# THE IMPACT OF THE GLOBAL FINANCIAL CRISIS ON THE EFFICIENCY OF FOREIGN BANKS IN TURKEY

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## Abstract

*The study empirically searches for the impact of the global financial crisis on the technical efficiency of foreign banks in Turkey. To estimate stochastic frontiers and to predict bank-level technical efficiencies relative to the estimated frontier, a Cobb-Douglas Stochastic Frontier Production Function is used for the period of 2002-2008. The study also estimates the bank specific determinants of technical inefficiencies of commercial banks in Turkey using a single equation of the Frontier model proposed by Battese and Coelli (1995). The results of the empirical research suggest that the ranking of commercial banks in terms of technical efficiency as state-owned, private domestic and foreign did not change during the crisis. The technical efficiencies of foreign bank subsidiaries, despite a decrease in 2007, are even closing the gap with private domestic commercial banks. The technical efficiency of state-owned banks, in contrast to both domestic and foreign private banks, continued to increase during both 2007 and 2008. The foreign bank subsidiaries have much higher technical efficiency scores compared to foreign bank branches, which have the most volatile efficiency scores. The technical efficiencies of commercial banks have a high, positive and statistically significant relation with the asset size.*

***Keywords**: Bank Efficiency; Restructuring and M&A; Stochastic Frontier Efficiency, Financial Crisis*

***JEL codes:** C30; D24; G21; G32; G34*

## 1. Introduction

In the bank efficiency literature, the *home field advantage* hypothesis (Berger et al. 1999) argues that foreign banks may have lower efficiency than domestic banks due to the cross-border disadvantages. The *global advantage hypothesis* (Berger et al. 1999) however suggests that some foreign banks overcome the diseconomies of cross-border operations and have higher

efficiencies than the domestic banks. There is a vast literature on the estimation of country-wise or cross-sectional efficiencies of foreign banks, with rather inconclusive results.[1] The conclusion that is generally accepted is that in developing countries foreign banks generally out-perform or have approximately equal efficiency with domestic, with the opposite occurring in developed countries; both having however considerable outliers. (Berger, 2007)

The literature concerning the impact of financial crisis on the efficiency of foreign banks is rather scarce. Martinez Peria, Powell and Vladkova-Hollar (2005) suggest that foreign banks would be pickier-though less over time- during the crises and they may import shocks from their home countries. Cull and Peria (2007) find out that foreign bank participation increases in post-crisis periods and that foreign bank participation did not increase bank credits to private sector. Tschoegl (2003) argues that foreign banks that generally emerge during the recovery phase of the crisis in the developing countries leave the country in the coming decades as domestic banks grow more rapidly. Detragiache and Gupta (2006) studied the impact of the Asian crises on the Malaysian banking system and found out that the foreign banks with more of a regional focus suffered as much as domestic banks during the crisis but the others did not.

Williams and Nguyen (2005) analyzed the impact of ownership change on bank efficiency in South East Asia between 1990 and 2003 by employing stochastic frontier analysis (SFA) and Fourrier flexible functional form. The results of their research, that encompass the crisis period, demonstrate that foreign ownership did not lead to performance improvements at privatized banks. Sufian (2009) investigated the efficiency of the Malaysian Banking Sector during the Asian financial crisis of 1997 by employing first Data Envelopment Analysis (DEA), and then a Tobit model for the period between 1995 and 1999. The empirical analysis shows that the technical efficiency of banks deteriorated rapidly a year after the crisis and that foreign banks by recapitalization exhibited a higher degree of efficiency vis-à-vis domestic banks.

[1] See Lensink et al. (2008) pp.836 for the empirical studies on foreign bank efficiencies with rather inconclusive results. The different results of efficiency estimates of foreign banks seem to stem from the choice of parametric (i.e. SFA) or non-parametric (i.e. DEA) frontier efficiency techniques; output or input oriented technical efficiency estimations; production/profit or cost functions; the intermediary, production, value-added or operating approaches; input and output variables; time period of the analysis, the regions analyzed, countries and country-specific environmental factors, etc.

Some recent empirical studies analyzed the efficiency change of banks and banking groups during the 2000-2001 crises and the restructuring period that followed suit in Turkey[2].

Aysan and Ceylan (2008) conducted a panel data fixed effects regression analysis on the Turkish Banking System , hereafter TBS, for the period of 1990-2006 that encompassed both the 1994 and the 2001 crisis in Turkey. Their research reveals that the restructuring after the 2001 crises robustly account for the improvement in the efficiency of banks in Turkey.[3] Aysan and Ceyhan (2007) used DEA and Malmquisit Total Factor Productivity (TFP) Change index in their study of TBS between 1990 and 2006 with respect to fixed time periods and changing frontiers. Their result suggests that all the banking groups experienced efficiency increase between 1990 and 2006 and that state-owned banks in Turkey became the most efficient banks after 2001, replacing the foreign banks.

Abbasoğlu, Aysan and Güneş (2007) analyzed the X-efficiency[4] of commercial banks for 2001-2005 by constructing a cost frontier. Their empirical results suggest that large banks have higher efficiency than smaller banks[5], the least efficient banks are the foreign banks but that the foreign banks are more profitable compared to the domestic banks.[6] Matousek et al. (2008) analyzed the efficiency of TBS for 2000-2005 by applying Stochastic Cost Frontier (SCF) Efficiency method and their results suggest that Turkish banks have still a large potential for improving their efficiency and that the restructuring in TBS transformed state-owned banks to more efficient banks than private banks. Özkan-Günay and Tektaş (2006) analyzed the relationship between efficiency and bank failures of commercial banks for the 1990-2001 periods covering the crises of 1994 and 2000-2001 in Turkey by using DEA. Their findings suggest that the banks that are overtaken by the Savings Deposit Insurance Fund (SDIF) already

[2] The frontier functions employed to search the efficiency of banks in Turkey in late 1990s and early 2000s focused mainly on the effects of liberalization on the Turkish Banking System. Fethi et al. (2001) Mercan and Yolalan (2000), Mahmud and Zaim (1998) to cite only a few, empirically show that liberalization increased the level of efficiency in TBS. Jackson, et al. (1998) researched the 1992-1996 period and found productivity increase in the post-liberalization era of Turkey, with the exception of the crises hit year 1994.

[3] Aysan and Ceylan (2008) find no robust relation neither between efficiency and foreign ownership nor with efficiency and return on investment (ROE) but their results suggest that efficiency is negatively related to number of branches and positively related to bank capitalization and loan ratio.

[4] X-efficiency refers to how well a bank is utilizing its inputs relative to comparable banks on the efficient frontier.

[5] Jackson and Fethi (2000) applied DEA and Tobit regression analysis for 48 banks in Turkey in 1998 and their findings also suggest a robust and positive relation between size and efficiency for Turkish banks.

[6] Işık and Hassan (2002) by employing DEA and Işık (2007) by using Malmquisit Index Theory and the generalized least regression format find however that foreign banks in Turkey are significantly more efficient than domestic banks.

had low efficiency scores. They suggest that the efficiency scores of banks should be used both by the managements of banks and also the Banking Supervisory Agencies.

This paper empirically analyzes the impact of the global crisis on the efficiency of foreign banks in the Turkish commercial banking industry. The global financial crisis is the first crisis that affected Turkey after the restructuring and the radical increase in foreign bank ownership in TBS through Mergers and Acquisitions (M&As).[7] The US subprime crisis started in mid-2007 with the decision of FED to increase policy rates. [8] The sub-prime mortgage loans, which were at the core of the crisis, encompassed origination of the loan and distribution of the risk by securitization of the loans.[9] The sub-prime crisis that severely affected the 'shadow banking' systems of the developed financial markets spread to the developing world economies in 2008.[10]

The sub-prime loans, the loan securitizations and Collateralized Debt Obligations (CDOs) are inexistent in the Turkish markets but the relations of the foreign banks with the home country and the parent company and the possible spillover effects of the sub-prime crises to these foreign bank branch and subsidiaries necessitate a deeper scrutiny. This empirical investigation is expected to shed light on the global financial crisis invoked changes in the technical efficiencies of the banks in general[11], foreign bank branch and subsidiaries in particular and also on the sources of technical inefficiencies of banks during 2002 - 2008 for Turkey. To the best knowledge of the author, the impact of the global crisis on the efficiency of foreign banks in Turkey is not empirically investigated so far. The rest of the paper is organized as

[7] The TBS is restructured after the devastating financial crisis in 2001 and M&As followed suit. With the foreign direct investment (FDI) inflows to Turkey that increased considerably after the start of accession negotiations with the European Union (EU) in 2005, the foreign ownership in TBS increased to 37.4% from 5% level (BRSA, 2008).
[8] The increase in policy rates ended the long lasting real price appreciation in the housing market and caused an increase in subprime mortgage defaults. The subprime mortgage defaults triggered a confidence crisis in the US and the developed EU interbank markets due to the lack of information of the counterparty's exposure to mortgage related assets. The increase in delinquency rates of subprime mortgages and the mismatch of the maturity structures of conduits and SIVs led to a drying up in asset-backed commercial paper market and the failure of several banks and hedge funds.
[9] The loans were securitized and the CDOs were sold in the over- the- counter (OTC) markets to Special Investment Vehicles (SIVs) that were actually connected to the banks. See Calomiris, 2008; Mizen, 2008; Gorton, 2008; Eichengreen, 2008 among others for the sub-prime crisis.
[10] The growth of GDP in Turkey that continued for 27 quarters showed a decrease of 6.2% in the last quarter of 2008 and unemployment in Turkey rose to 15.5% in January 2009 from 11.6% in January 2008. (BRSA) 2009
[11] The study investigates the efficiency of foreign banks but as all the banks in Turkey establish the frontier for the estimations, the efficiency results of other banking groups will also be briefly discussed.

follows: Section 2 describes the methodology and the dataset. Section 3 portrays the findings of the empirical research and discusses the results. Section 4 concludes.

## 2. Data and Methodology

The efficiency concept is developed by Farell (1957).[12].The frontier analysis consists of the estimation of the best-practice frontier of the optimal input mix for maximized outputs and the prediction of the firm- level efficiencies through the comparison of the efficiency of the concerned Decision Making Unit (DMU) with that frontier. The use of both the Stochastic Frontier Analysis (SFA) and the Data Envelopment Analysis (DEA) for banking sector increased considerably during the last couple of decades, following the financial market developments in terms of liberalization, privatization, crises, restructuring and M&As.

To evaluate the impact of the global crisis on the foreign banks in Turkey, the frontier of the most efficient banks are estimated and the efficiency levels of foreign banks are measured by their distance from the efficiency frontier. To this end, the Cobb-Douglas Stochastic Production Frontier (SPF) with the Technical Inefficiency Effects (TIE) of banks is used. The mean technical efficiency scores of the banks and the bank specific determinants of technical inefficiencies are estimated using a single equation of the Frontier model proposed by Batesse and Coelli (1995).The Cobb Douglas SPF may be expressed as follows:

$$\text{In}\,(Q_{i,t}) = \beta_0 + \sum_j \beta_j \;\text{In}\,(\chi_{j,i,t}) + v_{i,t} - u_{i,t}\,; \qquad (1)$$

where $Q_{i,t}$ is the output of bank i in period t defined as total loans and total securities , $\chi_{j,i,t}$ is a vector of input quantities representing deposits and other borrowings (D), labor (L)and capital (C) . $v_{it}$ are random variables which are assumed to be iid $N(0, \sigma v^2)$ and independent of the $u_{it}$ . $u_{it}$ are non-negative random variables which are assumed to account for technical inefficiency in production and are assumed to be independently distributed as truncations at zero[13] of the N $(\mu_{it}, \sigma u^2)$ distribution which may be expressed as:

[12] Aigner, Lovell and Schmidt and Meeusen and Van den Broeck independently proposed in late 1970's the parametric frontier efficiency measurement approach known as SFA. Charneses et al, on the other hand, developed the nonparametric frontier efficiency measurement approach of DEA also in late 1970's

[13]The generalized truncated normal distribution assumption is chosen as it allows for wider range of distributional shapes and assumes inefficiencies.

$$\mu_i = \delta_0 + \sum_m \delta_m Z_{m,i} \quad (2)$$

**Table 1 Descriptive Statistics of Input and Output and z variables in the SPF Model**

| | ***Output*** | ***Labor*** | ***Capital*** | ***Deposits*** | ***Total Assets*** | ***Loan/Ass.*** | ***NPL/L*** |
|---|---|---|---|---|---|---|---|
| *Mean* | 10210794 | 4376 | 1554240 | 10027730 | 13150930 | 37.92 | 3.19 |
| *Median* | 2014074 | 1470 | 38733030 | 2220054 | 2817089 | 37.42 | 0.41 |
| *Maximum* | 89358017 | 23330 | 11208372 | 83911792 | 1.04E+08 | 73.25 | 71.07 |
| *Minimum* | 6584 | 14 | 6459 | 3088 | 24661 | 0.29 | 0.00 |
| *Std. Dev.* | 17350422 | 5696 | 2430043 | 16468913 | 21477022 | 19.81 | 10.83 |
| *Obs.* | 210 | 210 | 210 | 210 | 210 | 210 | 210 |

*Source: Author's Calculations*

## 3. Results and Discussions

The MLE of the parameters for the technical efficiency (TE) effects frontier of the SPF Model are all statistically significant. Capital has the highest impact on the TE of TBS, followed by deposits and marginally by labor as illustrated in table 2.

**Table 2 MLE of the TE Effects of the SPF Model**

| | ***Coefficient*** | ***Standard Error*** | ***t-statistics*** |
|---|---|---|---|
| $\beta_0$ | 0.23156340+01 | 0.38549454E+00 | 0.60069176E+01 |
| $\beta_L$ | 0.96025259E-01 | 0.48032699E-01 | 0.19991643E+01 |
| $\beta_C$ | 0.52183613E+00 | 0.42739383E-01 | 0.12209726E+02 |
| $\beta_D$ | 0.35244628E+00 | 0.45942283E-01 | 0.76715013E+01 |
| $\delta_0$ | 0.64498730E+01 | 0.88166882E+00 | 0.73155281E+01 |
| $\delta_{T.A}$ | -0.41894924E+00 | 0.70698588E-01 | -0.59258502E+01 |
| $\delta_{L/A}$ | -0.20932612E-01 | 0.73345615E-02 | -0.28539691E+01 |
| $\delta_{NPL/LOANS}$ | 0.10527920E-01 | 0.49848371E-02 | 0.21119889E+01 |
| $\sigma^2$ | 0.31925223E+00 | 0.74282720E-01 | 0.42977993E+01 |
| $\gamma$ | 0.80259122E+00 | 0.54143854E-01 | 0.14823312E+02 |

*Source: Author's calculations*

To test if Cobb-Doulas production functions is an adequate representation of the data, Ho: $\beta_{ij} \neq 0$ for all i≤j=1, 2, 3 is tested and rejected.[14] To test the null hypothesis that there is no

[14] $LL_{C-D}$ = -0.80552161E+02 and $LL_{TRANSLOG}$ = -0,21352541E+02

TIE in the Model, ***Ho***: $\gamma$ = 0 is tested and rejected. [15] $\gamma$ = 0.80259122E+00 (0.54143854E-01) indicates that the vast majority of residual variation is due to inefficiency effect $u_i$, and that the random error $v_i$ is rather low. The estimated $\delta_{T.A}$, $\delta_{L/A}$, $\delta_{NPL/LOANS}$ parameters of the TIE model are significantly different from 0. The coefficients of $\delta_{T.A}$ and $\delta_{L/A}$ are negative which indicate that the larger the values of T.A or size, and the L/A. ratio, the smaller the values of inefficiency effects will tend to be. The positive coefficient of $\delta_{NPL/LOANS}$ shows, as would be expected, that the larger the values of NPL/loans, the larger the inefficiency effects will be.[16] The MLEs of $\delta_{T.A}$ $\delta_{L/A}$ and $\delta_{NPL/LOANS}$ are larger relative to their standard errors. Ho: $\delta_{T.A}$, $\delta_{NPL/LOANS}$ $\delta_{L/A}$ = 0 are tested to see if their true value is 0 and Ho is rejected based on Log Likelihood (LL) estimates.[17] The MLEs disclose that the asset size has a high impact on the technical efficiency scores, whereas L/A and NPL/Loans ratios have quite minor impacts on the technical efficiencies of banks in Turkey.

The sub-prime crisis started to spread its effects to the developing world only in the third quarter of 2008. The global financial crisis hit the real sector in Turkey starting from the third quarter of 2008. The NPLs could have seriously affected the banks in Turkey but with the smoothing of the effects of the global crisis, this did not realize and the technical efficiencies of banks in Turkey have not been radically affected. Table 3 reveals the efficiency scores of bank groups in Turkey.

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$\lambda$ = -2((-0.80552161E+02)-( -0,21352541+02)) = 118,30

118.30 > upper 5% point for the $\chi^2_5$ distribution which is 11.07. ( $\chi^2_5$ is used as 5 regressors are restricted.)

[15] LR test of the one sided error is estimated as 0.10341340E+03.

[16] See Coelli, Battese (1998), Coelli (1996) and Demir, Mahmud, Babuscu (2005) for the above robustness tests.

[17] LL function without $\delta_{T.A}$ is = -0.10115289+E03, without $\delta_{L/A}$ = -0.89833898+E02 and without $\delta_{NPL/LOANS}$ = -0.82538818+E02 and these new LL functions are all smaller than the initial LL function. Otherwise, the concerned variables would be deleted from the model.

**Table 3 Technical Efficiencies of Banking Groups in Turkey**

| ***Banking Groups*** | ***2002*** | ***2003*** | ***2004*** | ***2005*** | ***2006*** | ***2007*** | ***2008*** | ***Group Eff*** |
|---|---|---|---|---|---|---|---|---|
| *State-owned (3)* | 0,87 | 0,87 | 0,90 | 0,89 | 0,91 | 0,92 | 0,93 | 0,90 |
| *Private commercial (10)* | 0,73 | 0,73 | 0,76 | 0,82 | 0,84 | 0,83 | 0,82 | 0,79 |
| *SDIF (1)* | 0,75 | 0,73 | 0,69 | 0,51 | 0,37 | 0,53 | 0,19 | 0,54 |
| *Foreign branch (5)* | 0,42 | 0,36 | 0,51 | 0,55 | 0,56 | 0,62 | 0,53 | 0,51 |
| *Foreign subsidiary (11)* | 0,52 | 0,58 | 0,72 | 0,75 | 0,81 | 0,78 | 0,80 | 0,71 |
| *Mean Efficiency (yearly)* | 0,62 | 0,63 | 0,72 | 0,75 | 0,77 | 0,77 | 0,75 | 0,72 |

*Source: Author's calculations* Note1: The numbers in brackets show the number of banks that are taken into estimations from each banking group. Note 2: SDIF (1) represents the bank that is still under the fund control.

The mean efficiency of TBS increased steadily from 2002 to 2006 but declined slightly in 2007 and 2008. The high technical inefficiencies of the TBS in 2002 can be explained with the crises of 2001 and the increasing efficiency scores with the through and radical restructuring. State-owned Turkish banks rank first in technical efficiency and the technical efficiencies of state-owned banks are neither affected in 2007 nor in 2008. This finding is closely linked to the total asset size of the state-owned banks. The radical restructuring in terms of number of personnel and number of branches in state-owned banks during the Banking Restructuring Period in Turkey apparently rendered the state-owned banks as the most efficient banks, which was not the case before the 2001 crisis. It seems that the restructuring was a much better solution compared to privatization for these state-owned banks after rather unsuccessful privatizations of some banks that had to be taken over by the Savings Deposit Insurance Fund in 2001 with huge burdens.

The private domestic commercial banks have high efficiency scores except one bank which is the only small private commercial bank with a low assets size. There have been only very minor declines in the technical efficiencies of private commercial banks both in 2007 and in 2008. The private commercial banks, the number of which decreased radically during the 2001 crisis, show that the remaining banks are seasoned robust private commercial banks.

The foreign bank branches in Turkey have comparatively the lowest technical efficiency scores among all the banking groups in the Turkish Banking Industry. Most of these banks are either affected in 2007 or in 2008 from the crisis but rather drastically. On the other hand, these banks demonstrate a very high level of volatility in technical efficiency from one year to the other. The technical efficiency scores of the foreign banks and branches are all in line with their sizes.

The mean technical efficiency of foreign bank subsidiaries in Turkey is estimated to be 71 % for the period of 2002-2008. The TE scores of foreign bank subsidiaries suggest that efficiency increased very fast since 2002, declined rather strongly in 2007 but continued to increase in 2008 and almost cached-up with the efficiency of private domestic banks by 2008 as shown in table 4.

**Table 4 Technical Efficiencies of Foreign Banks in Turkey**

| ***Banks*** | ***2002*** | ***2003*** | ***2004*** | ***2005*** | ***2006*** | ***2007*** | ***2008*** |
|---|---|---|---|---|---|---|---|
| *Foreign Bank Branch 1* | 0,2299 | 0,2793 | 0,4812 | 0,4636 | 0,745 | 0,7546 | 0,5395 |
| *Foreign Bank Branch 2* | 0,4836 | 0,3081 | 0,6964 | 0,7793 | 0,6715 | 0,7387 | 0,7884 |
| *Foreign Bank Branch 3* | 0,2558 | 0,2277 | 0,2481 | 0,1465 | 0,1199 | 0,1986 | 0,2749 |
| *Foreign Bank Branch 4* | 0,3244 | 0,2847 | 0,6482 | 0,7076 | 0,7536 | 0,9603 | 0,6534 |
| *Foreign Bank Branch 5* | 0,8165 | 0,702 | 0,4538 | 0,6679 | 0,5033 | 0,4256 | 0,3776 |
| *Foreign B. Subsidiary 1* | 0,4624 | 0,5211 | 0,5451 | 0,581 | 0,6075 | 0,5678 | 0,6768 |
| *Foreign B. Subsidiary 2* | 0,4502 | 0,5739 | 0,6741 | 0,6437 | 0,7527 | 0,6999 | 0,7888 |
| *Foreign B. Subsidiary 3* | 0,7249 | 0,808 | 0,7697 | 0,8339 | 0,8755 | 0,9267 | 0,9157 |
| *Foreign B. Subsidiary 4* | 0,1804 | 0,1675 | 0,8867 | 0,5139 | 0,7467 | 0,3205 | 0,4458 |
| *Foreign B. Subsidiary 5* | 0,8265 | 0,8291 | 0,8727 | 0,8929 | 0,8915 | 0,9159 | 0,9249 |
| *Foreign B. Subsidiary 6* | 0,73 | 0,7527 | 0,8204 | 0,8351 | 0,8878 | 0,8592 | 0,8814 |
| *Foreign B. Subsidiary 7* | 0,6758 | 0,7065 | 0,8219 | 0,8611 | 0,8942 | 0,8844 | 0,8674 |
| *Foreign B. Subsidiary 8* | 0,1619 | 0,1626 | 0,5522 | 0,8657 | 0,8463 | 0,7592 | 0,8482 |
| *Foreign B. Subsidiary 9* | 0,7142 | 0,841 | 0,8767 | 0,8864 | 0,9153 | 0,9198 | 0,9175 |
| *Foreign B.Subsidiary10* | 0,4495 | 0,4778 | 0,5243 | 0,5989 | 0,7746 | 0,8778 | 0,8943 |
| *Foreign B. Subsidiary11* | 0,3521 | 0,5646 | 0,5924 | 0,764 | 0,768 | 0,7894 | 0,6784 |

*Source: Author's calculations*

Seven of the foreign bank subsidiaries in Turkey used to be privately owned domestic banks before the 2001 crisis and during the restructuring period they changed ownership from domestic to foreign. Four of these banks prove the cream - skimming affect in bank M&As as their technical efficiencies were already high before the change of ownership.[18] These four banks continued to increase their efficiency at 90% levels even in 2007. The technical efficiencies of these four are either not affected from the global crisis or negatively affected only at a minor extent in 2007 or in 2008.The remaining three banks had very low efficiency scores in 2002- just after the crisis- and the TE of these banks in the course of time increased quite radically. These

[18] This finding is consistent with Poghosyan and Borovick (2006) who investigated the cream-skimming effect using a sample of 275 banks from 19 transition economies by implementing first a panel probit model and then a stochastic efficiency frontier function. Their findings put forward the fact that cream skimming effect is significant in transition economies.

foreign banks are affected either in 2007 or in 2008 from the global financial crisis. These banks now have high technical efficiencies proving the increase in efficiency due to foreign M&As.

The four greenfield investment banks had low efficiencies in 2002 and the technical efficiencies of these banks are all affected at a higher level from the global crisis, some showing declines both in 2007 and in 2008. The results again suggest a close link between the technical efficiencies of these banks and their sizes as the smallest two have the lowest efficiency scores. Two of these greenfield investment banks that are world-wide known multinationals had some problems in the parent company due to the global crisis; however, in line with the non-existence of serious cross-over effects, these banks do neither show serious declines in their technical efficiencies.

## 4. Conclusions

The study empirically investigated the impact of the global crisis on the technical efficiency of foreign banks in the TBS by applying SFA for the 2002-2008 periods. The TBS in general and the foreign banks in particular have been-at least so far- affected at a rather minor extent from the global crisis compared to the turmoil in the financial markets of the developed world. This outcome is the result of a combination of three interlinking facts.

First, the loan securitizations, the sub-prime loans, CDOs, the practice of selling the subprime loan tranches in the over-the-counter markets to SIVs are all inexistent in the bank-based developing Turkish financial markets. Hence the banks in Turkey were immune from the main source of the crisis. Second, the banks in Turkey had already lived a drastic banking crisis in 2001 and the remaining banks had been thoroughly restructured and strengthened with a new Banking Law that abolished almost all the practices that caused the 2001 crisis, with the establishment of a BRSA and the adaption of the bank regulations in line with that of the European Union. Third, there have been no serious cross-country affects of the crisis in conjunction with the multinational banks.

The TE in TBS increased steadily during the 2002-2008 period. The size has a high, positive and statistically significant relation with TE in TBS. The ranking of commercial banks in terms of TE as state-owned, private domestic and foreign did not change during the crisis. The State-owned banks have by far the highest efficiency scores compared to the other banking

groups and their efficiency has not decreased during the global crisis period. This may be explained by the immediate radical reforms during restructuring and by their size advantage and serves as a good example of restructuring versus privatizing. The private domestic commercial banks have high TE scores and affected only at a minor extent from the crisis.

The empirical results reveal that the TEs of foreign bank subsidiaries steadily increased since the 2001 crisis, hit in 2007 but cached-up the TEs of domestic private commercial banks by 2008. The foreign bank branches have the lowest and the most volatile technical efficiency scores among all the banking groups in the TBS. Most of these banks are affected from the crisis rather drastically.

Turkish Banking Industry serves as a good example to investigate the impacts of financial market developments in developing countries of the last couple of decades, in terms of liberalization, privatization, crises, restructuring and M&As. This empirical investigation enables us to draw out certain policy suggestions for the Turkish Banking Industry. The comparison of TEs and the impact of the crisis on the technical efficiencies render the establishment of foreign bank subsidiaries with M&As more rational than foreign bank greenfield investments and foreign bank branches. Capital has the largest impact on the TE of banks. TE and size of banks are positively and closely interlinked. Restructuring of state-owned banks may prove better results than privatization. Banks in Turkey have still potential- some even larger - for improvement in terms of technical efficiency.

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