7305	1,0000	1,0000	0,7305
2006-2001	2[a]	1,0000	0,6302	1,0000	1,0000	0,6302
2002-2006(mean-ar)		1,0160	0,7949	1,0000	1,0160	0,8090

Table 3: Productivity change with respect to fixed frontiers (continued)						
Private Banks	*#*	*EFFCH*	*TECCH*	*PEFCH*	*SECH*	*TFPCH*
90-90	-	-	-	-	-	-
91-90	23	1,4620	0,6680	1,0310	1,4180	0,9077
92-90	23	1,0847	0,6758	1,0387	1,0443	0,6942
93-90	23	0,8146	0,6558	0,9756	0,8349	0,4984
94-90	23	0,7624	0,5759	0,9865	0,7728	0,4102
95-90	23	0,6853	0,5460	0,9359	0,7322	0,3484
96-90	24	0,7553	0,3357	0,9738	0,7756	0,2360
97-90	24	0,7803	0,2333	0,9784	0,7975	0,1609
98-90	25	0,8177	0,1936	1,0369	0,7886	0,1472
99-90	25	0,8396	0,1638	1,1013	0,7623	0,1242
2000-1990	25	0,7851	0,1253	0,9777	0,8030	0,0946
91-2000(mean-ar)		0,8787	0,4173	1,0036	0,8729	0,3622
2001-2001	-	-	-	-	-	-
2002-2001	17	0,9927	1,0127	1,0047	0,9880	1,0113
2003-2001	17	0,9991	0,8520	0,9961	1,0030	0,8553
2004-2001	17	1,0019	0,7463	1,0022	0,9997	0,7435
2005-2001	16	0,9634	0,6540	0,9949	0,9684	0,6276
2006-2001	16	0,9688	0,5729	0,9997	0,9691	0,5505
2002-2006(mean-ar)		0,9852	0,7676	0,9995	0,9856	0,7576
Foreign Banks	*#*	*EFFCH*	*TECCH*	*PEFCH*	*SECH*	*TFPCH*
90-90	-	-	-	-	-	-
91-90	9	1,4177	0,6896	1,0081	1,4063	0,9144
92-90	9	1,1676	0,6879	0,9968	1,1713	0,7704
93-90	9	1,0896	0,6289	1,0076	1,0813	0,6805
94-90	9	1,0469	0,5143	1,0437	1,0030	0,5191
95-90	9	0,9899	0,3809	1,0219	0,9687	0,3551
96-90	9	1,1555	0,2203	1,1050	1,0458	0,2601
97-90	9	1,1174	0,1279	1,0968	1,0187	0,1433
98-90	9	0,9918	0,1195	1,0042	0,9876	0,1151
99-90	9	1,1660	0,0889	1,1028	1,0573	0,1036
2000-1990	9	0,9997	0,0606	1,0161	0,9839	0,0588
91-2000(mean-ar)		1,1142	0,3519	1,0403	1,0724	0,3920
2001-2001	-	-	-	-	-	-
2002-2001	2	1,0000	0,8513	1,0000	1,0000	0,8513
2003-2001	2	1,0000	0,8697	1,0000	1,0000	0,8697
2004-2001	2	1,0220	0,7981	1,0000	1,0220	0,8200
2005-2001	3*	1,0070	0,7174	1,0040	1,0030	0,7244
2006-2001	3	1,0417	0,6658	1,0340	1,0075	0,7029
2002-2006(mean-ar)		1,0142	0,7805	1,0076	1,0065	0,7937

Source: Authors' calculation., "mean-ar" stands for "arithmetic mean".
2006 values are as of Sep. 2006.
EFFCH= TFPCH/TECCH.
SECH= EFFCH/PEFCH.
***** Increase by one bank in the number of foreign banks is due to the changing status of Türk Dış Ticaret Bankası A.Ş. acquired by Fortis Bank SA/N.V. from private banks to foreign banks.
[a] Drop by one bank in the number of state banks is due to data insufficiency for T.C. Ziraat Bankası A.Ş.

Table 4: Productivity change with respect to changing frontiers						
All Banks	*#*	*EFFCH*	*TECCH*	*PEFCH*	*SECH*	*TFPCH*
90-90	-	-	-	-	-	-
91-90	40	1,5102	0,6521	1,1256	1,3417	0,8790
92-91	41	1,1075	0,7302	1,1357	0,9751	0,7766
93-92	47	1,1268	0,7016	1,3978	0,8061	0,7369
94-93	46	0,8953	1,1133	0,9621	0,9305	0,9668
95-94	46	1,4800	0,5694	1,0917	1,3556	0,7936
96-95	47	1,0920	0,8382	1,0129	1,0781	0,7700
97-96	45	1,3275	0,5942	1,0425	1,2734	0,7656
98-97	44	1,2128	0,8480	1,0782	1,1248	1,0187
99-98	47	0,9754	1,1039	1,0929	0,8925	1,0720
2000-1999	48	1,0818	0,8634	0,9855	1,0978	0,9317
91-2000 (mean-ge)		1,1657	0,7818	1,0869	1,0725	0,8639
2001-2001	-	-	-	-	-	-
2002-2001	34	0,9583	1,0007	0,9725	0,9854	0,9678
2003-2002	35	0,9795	0,9413	1,0028	0,9768	0,9233
2004-2003	33	1,0114	0,8826	0,9979	1,0136	0,8899
2005-2004	32	1,0436	0,8009	1,0071	1,0362	0,8325
2006-2005	21	1,0105	0,9359	1,0117	0,9989	0,9460
2002-2006 (mean-ge)		1,0002	0,9097	0,9983	1,0019	0,9106
State Banks	*#*	*EFFCH*	*TECCH*	*PEFCH*	*SECH*	*TFPCH*
90-90	-	-	-	-	-	-
91-90	6	1,0762	0,8501	0,9514	1,1312	0,8941
92-91	6	1,4242	0,8124	1,1754	1,2117	1,1246
93-92	6	1,6906	0,8557	2,8846	0,5861	1,1668
94-93	6	0,6963	1,1761	0,6965	0,9996	0,8137
95-94	6	1,1951	0,7801	0,9078	1,3165	0,9248
96-95	5	1,2483	0,8812	0,9409	1,3267	1,0733
97-96	5	1,2935	0,7023	1,3895	0,9309	0,9150
98-97	4	1,1482	0,8943	0,9903	1,1594	1,0139
99-98	4	0,8904	1,1098	1,1217	0,7938	0,9688
2000-1999	4	1,4330	0,8193	1,2697	1,1286	1,1550
91-2000 (mean-ge)		1,1770	0,8782	1,1417	1,0309	0,9984
2001-2001	-	-	-	-	-	-
2002-2001	3	0,9850	1,0578	1,0000	0,9850	1,0405
2003-2002	3	0,9257	0,9840	1,0000	0,9257	0,9107
2004-2003	3	0,9911	0,9240	1,0000	0,9911	0,9162
2005-2004	3	1,0099	0,8899	1,0000	1,0099	0,8973
2006-2005	2*	1,0000	0,9216	1,0000	1,0000	0,9216
2002-2006 (mean-ge)		0,9819	0,9537	1,0000	0,9819	0,9359

Table 4: Productivity change with respect to changing frontiers (continued)						
Private Banks	#	*EFFCH*	*TECCH*	*PEFCH*	*SECH*	*TFPCH*
90-90	-	-	-	-	-	-
91-90	21	1,67549	0,60049	1,236	1,3553	0,88904
92-91	21	1,05591	0,69745	1,234	0,8560	0,71679
93-92	28	0,86819	0,67408	1,127	0,7707	0,55490
94-93	27	0,94371	1,00910	0,978	0,9647	0,93782
95-94	26	1,58051	0,55783	1,164	1,3578	0,82917
96-95	28	1,03937	0,84125	1,051	0,9889	0,67464
97-96	27	1,31417	0,58963	0,960	1,3688	0,75894
98-97	28	1,28808	0,85079	1,130	1,1404	1,08476
99-98	30	0,92285	1,13581	1,017	0,9071	1,03614
2000-1999	30	1,07648	0,86143	0,974	1,1051	0,92489
91-2000 (mean-ge)		1,1765	0,7818	1,0871	1,0815	0,8407
2001-2001	-	-	-	-	-	-
2002-2001	19	0,93340	0,97492	0,962	0,9701	0,91516
2003-2002	19	0,97615	0,91873	1,006	0,9707	0,90015
2004-2003	19	1,00811	0,87914	0,996	1,0125	0,88172
2005-2004	18	1,05060	0,79262	1,004	1,0466	0,82896
2006-2005	17	1,00740	0,93074	1,009	0,9982	0,93778
2002-2006 (mean-ge)		0,9951	0,8992	0,9953	0,9996	0,8928
Foreign Banks	#	*EFFCH*	*TECCH*	*PEFCH*	*SECH*	*TFPCH*
90-90	-	-	-	-	-	-
91-90	13	1,42417	0,64783	1,010	1,4104	0,85315
92-91	14	1,04865	0,74767	0,952	1,1017	0,71711
93-92	13	1,46976	0,69119	1,310	1,1218	0,96163
94-93	13	0,88186	1,32513	1,039	0,8486	1,11105
95-94	14	1,40259	0,49631	1,026	1,3664	0,65928
96-95	14	1,14929	0,81483	0,964	1,1923	0,86603
97-96	13	1,37294	0,55987	1,080	1,2711	0,71892
98-97	12	1,03768	0,82388	0,987	1,0510	0,84623
99-98	13	1,13943	1,01943	1,278	0,8913	1,19902
2000-1999	14	0,98658	0,88178	0,925	1,0663	0,87909
91-2000 (mean-ge)		1,1913	0,8008	1,0572	1,1321	0,8812
2001-2001	-	-	-	-	-	-
2002-2001	12	0,99093	1,02724	0,984	1,0073	1,03302
2003-2002	13	0,99679	0,96439	0,999	0,9981	0,96004
2004-2003	11	1,02134	0,87739	1,001	1,0203	0,89563
2005-2004	11	1,04138	0,79026	1,016	1,0254	0,82056
2006-2005	2	1,03415	0,97295	1,044	0,9902	1,00625
2002-2006 (mean-ge)		1,0169	0,9264	1,0087	1,0083	0,9431

Source: Authors' calculation.
"mean-ge" stands for "geometric mean".
2006 values are as of Sep. 2006.
EFFCH= TFPCH/TECCH.
SECH= EFFCH/PEFCH.
*: Drop by one in the number of state banks is due to insufficient report of data by T.C. Ziraat Bankası A.Ş.

Table 5: Technical, scale and pure technical efficiencies				
All Banks				
Years	*Number*	*TE*	*PTE*	*SE*
1990	40	0,52439	0,7916	0,6624
1991	40	0,46047	0,7399	0,6224
1992	41	0,47698	0,7681	0,6210
1993	47	0,53637	0,6811	0,7875
1994	46	0,61815	0,7501	0,8241
1995	46	0,52629	0,7621	0,6906
1996	47	0,63005	0,8310	0,7582
1997	45	0,53079	0,8163	0,6503
1998	44	0,67965	0,8440	0,8053
1999	47	0,74216	0,8243	0,9004
2000	48	0,71053	0,8783	0,8090
2001	34	0,87949	0,9529	0,9230
2002	34	0,91781	0,9685	0,9477
2003	35	0,87600	0,8904	0,9838
2004	33	0,94588	0,9728	0,9723
2005	32	0,92159	0,9740	0,94618
2006	21	0,98518	0,9872	0,9979
Mean		0,7036	0,8490	0,8178
State Banks				
Years	*Number*	*TE*	*PTE*	*SE*
1990	6	0,31729	0,9177	0,3457
1991	6	0,28668	0,9649	0,2971
1992	6	0,21700	0,7810	0,2779
1993	6	0,18757	0,3392	0,5530
1994	6	0,39112	0,6232	0,6276
1995	6	0,43087	0,8400	0,5129
1996	5	0,41448	0,9340	0,4438
1997	5	0,38999	0,7895	0,4940
1998	4	0,42401	0,7242	0,5855
1999	4	0,46551	0,6493	0,7170
2000	4	0,34461	0,5834	0,5907
2001	3	0,87724	1,0000	0,8772
2002	3	0,86445	1,0000	0,8644
2003	3	0,97159	1,0000	0,9716
2004	3	0,97998	1,0000	0,9800
2005	3	0,97098	1,0000	0,9710
2006	2	1,0000	1,0000	1,0000
Mean		0,5608	0,8321	0,6535

Table 5: Technical, scale and pure technical efficiencies (continued)				
Private Banks				
Years	*Number*	*TE*	*PTE*	*SE*
1990	22	0,5668	0,9335	0,6072
1991	22	0,4505	0,7284	0,6184
1992	22	0,4584	0,7105	0,6452
1993	29	0,5749	0,6836	0,8410
1994	28	0,6500	0,7612	0,8539
1995	27	0,4780	0,7132	0,6702
1996	29	0,6379	0,8079	0,7896
1997	28	0,5355	0,8319	0,6437
1998	29	0,6800	0,8261	0,8231
1999	31	0,7459	0,8275	0,9014
2000	31	0,7291	0,9100	0,8012
2001	19	0,8704	0,9248	0,9412
2002	19	0,9336	0,9903	0,9428
2003	19	0,9426	0,9669	0,9749
2004	18	0,9356	0,9696	0,9649
2005	17	0,9049	0,9674	0,9353
2006	16	0,9877	0,9890	0,9987
Mean		0,7107	0,8554	0,8207
Foreign Banks				
Years	*Number*	*TE*	*PTE*	*SE*
1990	12	0,75918	0,8299	0,9147
1991	12	0,63001	0,8077	0,7800
1992	13	0,65771	0,9068	0,7253
1993	12	0,59008	0,7599	0,7765
1994	12	0,71980	0,8486	0,8482
1995	13	0,67396	0,8254	0,8165
1996	13	0,69543	0,8597	0,8089
1997	12	0,59774	0,8139	0,7344
1998	11	0,80957	0,9723	0,8326
1999	12	0,80316	0,8415	0,9545
2000	13	0,85004	0,9566	0,8886
2001	12	0,96773	1,0671	0,9069
2002	12	0,97827	1,0077	0,9708
2003	13	0,95868	0,9587	1,0000
2004	12	0,95282	0,9707	0,9816
2005	12	0,93292	0,9765	0,9554
2006	3	0,96169	0,9690	0,9925
Mean		0,7964	0,9042	0,8757

Source: Authors' calculation.
TE: CRS Technical Input Efficiency, SE: Scale Efficiency, PTE: Pure Technical Efficiency
TE=PTE*SE.
2006 values are as of Sep. 2006.

Table 6: Percentage of banks with Productivity change, Technological change, Efficiency change, Pure Technical Efficiency Change and Scale Efficiency change

Period	#	*TFPCH*			*TECHCH*			*EFFCH*			*PEFFCH*			*SECH*		
		Growth	*Loss*	*Same*	*Growth*	*Loss*	*Same*	*Growth*	*Loss*	*Same*	*Growth*	*Loss*	*Same*	*Growth*	*Loss*	*Same*
1990-90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1991-90	40	58	43	0	90	10	0	18	70	13	20	28	53	25	63	13
1992-91	41	80	20	0	83	17	0	34	49	17	29	29	41	37	46	17
1993-92	47	81	19	0	91	9	0	47	38	15	21	47	32	60	26	15
1994-93	46	74	26	0	39	61	0	57	24	20	48	24	28	57	24	20
1995-94	46	80	20	0	96	4	0	15	72	13	30	30	39	15	72	13
1996-95	47	72	28	0	66	34	0	60	30	11	36	19	45	62	28	11
1997-96	45	73	27	0	91	9	0	18	71	11	24	29	47	18	71	11
1998-97	44	50	50	0	89	11	0	18	66	16	23	34	43	25	59	16
1999-98	47	51	49	0	32	68	0	53	30	17	21	40	38	57	23	19
2000-99	48	69	31	0	88	13	0	38	40	23	44	21	35	25	50	25
2001-2001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2002-2001	34	62	38	0	50	50	0	50	21	29	26	15	59	44	24	32
2003-2002	35	80	20	0	74	26	0	49	17	34	23	14	63	49	14	37
2004-2003	33	82	18	0	88	12	0	24	33	42	15	21	33	21	33	45
2005-2004	32	94	6	0	97	3	0	19	38	44	16	16	69	19	38	44
2006-2005	21	62	38	0	76	24	0	10	14	76	10	10	81	10	14	76

Source: Authors' calculation.
2006 values are as of Sep. 2006.
Productivity change= TFPCH, Technological change= TECHCH, Efficiency change= EFFCH, Pure Technical Efficiency Change= PEFFCH, Scale Efficiency change= SECH.

Table 7: Number of banks with Productivity change, Technological change, Efficiency change, Pure Technical Efficiency Change and Scale Efficiency change

Period	#	*TFPCH*			*TECHCH*			*EFFCH*			*PEFFCH*			*SECH*		
		Growth	*Loss*	*Same*	*Growth*	*Loss*	*Same*	*Growth*	*Loss*	*Same*	*Growth*	*Loss*	*Same*	*Growth*	*Loss*	*Same*
1990-90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1991-90	40	23	17	0	36	4	0	7	28	5	8	11	21	10	25	5
1992-91	41	33	8	0	34	7	0	14	20	7	12	12	17	15	19	7
1993-92	47	38	9	0	43	4	0	22	18	7	10	22	15	28	12	7
1994-93	46	34	12	0	18	28	0	26	11	9	22	11	13	26	11	9
1995-94	46	37	9	0	44	2	0	7	33	6	14	14	18	7	33	6
1996-95	47	34	13	0	31	16	0	28	14	5	17	9	21	29	13	5
1997-96	45	33	12	0	41	4	0	8	32	5	11	13	21	8	32	5
1998-97	44	22	22	0	39	5	0	8	29	7	10	15	19	11	26	7
1999-98	47	24	23	0	15	32	0	25	14	8	10	19	18	27	11	9
2000-99	48	33	15	0	42	6	0	18	19	11	21	10	17	12	24	12
2001-2001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2002-2001	34	21	13	0	17	17	0	17	7	10	9	5	20	15	8	11
2003-2002	35	28	7	0	26	9	0	17	6	12	8	5	22	17	5	13
2004-2003	33	27	6	0	29	4	0	8	11	14	5	7	11	7	11	15
2005-2004	32	30	2	0	31	1	0	6	12	14	5	5	22	6	12	14
2006-2005	21	13	8	0	16	5	0	2	3	16	2	2	17	2	3	16

Source: Authors' calculation.
2006 values are as of Sep. 2006.
Productivity change= TFPCH, Technological change= TECHCH, Efficiency change= EFFCH,
Pure Technical Efficiency Change= PEFFCH, Scale Efficiency change= SECH.

Table 8: The main reason of productivity changes (percentages)

Period	#	*Productivity growth **mainly** due to:*		*Productivity loss **mainly** due to:*		*No change*	*Efficiency increase **mainly** due to:*		*Efficiency decrease **mainly** due to:*		*No change*
		Efficiency increase	*Technological progress*	*Efficiency decrease*	*Technological regress*		*PTE increase*	*SE increase*	*PTE decrease*	*SE decrease*	
1990-90	-	-	-	-	-	-	-	-	-	-	-
1991-90	40	3	54	33	10	0	8	10	23	48	13
1992-91	41	15	66	15	5	0	15	20	20	29	17
1993-92	47	26	55	17	2	0	6	40	21	17	15
1994-93	46	43	30	9	17	0	33	24	17	7	20
1995-94	46	7	74	15	4	0	11	4	15	57	13
1996-95	47	40	32	19	9	0	19	40	11	19	11
1997-96	45	7	67	24	2	0	16	2	18	53	11
1998-97	44	7	43	43	7	0	5	14	25	41	16
1999-98	47	32	19	17	32	0	15	38	17	13	17
2000-99	48	23	46	25	6	0	27	10	13	27	23
2001-2001	-	-	-	-	-	-	-	-	-	-	-
2002-2001	34	32	29	6	32	0	21	29	6	15	29
2003-2002	35	29	51	11	9	0	20	29	11	6	34
2004-2003	33	9	73	9	9	0	12	12	21	12	42
2005-2004	32	6	88	6	0	0	6	13	9	28	44
2006-2005	21	0	62	14	24	0	5	5	10	5	76

Source: Authors' calculation.
2006 values are as of Sep. 2006.

Table 9: The main reason of productivity changes (numbers)

Period	#	*Productivity growth **mainly** due to:*		*Productivity loss **mainly** due to:*		*No change*	*Efficiency increase **mainly** due to:*		*Efficiency decrease **mainly** due to:*		*No change*
		Efficiency increase	*Technological progress*	*Efficiency decrease*	*Technological regress*		*PTE increase*	*SE increase*	*PTE decrease*	*SE decrease*	
1990-90	-	-	-	-	-	-	-	-	-	-	-
1991-90	40	1	22	13	4	0	3	4	9	19	5
1992-91	41	6	27	6	2	0	6	8	8	12	7
1993-92	47	12	26	8	1	0	3	19	10	8	7
1994-93	46	20	14	4	8	0	15	11	8	3	9
1995-94	46	3	34	7	2	0	5	2	7	26	6
1996-95	47	19	15	9	4	0	9	19	5	9	5
1997-96	45	3	30	11	1	0	7	1	8	24	5
1998-97	44	3	19	19	3	0	2	6	11	18	7
1999-98	47	15	9	8	15	0	7	18	8	6	8
2000-99	48	11	22	12	3	0	13	5	6	13	11
2001-2001	-	-	-	-	-	-	-	-	-	-	-
2002-2001	34	11	10	2	11	0	7	10	2	5	10
2003-2002	35	10	18	4	3	0	7	10	4	2	12
2004-2003	33	3	24	3	3	0	4	4	7	4	14
2005-2004	32	2	28	2	0	0	2	4	3	9	14
2006-2005	21	0	13	3	5	0	1	1	2	1	16

Source: Authors' calculation.
2006 values are as of Sep. 2006.

9. REFERENCES

Arolat, O. S. (2006). Bankacılıkta Değişme ve Gelişmenin Yönü. http://www.dunyagazetesi.com.tr/news_display.asp?upsale_id=289250

Bonin, J.P., Hasan, I. and Wachtel, P. (2005). Bank Performance, Efficiency and Ownership in Transition Countries. *Journal of Banking and Finance,* 29,p. 31-53.

Caves, D.W., Christensen, L.R. and Diewert, D.E. (1982). The Economic Theory of Index Numbers and the Measurement of Input, Output and Productivity. *Econometrica,* 50, 1, p. 393-414.

Çakar, V. (2003). Yabancı Sermayeli Banka Girişleri ve Ulusal Bankacılık Sektörleri Üzerindeki Etkileri. *TCMB Bankacılık ve Finansal Kuruluşlar Genel Müdürlüğü, TCMB Uzmanlık Yeterlilik Tezi*, p.21.

Etkin, L.P., Helms, M.M., Turkkan, U. and Morris, D.J. (2000). The Economic Emergence of Turkey. *European Business Review*, 12, 2, p. 64-75.

Fare, R., Grosskopf, S., Norris, M and Zhang, Z. (1994). Productivity Growth, Technical Progress and Efficiency Change in Industrialized Countries. *American Economic Review*, 84,1, p. 66-83.

Favero, C. and Papi, L. (1995). Technical and Scale Efficiency in the Italian Banking Sector: A Non-parametric Approach. *Applied Economics*, 27, p. 385-395.

Fukuyama, H. (1993). Technical and Scale Efficiencies of Japanese Commercial Banks: A Nonparametric Approach. *Applied Economics*, 25, p. 1101-1112.

Gamal, M. A. and Inanoglu, H. (2005). Inefficiency and Heterogeneity in Turkish Banking: 1990–2000. *Journal of Applied Econometrics*, 20, p. 641–664.

Green, C.J., Murinde, V. and Nikolov, I. (2003). Are Foreign Banks in Central and Eastern Europe More Efficient than Domestic Banks? *24th SUERF Colloquium on Stability and Efficiency of Financial Markets in Central and Eastern Europe*.

Isık, I. and Hassan, M.K. (2003a). Financial Deregulation and Total Factor Productivity Change: An Empirical Study of Turkish Commercial Banks. *Journal of Banking and Finance*, 27, p. 1455-1485.

Isık, I. and Hassan, M.K. (2003b). Financial Disruption and Bank Productivity: The 1994 experience of Turkish Banks. *The Quarterly Review of Economics and Finance,* 43, p. 291-320.

Isık, I. and Hassan, M.K. (2002). Technical, Scale and Allocative Efficiencies of Turkish Banking Industry. *Journal of Banking and Finance,* 26, p. 719-766.

Isık, I. and Reda, M. (2006). Efficiency and Productivity Change of Egyptian Commercial Banks(1995-2003). *ERF 13th Annual Conference*. December 2006.

Jemric, I. and Vujcic, B. (2007). Efficiency of Banks in Croatia: A DEA Approach. *The Croatian National Bank*, Feb. 2007.

Kasman, A. (2002). Cost Efficiency, Scale Economies, and Technological Progress in Turkish Banking. *Central Bank Review* 1, p. 1-20.

Malmquist, S. (1953). Index Numbers and Indifference Surfaces. *Trabajos de Estatistica,* 4, p. 209-242.

Naaborg, I., Scholtens, B., Haan, J., Bol, H. and Haas, R. (2003). How Important are Foreign Banks in the Financial Development of European Transition Countries? *CESIFO Working Paper,* No 1100, Dec.2003.

Özkan-Günay and Tektas (2006). Efficiency Analysis of the Turkish Banking Sector in Pre-crisis and Crisis Period: A DEA Approach. *Contemporary Economic Policy*, 24, 3, p. 418–431.

Steinherr, A., Tukel, A. and Ucer, M. (2004). The Turkish Banking Sector: Challenges and Outlook in Transition to EU Membership, *Bruges European Economic Policy Briefings*, No.9.

Tarim, A. (2001). Veri Zarflama Analizi. Matematiksel Programlama Tabanlı Göreli Etkinlik Ölçüm Yaklaşımı. *Sayıştay Yayınları,* No:15, 2001.

Tatari, B. (2005). Yabancıların Bankacılık Sektörüne İlgisi. İzmir Ticaret Odası , http://www.izto.org.tr/NR/rdonlyres/B942DEAC-917E-4200-81F5-2D065174DF75/4914/YabBanka1.pdf

Tschoegl, Adrian E. (2003). Financial Crises and the Presence of Foreign Banks. *Wharton Financial Institutions Center Working Paper Series No: 03-35.*Wharton Financial Institutions Center.

Turkish BRSA. Finansal Piyasalar Raporu. Aralık 2006, sayı 4, Strateji Geliştirme Dairesi.

Turkish BRSA. Bankacılık Sektörü Yeniden Yapılandırma Programı-Gelişme Raporu VII. Ekim 2003.

Yıldırım (2002). Evolution of Banking Efficiency Within an Unstable Macroeconomic Environment: the Case of Turkish Commercial Banks. *Applied Economics*, 34, p. 2289-2301.

Zaim, O. (1995). The Effect of Financial Liberalization on the Efficiency of Turkish Commercial Banks. *Applied Financial Economics* 5, p. 257–264.

Zhu, J. (2003). Quantitative Models for Performance Evaluation and Benchmarking: Data Envelopment Analysis with Spreadsheets and DEA Excel Solver. Kluwer Academic Publishers, p. 1-5; 11; 278-280.

"Banking in Turkey", http://www.byegm.gov.tr/REFERENCES/banking.htm.