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BDDK'NIN TÜRK BANKACILIK SEKTÖRÜ ÜZERİNDEKİ ETKİSİNİN MALMQUİST İNDEKSİ İLE TEST EDİLMESİ (1995-2010)

TESTING THE EFFECTS OF BRSA ON TURKISH BANKING SECTOR BY MALMQUIST INDEX (1995-2010)

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Özet

Bu çalışmada seçilen on Türk bankası, BDDK(Bankacılık Düzenleme ve Denetleme Kurulu)'nın banckacılık sektörü verimliliği üzerindeki etksinin belirlenmesi için Malmquist Toplam Faktör Verimliliği (TFP) indeksi ile analiz edilmiştir.Çalışmaya göre BDDK öncesi (1995-2000) ile BDDK sonrası (2000-2010) yılları arasında yapısal değişimin olmadığı saptanmıştır. Veri zarflama analizine dayanan Malmquist Toplam Faktör Verimliliği (TFP) indeksi bankaların performasının ve etkinliğin belirlenmesinde kullanışmıştır. Analiz öncesi kullanılan metodları ve analiz sonuçları ile literatür çalışmasına yer verilmiştir.Sonuçlara gore BDDK'nın 2000 yılındaki kuruluşundan sonra bankacılık siteminin toplam faktor verimliliği yükselmiştir. Ayrıca analiz sonuçlarına gore regülasyon öncesi TFP %0,5 düşmesine rağmen regülasyon sonrasında ortalam %2,2 yükseliş göstermiştir.

Anahtar Kelimeler: Türk Bankacılık Sistemi, Regülasyon, Parametrik Olmayan Analiz.
Jel Kodları: G21, G18, C14.

Abstract

In this study ten selected Turkish banks are analyzed by The Malmquist Total Factor Productivity (TFP) index related to reveal Banking Regulation and Supervision Agency's (BRSA) impacts on banking sector productivity. In the study it is determined that without structural change during the period between the years 1995-2000 (pre BRSA) and 2000-2010 (post BRSA) years. The Malmquist Total Factor Productivity (TFP) index which bases on data envelopment analysis is used to determine the effectiveness and performance. Before analyzing; the studies in literature are given place together with their materials, methods and also results. The results show that the changes in total factor productivity in banking system are increased after the establishment of BRSA in 2000. The analysis results indicates that while TFP decreased by 0.5% during the pre-regulation period, after regulation, an increase occurred at an average of 2.2% in TFP within Turkish banking system.

Key Words: Turkish Banking System, Regulation, Nonparametric Analysis.
Jel Codes: G21, G18, C14

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INTRODUCTION

The main purpose of economics is to maximize the wealth of society in the frame of alternative use possibilities of the available resource. In the direction of this purpose, the main reason of preferring the system of market economy in developed countries is based on the assumption that the competitive markets will provide the optimum resource allocation and thus social wealth will increase. Economic efficiency, moving from data and technology and certain resource stocks in an economy, is defined as a possibility to obtain maximum product. According to this, economic effectiveness, including the conditions related to Pareto optimum, consists of both production and allocative efficiency.

By the time of prevailing of liberal economic approach, beside deregulation that becomes widespread, depending on privatization applications, financial markets faced serious problems resulted from asymmetric information and market failures Associated with the market failures resulted from information systems, the opinion that the system about any area should be supervised by a supreme board subjecting to the regulations and supervision of public became a current issue. In regulating and supervising the troubles of interest, it revealed that there was a need to new practices. The way of this new structuring policies are regulation and supervision.

With the effect of globalization as well regulating and supervising the banking transactions differing and becoming more complicated and attributing them to a certain standard are considerable important in terms of running the system effectively. In general meaning, restructuring programs developed on banking system have four basic aims, which can be counted as protecting of banking regulations, which consist of the codes on regulating and supervising the markets, and forming the supreme boards to undertake this duty, the depositors; providing the monetary stability; obtaining an effective and competitive financial system; and protecting it against systematic risks. The main purpose of this study consists of introducing the effect of regulation and supervision activities implemented on banking system on the effectiveness of Turkish banking system. In the analyses, in which new enveloping methods are preferred, the data on ten banks being in active Turkish banking sector are taken into consideration.

Beside these aims, the main reasons for bank regulations are the requirement of security network mechanism for depositors. This situation appears as a result of externalities of public regulation theories and is used for the aim of eliminating the negative externalities, which inefficiencies of bank failures will create on the depositors. Although the need for banking regulation emerges depending on the externalities of public regulation theory and market failures, banking regulations inherently needs to be analyzed. It is accepted that the regulation applications on banking system are started with enacting the first code (code of protecting deposits, numbered if 2243). However these all codes dating to the year 2000, when Banking Regulation and Supervising Agency (BRSA) is established, only primarily possess a quality of regulation. Therefore, the regulation policies toward to banking sector are accepted to begin with establishment of BRSA. Hence, in order to be able to analyze the effects of regulation policies toward the banking sector, as a period pre-BRSA, the period 1995 -20000, is considered, as a period post –BRSA, the period 2001 – 2010. After that BRSA was officially established with the code of numbered 4389.

I. ECONOMIC EFFICIENCY, REGULATION AND REGULATION OF BANKING SECTOR

The concept of economic effectiveness is also defined as allocative efficiency and static efficiency. In addition, in the free market conditions, as a result of providing the optimum resource allocation, and increase of the quality and quantity of resource stocks, depending on technological developments, the performance measurement associated with the cases, in which it is possible to increase the social wealth is named as dynamic efficiency (Kök and Çoban, 2009).

Along with increasing dominance of strategic analyses in industrial economics, the importance of regulation theory also began to increase. On the ground of regulation theory, there is public regulation in the countries where public-originated formations are predominant in economic, social, and political areas. A common definition does not take place in the concept regulation, but the definitions made by a number of economists are concentrated on the regulation and supervision dimension of concept. Regulation is defined in two ways; narrow and broad. Regulations in narrow meaning, are the whole of rules, supported by sanctions, formed by the governments in order to prevent the undesired actions of individuals and firms from economic and social point of view. In broad meaning, regulation is defined as taking under control and/or regulating and/or guiding and shaping every sort of activity and process via the rules, recommendations, restrictions, and incentives to be formed by any authority or mechanism having the possibility to form sanctions (Guasch and Hahn, 1999: 138). The theory of economic regulation includes two sorts of regulation; the structural regulation used for regulating the market and the managerial one used for regulating the market behavior. The banking regulations are closely related to these both regulation sorts. Forming the codes related to banking systems and structural risk assessment are of examples of managerial regulation. Since it needs an specific analysis, regulation instruments to be used for banking aims present distinction compared to general regulation instruments: The instruments of interest can be put in order as deposit insurance, capital sufficiency, limits of deposit interest rates, inlet and outlet for sector, limitation of interbank communication and merging, portfolio limitation, obligatory reserves, and the supervision of regulation authority (Freikas and Rochet, 1998: 259).

Rather than regulation in general meaning, the financial regulations, including banking regulations, are considered in two separate categories according to their reasons (Brownbridge and Kirkpatrick, 1999: 2-3). First is economic regulations applied toward the aim of decreasing the market failures in allocation of resources, while the second is the prudent regulations toward protecting the stability of financial system and especially small depositors.

The generally acceptable principle associated with the regulations in banking area it that the regulations are built on eliminating or mitigating the systemic risks. The applications on banking regulation generally include the rules about managing the banks and other public institutes prudently; determining the rate of capital sufficiency; limitations brought on taking excessive risk; the restrictions put on the interdependent credits; the rules related to conducting the transactions; how financial institutes will carry out the transactions with customers; the requirements of disclosing the information to public opinion; the rules about allowable transactions; to which banks will be permitted about carrying out the transactions of movable values and insurance; property rules; and the rules toward permitting for being bank owner (Llewellyn, 2001: 12). When considering from this point of view, the regulation policies on banking system is considered in the prudent regulations.

Initially, increasing the efficiency of banking sector in Turkey were attempted to be realized with legal arrangements in general meaning. In this frame, the first regulation is the code of protecting deposits, numbered of 2243, enacted in 1933 and remained in active for only three years In 1980s, with liberalization of banking market and effect of international conjecture, a new regulation is needed and in 1985, the new banking code numbered of 3182 (Taşçıoğlu, 1998: 22).

In Turkey, regulation applications, especially seen in the recent years intensively, in the meaning of regulation and supervision, its past in banking sector are also based on highly old days in compatible with world applications. However, the regulation an application toward Turkish Banking Sector is began to be applied with establishment of BRSA. In this context, the code numbered of 4389 arranging became a beginning point and from the accepting date, as the example of TMSF, amending 8 times, the necessary arrangements were carried out. In addition, in the date of 02.07.2005, banking code numbered of 5387 repealing the code numbered of 4389 was accepted.

II. LITERATURE

In economics literature, there are many studies, where the efficiency/productivity of banking system is measured. The date of studies goes to the highly old days, but the main reason of this is that measuring the run and efficiency of the banking system having a quite heterogeneous structure is not very easy. On the other hand, as a result of structural order in the markets that develop and change, a number of variable affecting the productivity of banks are under consideration. Although all these variables farm the subject of different studies, together with the system that changes, the methods used in the studies also modified.

Banking system presents important in terms of its being a payments instrument of a financial mechanism. Hence, the stability of financial markets, determination of development and growth are largely based on the banking system that runs effectively. There are available many studies, both theoretical and empirical, but one of the oldest methods used associated with the measurement of productivity is the approach of Data Enveloping Analysis (DEA). Some of the studies carried out toward banking systems, using method of DEA, are summarized via literature summary on Table 1.

Table 1: Literature Summary

Authors	Title of Study	Variables	Method	Conclusion
Jackson et al. (1998)	Efficiency and Productivity Growth in Turkish Commercial Banking Sector: A non-parametric approach	Number of staff and total activity incomes without labor as input, total credits, total current deposits and total time deposits as output	Malmquist Productivity Index based on DEA	Except for the Crisis period 1993 – 1994, due to improvements in competition and technology, it was shown that foreign private banks are more effective than public banks. It was emphasized that the Crisis 1994 had a negative effect on the efficiency and productivity of banks and the actions taken during crisis increased the efficiency and productivity.
Isık and Hassan (2003)	Financial Disruption and Bank Productivity: The 1994 Experience of Turkish Bank	As input, number of staff (labor force), capital and available funds; as output, short and long termed debts, risk-free balance sheet actives (guaranteed) and the other assets	Malmquist Index based on DEA	It is found that the banks undergone the loss of important efficiency and productivity; that disturbance of averaged efficiency and productivity values in pre-crisis years is an indicator of emergence of crisis; in post –crisis period, the actions taken by government and banks became helpful to reviving of financial sector and reaching the pre-crisis efficiency and productivity in two years
Leigh M. Drake, Maximilian J. B. Hall and Richard Simper (2005)	The Impact of Macroeconomic and Regulatory Factors on Bank Efficiency: A Non-Parametric Analysis of Hong Kong's Banking System	By using x and y to represent its particular observed inputs and outputs, technical efficiency is calculated by solving the following input-based linear programme. Those three inputs specified are employee expenses, other non-interest expenses and loan loss provisions.	The slacks-based model (SBM) ve DEA	The results indicate: high levels of technical inefficiency for many institutions; considerable variations in efficiency levels and trends across size groups and banking sectors; and also differential impacts of environmental factors on different size groups and financial sectors. Surprisingly, the accession of Hong Kong to the People's Republic of China, episodes of financial deregulation, and the 1997/98 South East Asian crisis do not seem to have had a significant independent impact on relative efficiency. However, the results suggest that the impact of the last mentioned may have come via the adverse developments in the macro economy and in the housing market.
Bastı (2005)	The Effects on Turkey Commercial Banking Sector's Total Factor Productivity of 2001 Financial Crisis	Productivity and efficiency data of banking sector	Malmquist Productivity Index	It is suggested that in the sector, a productivity loss occurred due to crisis; that along with the increase experienced in the post- crisis period, sector cleared the negative effect of crisis; and that productivity fall during crisis was resulted from lagging of effective limit.

Pasiouras (2007)	The Effects of Regulation Policies on Turkish Banking Sector: A Nonparametric Analysis	A linear combination of actual input-output correspondences of 715 banks from 95 countries.	DEA	The results provide in favour of all three pillars of Basel II that promote that adoption of strict capital adequacy standarts.
Öncü and Aktaş (2007)	Productivity Change in Turkish Banking Sector Restructuring Period	As input, staff number, physical capital and borrowed funds; as output, total credits (net) and the other earning assets (securities portfolio, funds sold in interbank monetary market, and banks and other financial agents)	Malmquist TPV Index with Agency Approaach	It was emphasized that total factor productivity of banks increased by 8.3%; following the limited fall of 0.1% in 2001, that there was productivity increases of 10%, 10.3%, and 13.5%, in 2003, 2004, and 2005, respectively; that the resources of these increases were the improvements of efficiencies of banks in using input in 2002, while in 2003, 2004, and 2005, they were technological improvements resulted from the innovations in banking technology; and in only 2002, that efficiency variation index proceeded above technological variation index.
Zhao, Casu, Ferrari (2009)	Regulatory reform and productivity change in Indian banking	The data set contains 13 years of accounting data for 65 banks (27 public, 20 domestic private and 18 foreign), for a total of observations. All data were deflated using the GDP deflator using 1991 as a base.	DEA; Malmquist Index; Stochastic Frontier Analysis	Both approaches show that the Indian banking industry, after an initial adjustment phase, experienced sustained productivity growth driven mainly by technological progress. Results also indicate a changing relationship between cost efficiency and ownership structure along with the reform processes, and decreasing mean cost efficiency at the aggregate industry level.
Georgios E. Chortareas, Claudia Girardone and Alexia Ventouri (2012)	Bank Supervision, Regulation and Efficiency: Evidence from the European Union	The traditional accounting ratios and focus on a selected sample of EU commercial banks over the period 2000-2006.	Quasi Likelihood Estimation Method	The main findings are that interventionist supervisory and regulatory policies such as empower capital restrictions, fortifying official supervisory powers, private sector monitoring and restricting bank activities, significantly impede the efficient operation of banks. Evidence also suggests that banks from countries with more open, competitive and democratic political systems are more likely to benefit from higher operating efficiency levels.
Houda Sassi (2013)	Regulation, Economic Freedom and Efficiency in Selected Mena Banks	Paper is analyzing the relationship between the indicators of regulation and economic freedom and the technical efficiency of commercial banks in 5 MENA countries during the period of 2003-2011.	DEA, Tobit regression	The empirical results indicate evidence that a strong restriction can result in higher bank inefficiency. However, banks operating in conditions of economic freedom and governance are more likely to benefit from higher operating efficiency levels.

Girginer (2010)	Before and After the Period of Financial Crisis of 2007 The Evaluation of Commercial Banks' Activities in Turkey with data envelopment analysis (DEA)	12 banks determined as the units of decision making were analyzed via three different DEA model with 5 input, single output, toward output (OCR)	DEA	From the recent financial crisis experienced the finding that private banks were more affected than public banks were obtained.
Uzgoren and Şahin (2011)	Financial Efficiency and Productivity Changes of The Deposit Banks in Turkish Banking Sector in Post-Restructuring Practice: An Application of Data Envelopment Analysis and Malmquist Total Factor Productivity Index	For 21 banks, as input, Total Deposits, Total Equity and total interest expenditures; as output; total credit and total interest incomes.	DEA and Malmquist TPV Index	It was determined that application of Restructuring Program for Banking Sector had a positive effect on the efficiency and productivity of banks, however this effect remained in limited level; that productivity increase indicated a linear directional development; and that total factor productivity of banks was higher than the efficiency values
Vinod S. Changarath, Michael F. Ferguson and Yong H. Kim (2011)	Do Capital Standards Promote Bank Safety? Evidence from Involuntary Recapitalizations	The economic trade-offs in the stipulation of minimum capital norms, they modelled the cumulative abnormal returns using changes in insider ownership, changes in the option value of deposit insurance, and other controls.	DEA	They found that post-issue efficiency is significantly related to the degree of inside owner dilution. Thus, minimum capital standards succeed in their intended purpose of protecting taxpayer supported deposit insurers, but carry the hidden cost of increasing insider moral hazard. We find that diluted insider positions lead to poorer operating performance in the long run and actually culminate in failure for a significant number of banks. Therefore, the agency costs of minimum capital regulations must be factored into any policy analysis
Tanna, S. , Pasiouras, F. and Nnadi, M. (2013)	The effect of board size and composition on the efficiency of UK banks	Data of 17 banking institutions operating in the UK between 2001 and 2006	The panel data regressions	After controlling for bank size and capital strength, we find some evidence of a positive association between board size and efficiency, although this is not robust across all our specifications. Board composition, by contrast, has a robustly significant and positive impact on all measures of efficiency.

James R. Bartha, Chen Linb, Yue Mac, Jesús Seade, Frank M. Song (2013)	Do bank regulation, supervision and monitoring enhance or impede bank efficiency?	4050 banks observations in 72 countries over the period 1999–2007 are used.	AN un-balanced panel analysis	It is found that the tighter restrictions on bank activities are negatively associated with bank efficiency while grater capital regulation stringency is marginally and positively associated with bank efficiency.
Tobias Hagen (2013)	Impact of National Financial Regulation on Macroeconomic and Fiscal Performance after the 2007 Financial Shock – Econometric Analyses Based on Cross-Country Data	Using cross-country data, this paper estimates the impact of the 2007 financial shock on countries' macroeconomic developments conditional on national financial regulations before the crisis. For this purpose, the "financial reform index".	Robust Regression and semi-parametric regression	The econometric analyses indicate that countries with more deregulated financial markets experienced deeper recessions, stronger employment losses, and larger government budget deficits. Against the background of the ongoing global crisis and the results of other studies, the usefulness of liberalized financial markets for macroeconomic stability and economic development should be rigorously reconsidered.

III. METHODOLOGY

A number of studies have compared the efficiency of Turkish banks in terms of ownership types or sizes. By testing total factor productivity (TFP) changes components, we assess the efficiency provided by technological change (TC) and Technical efficiency change (TEC) to reveal the impacts of supreme council BRSA, on banking sector productivity.

In this paper, we aimed to reveal the banking regulation policies' effects on the efficiency of Turkish banks. In accordance with this purpose, we focused on the data between 1995 and 2010, we chose the 10 biggest banks of the Turkish banking sector, which have retained the same name and haven't had any changes in their partnership structure. These banks are: İşbank, Garanti Bank, Akbank, Vakifbank, Halkbank, Finansbank, TEB, Sekerbank and Alternatifbank. The data sets in this analysis were collected The Banks Association of Turkey (TBB) data base for balance sheet items. The study sample indicators that make up the balance sheet of the banks are organized in Table-2 below.

Table 2. Key Indicators of Banks Balance Sheet (2010)

Banks	Year of Establishment	Total Assets (Million TL)	Total Equity (Million TL)	Paid in Capital (Million TL)	Net Profit (Million TL)	Number of Branch	Number of Staff
Ziraat Bank	1863	151.160	13.458	2.500	3.713	1.399	22.708
İşbank	1924	131.796	17.014	4.500	2.982	1.142	23.944
Garanti Bank	1946	123.963	16.475	4.200	3.145	859	16.675
Akbank	1948	113.183	17.565	4.000	2.857	913	15.330
Vakifbank	1954	73.962	8.559	2.500	1.157	636	11.077
Halkbank	1938	72.942	7.445	1.250	2.010	709	13.450
Finansbank	1987	38.087	5.208	2.205	915	503	11.734
TEB	1927	19.031	1.813	1.100	300	335	5.646
Sekerbank	1953	11.369	1.400	750	170	260	3.485
Alternatifbank	1992	4.259	462	300	28	53	1.086

Source: The Banks Association of Turkey (TBB), 2012.

General outlook of Turkish Banking Sector has many different ratios. The sector's capital adequacy standard ratio is 15.3% as of December 2013. Asset size of the Turkish Banking Sector has reached TL 1.732 billion as of December 2013. Loans which are the biggest item are composing

60.5% of total assets with TL 1.047 billion in the end of 2013. The sector's profit is TL 24.732 million; it has increased by TL 1.210 million (5.1%) comparing to the same period of previous year (BRSA, 2014).

In this paper, we applied the stochastic frontier approach and non-parametric analysis DEA to analyze the efficiency of the banks and to develop policy recommendations (Coelli, 1996; Coelli and Rao, 1998; Coelli et al., 1998; Coellli, 2001; Battese at al., 2001; Coelli and Rao, 2001; Tarım, 2001).

The importance of "efficiency" as a term and calculating efficiency started with Farrel (1957). Measuring multiple input firms' efficiency can be found in Debreu (1951) and Koopmansın (1951) studies (Kök, 1991: 127-144).

Farrel decomposed productivity growth into two components. These two components are technical efficiency and allocative efficiency. Technical efficiency involves producing maximum output with a given quantity of input. Allocative efficiency involves producing a given quantity of output at minimum cost when the input prices and the technology are constant. This leads to the decomposition of productivity into changes in efficiency (catching up) and changes in technology (innovation) (Kök, 1991: 45-73).

There are three main modelling methodologies used to calculate bank efficiency measurement. These are the intermediation approach, the production approach and the profit approach. The intermediation approach consider financial earning asset as outputs and input as liabilities (deposits) and labour and physical capital. The production approach considers both financial earning assets and liabilities (deposits) as outputs. Bu there is still no consensus on which of the three methodologies defined above should be used in bank efficiency analysis. (Drake et al., 2009: 3).

In this study we chose the intermediation method to calculate bank efficiency measurement and the effect of banking regulation policies on efficiency. Using this approach we considered the total loans and net profit / loss as an output vector. For the input vector, the number of staff, deposits and paid-up capital are taken into account. The balance sheet items as input and output which are chosen to use in analysis are shown in Table-3.

Table 3. Input and Output

Approach	Input	Output
Intermediation Method	Paid in Capital Number of Staff Total Deposit	Total Credits Net Current Profit/Loss

The data envelopment analysis, measures the changes in efficiency using the Malmquist total factor efficiency index. The efficiency change is decomposed into technological change (TC) and technical efficiency change (TEC). The total factor productivity is decomposed to technological change (TC) and Technical efficiency change (TEC).

$$TFP= TC*TEC \quad (1)$$

An improvement in technological change (TC) is considered a shift in the best-practice frontier; in fact an improvement in Technical efficiency change (TEC) is called "catch up" term. The technical efficieny change (TEC) is decomposed into the scale change (SEC) and pure efficiency change (PTEC) components (Casu et al., 2004: 2531)

TEC = PTEC*SEC (2)

Deap Version 2.1 which is developed by Coelli is used in our analysis, aiming to maximize the output in the fixed input, by the output output-oriented approach also considering the variable return to scale (VRS).

Output oriented efficiency measurement, with a particular input vector can be produced under the use of a particular production technology shows the ratio of the maximum output level of the output level of the observed (Coelli et al., 2005: 67). If the Malmquist TFP index value is greater than 1, it indicates an increase in productivity, If index values is smaller than 1; it indicates a decrease in efficiency. If the index is equal to 1, shows that there is no change in productivity.

IV. EMPRICAL RESULTS

The banks operating in the Turkish banking sector's input-oriented, variable returns to scale efficiency values are shown on the Table-4.

Table 4. The Banks Input-Oriented, Variable Returns to Scale Efficiency Values

Banks	1995	1996	1997	1998	1999	2000
Ziraat Bank	1	1	1	1	1	1
İşbank	1	1	1	1	1	1
Halkbank	0,523	0,467	0,397	0,636	1	0,730
Akbank	1	1	1	1	1	1
Vakifbank	1	0,807	1	0,943	1	1
Garanti Bank	1	1	1	1	1	1
Finansbank	1	1	1	1	0.973	1
TEB	1	1	1	0,807	0,820	1
Sekerbank	1	1	1	1	1	1
Alternatifbank	0,922	1	1	1	1	1
Average Efficiency	0,944	0,927	0,940	0,939	0,979	0,973

According to Table-4 the banks belonging to the large scale (Ziraat Bank, İşbank, Akbank, Garanti Bank) and those belonging to the medium scale (Sekerbank) are efficient, every year studied, including the regulation year 2000. The Halkbank is inefficient all years except 1999. Vakifbank is efficient all years except 1996 and 1998. Finansbank is efficient except 1999 all years. TEB is efficient except 1998 and 1999 every year. The Alternatif bank which is belonging to segment of small scale is efficient every year except 1995. The highest average efficiency value refers to year of 1999 before the regulation year 2000. In this sense the average efficiency rates of banks is 0.973 in the regulation year 2000 , and before the regulation the lowest efficiency value wa 0.927 in 1996.

Following the regulation year of 2000, technical efficiency changes of the banks are shown on the Table-5.

Table 5. The Banks Input-Oriented, Variable Returns to Scale Efficiency Values

Banks	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Ziraat Bank	0.514	0.389	0.460	1	1	1	1	1	1	1
İşbank	1	1	0.959	0.541	0.598	0.540	0.599	0.852	0.785	0.833
Halkbank	1	1	0.532	0.633	0.901	0.832	0.891	1	1	1
Akbank	1	1	1	1	1	1	0.944	1	1	0.994
Vakifbank	1	1	1	1	0.621	0.804	0.774	0.731	0.713	0.632
Garanti Bank	1	1	1	0.563	0.641	0.752	1	1	1	1
Finansbank	1	1	1	1	1	1	0.759	0.739	0.707	0.918
TEB	1	1	1	1	1	1	1	1	1	0.715
Sekerbank	0.886	0.865	0.991	1	0.943	1	1	1	1	1
Alternatifbank	1	1	1	1	1	1	1	1	1	1
Average Efficiency	0.940	0.925	0.894	0.874	1	0.893	0.897	0.932	0.920	0.909

According to Table-5 Ziraat Bank's efficiency coefficient has been decreasing in the first years but after 2004 it is relatively pure efficient. The İşbank is relatively pure efficient two years after the regulation, and after that it is relatively inefficient. Alternatif bank is fully efficient during post regulation stage 2000-2010.

TEB is relatively efficient after regulation except during the year of 2010. Akbank is fully efficient every year except 2007 and 2010. If we look at the average efficiency scores of the banks after the regulation, only the year of 2005 is efficient. The reason for this situation is the 2001 financial crisis's effects on the banking sector.

The main aim of the study to calculate the Banks' Total Factor Productivity (TFP) changed over the years. Malmquist TFP index values are calculated considering the average geometric mean. Malmquist index averages of banks before and after the regulation years of 1995-2010, are summarized in Table-6. In table, the Malmquist index averages are geometric means. In table-6 TEC, TC, PTEC, SEC, MI represents respectively to; Technical Efficiency Change, Technological Change, Pure Technical Efficiency Change, Scale Efficiency Change, Malmquist Total Factor Productivity Change.

The Malmquist TFP index value which is bigger than 1 means a positive progress of TFP t time up to t+1. If this index is smaller than 1, it means that TFP decreases over ~~the~~ time.

Table 6. Malmquist Index Summary

Years	TEC	TC	PTEC	SEC	MI
1996	0,943	1,087	0,976	0,967	1,025
1997	1,014	1,010	1,005	1,008	1,024
1998	1,055	0,997	1,020	1,034	1,051
1999	0,997	0,943	1,051	0,948	0,940
2000	1,011	0,930	0,991	1,020	0,941
2002	1,008	0,804	0,970	1,039	0,810
2003	0,981	1,298	0,964	1,018	1.273
2004	1,004	0,988	0,981	1,023	0,993
2005	0,942	1,116	1,005	0,938	1,052
2006	1,101	1,012	1,030	1,069	1,114
2007	1,014	0,994	1,009	1,005	1,008
2008	1,068	0,734	1,045	1,022	0,785
2009	0,973	1,360	0,985	0,988	1,323

2010	0,981	0,985	0,986	0,995	0,966
Average 1995-2000	1,003	0,992	1,008	0,995	0,995
Average 2001-2010	1.007	1.015	0.997	1.010	1.022

Considering the annual average Malmquist index values of banks (Table-6), the average factor efficiency increased 2.5% in 1996. This efficiency increase arises from 0.08% technological change. The annual average Malmquist index values of banks soared 2.4% in 1997.This raise arises from 1.4% technical efficiency change. Decomposing the technical efficiency change it comes from 0.5% pure technical efficiency change,–0.8% scale efficiency change. The banks TFP soared 5.1% in 1998, it stems from catch up effect. The TFP diminished in 1999 and 2000 as well. This was resulting from technological effect.

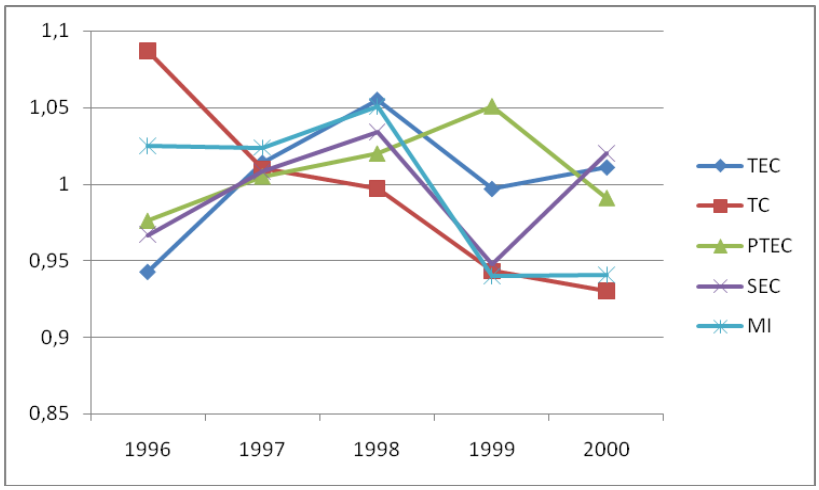

Figure 1. The Average Malmquist TFP Index of the Banks Pre- Regulation

As shown in Figure-1, the banks have lived technological downfall before the regulation in addition that technical efficiency change has increased until 1998 after that it has been declining. On the other hand the Malmquist index is used to examine the managerial efficiency change of the banks over the period 1995-2000. This indicates that over the 6 years (1995-2000) managerial efficiency of 6 banks with an efficiency change greater than 1, however there are 4 banks with an efficiency variation of less than 1. This means that managerial efficiency of 4 banks has been declining for the 1995-2000 period (Lin et al., 2007:825). Management inefficiencies generally associated with the technical ineffciency. Turkish commercial banks' capacity to compete with the relatively high technical efficiency largely banks depends on improved administrative efficiency (Işık and Hassan, 2002: 762).

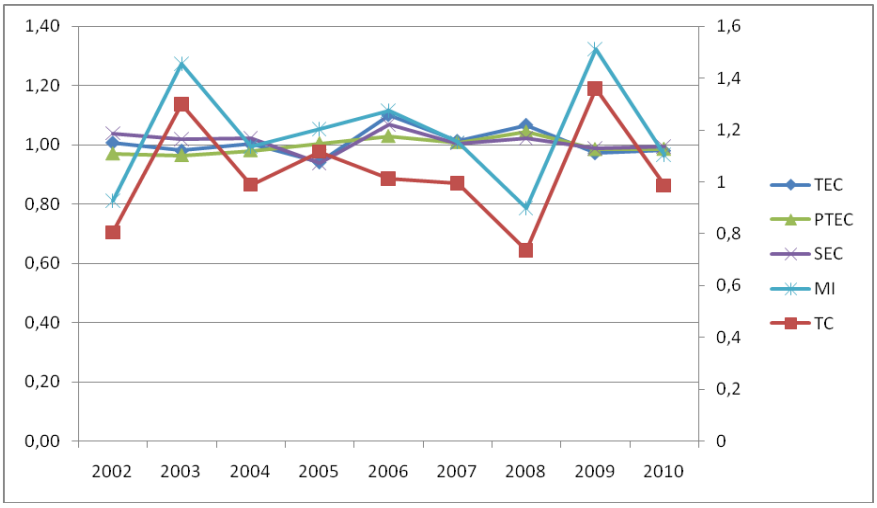

Figure 2. The Average Malmquist TFP Index of the Banks Post- Regulation

As shown in Figure-2, the average Malmquist TFP index (MI) of the banks has increased after the regulation between the 2000 and 2003. The banks TFP shrank during the 2000-2002 years after the regulation. The structural economic program which was carried out at the beginning of 2000, combined with rising economic and political uncertainties has led to shocks in the banking sector.

After the 2000 and 2001 banking crises the SDIF (Savings Deposit Insurance Fund) took management and supervision of the banks. This could be one of the reasons for TFP decrease. The New Economic Stability Program which imposed on 15 May 2001 after the establishment of BRSA helped to enhance the financial indicators of the banks.This program imposed restrictions on banks budgets and financial indicators. In this sense the capital adequacy ratio of the banks was increased also controls for credits became stricter. Consequently banks TFP ratios diminished until 2003. Realization of the regulations and new obligations introduced to banks increased TFP of the banks by 27% during the 2002-2003 periods. 29% of the increase resulted from the technological development of these. The most important reason for TFP fall of 2008 was technological regress.

On the other hand the global financial crisis which started with the bankruptcy of Lehman Brothers in September 2008 in the USA, has been deepening in the world of 2009 and it contributed for positive impact on banks' TFP values. Although the bank's TFP has contracted 4% in 2010. As a result when we examine the bank's TFP ratios for two periods (before and after the regulation) TFP shrank 0.5% in 2010 before the regulation. TFP has soared 2.2% for 2001-2010 terms after the regulation.

The summary of the Malmquist and technical efficiency change values (1995-2000) are shown in Table-7. In table, the Malmquist index averages are geometric means. In table-6 TEC, TC, PTEC, SEC, MI represents respectively to; Technical Efficiency Change, Technological Change, Pure Technical Efficiency Change, Scale Efficiency Change, Malmquist Total Factor Productivity Change.

Table 7. The Summary of the Average Malmquist and Technical Efficiency (1995-2000)

Banks	TEC	TC	PTEC	SEC	MI
Ziraat Bankası	1	0,960	1	1	0,960
İşbankası	0,984	0,955	1	0,984	0,940

Halkbank	1,058	0,991	1,069	0,989	1,048
Akbank	1	1,080	1	1	1,080
Vakıfbank	1	1,059	1	1	1,059
Garanti Bank	1	1,301	1	1	1,301
Finansbank	1	1,173	1	1	1,173
TEB	0,936	1,103	1	0,936	1,033
Sekerbank	1,059	0,895	1,016	1,042	0,948
Alternatifbank	1	0,589	1	1	0,589
Average	1,003	0,992	1,008	0,995	0,995

Ziraat Bank, İşbank, Sekerbank and Alternatifbank's reduction in total factor productivity (TFP) was due to technological deterioration for period between the years 1995-2000 (Table-7). The Malmquist Index (MI) has risen for the following banks after the regulation changes: Halkbank, Akbank, Vakifbank, Garanti Bank, Finansbank, and TEB. These banks' technical efficiency index change is over 1. Based on the first-stage DEA results; Akbank, Vakifbank, Garanti Bank, Finansbank efficiency was mainly caused by technological change. This technological enhance is called as innovation. For Halkbank and Sekerbank this has resulted in a significant improvement in technical efficiency. These banks seem to have been able to exploit catching up effect.

Before the regulation (1995-2000), Akbank, Vakif Bank, Garanti Bank, Finansbank and TEB showed improvement in the TFP index. This productivity growth seems to have been brought by improvements in positive technological change. Related banks improvements in best practice can be seen as increase inproduction possibilities, banks could all have influenced the boundary shift (Avcı and Kaya, 2008: 856).

The summary of the Malmquist and technical efficiency change values after regulation (2001-2010) are shown in Table-8. In table, the Malmquist index averages are geometric means. In table-6 TEC, TC, PTEC, SEC, MI represents respectively to; Technical Efficiency Change, Technological Change, Pure Technical Efficiency Change, Scale Efficiency Change, Malmquist Total Factor Productivity Change.

Table 8. The Summary of the Average Malmquist and Technical Efficiency (2001-2010)

Banks	**TEC**	**TC**	**PTEC**	**SEC**	**MI**
Ziraat Bank	1,080	1,064	1,077	1,003	1,149
İşbank	0,990	1,014	0,980	1,010	1,003

Halkbank	1,102	0,915	1,000	1,102	1,008
Akbank	0,999	1,053	0,999	0,999	1,052
Vakifbank	0,950	1,065	0,950	1,000	1,011
Garanti Bank	1,000	1,051	1,000	1,000	1,051
Finansbank	0,986	0,983	0,990	0,995	0,969
TEB	0,946	1,035	0,963	0,981	0,979
Sekerbank	1,030	0,938	1,014	1,016	0,966
Alternatifbank	1,000	1,042	1,000	1,000	1,042
Average	1,007	1,015	0,997	1,010	1,022

Ziraat Bank has achieved the highest TFP incease (15%) among banks during 2001-2010 periods (Table-8). Finansbank, TEB and Sekerbank's TFP has increased in this period.

Alternatifbank has experienced a dramatic increase in the index after the regulation (2001-2010 periods).Malmquist index was only 0.589 before the regulation and it has increased to 1.042 after the regulation. When we look at the balance sheet and income table of the Alternatifbank, we see that total credits and average profit has soared after 2001.We used total credits and prodit as an output indicator.In addition to this, total deposits did not rise as much as output. We took deposits as input indicator in the analysis. These factors contributed to banks efficiency boost.

The legislation and controls on the banks after the regulation had a positive effect on the banks efficiency ratios compared to the period prior to regulation.The banks average TFP increase can be decomposed into change 1.5% technological progress and 0.7% change in best practice catch up.

CONCLUSION AND DISCUSSION

Over the last 13 years, Turkish banks have adopted significant reforms and experiencied a strong growth period, after foundation of supreme council BRSA. Therefore, it may be interesting for academics to measure the performance of the banking system and to detect efficiency effects on the performance of the banking system.

This paper aims to reveal the impacts of supreme council BRSA, established in 2000 to put in order and supervise the banking sector, on banking sector productivity. In this study, the establishment of the BRSA's banking system as a regulator, the impact on Total Factor Productivity is measured by the Malmquist index. In the analysis the pre-regulation period has been chosen as 1995-2000, and post- regulation period defined as after setting up BRSA 2001-2010 period.

After the literature search, there are many studies measuring Turkish banking sector efficiency and productivity although they do not generally measure the efficiency changes of the banks before

and after the regulation. Uzgören and Şahin (2011) has measured the efficiency of the banks before and after the regulation and found out the 2001 regulations had positive but limited effect on banks' efficiency. Our findings are parallel to Uzgören and Sahin (2011) which stated that regulation of banks had increase in total factor efficiency after the regulation also 2000 -2001 banking crises have lead to decline in TFP ratios.

When we decompose the total factor productivity into two different periods such as pre-regulation period and post-regulation period; TFP has decreased 0.5% for pre-regulation period (1995-2000) in contrast to it has increased 2.2% for post-regulation period (2001-2010). After the post – regulation period between the years 2001-2002, the banks' TFP has decreased because of the 2000 and 2001 banking crises. In a similar way, Bastı (2005) found that financial crises contracted the total brokerage operations of the banks and 2001 banking crisis has led to productivity slowdown in the banking sector.

The establishment of the BRSA introduced new rules in place within the framework of regulations and limitations. The banks' TFP has increased by 27% for the period 2002-2003. This productivity growth seems to have been brought by improvements in technological progress (29%). However between the years 2007-2008 productivity downfall seems to have been brought by technological deterioration. Girginer (2010) has detained private banks, impressed more than public banks after the global crises. The global financial crisis, according to the results of our initial period (2008-2009) had a positive impact on banks' TFP values. But as the crisis deepened, TFP fell by 4% in 2009.

Overall, regulations which had more application area after the 1980s global privatization wave enhanced Turkish banking sector management and governance efficiency. The banking sector's total factor productivity has increased in time, particularly after introduction of the BRSA between years 2000-2001.

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