Ownership Structure and Efficiency of Tunisian Banking Sector

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Abstract

In this paper, we'll try to study the impact of ownership structure (state owned/private) of banks in Tunisia on its level of cost efficiency. While, we have proposed an assessment of the cost efficiency of Tunisian banks during the period 1999-2009 on a sample of 17 universal banks using a stochastic frontier model (SFA). We introduced in the translog cost function of the external variables related to the environment in which banks operate in order to know whether these variables affect the cost efficiency scores of banks or not. Overall, our results demonstrate that environmental variables contribute significantly and positively to the difference cost-efficiency scores between Tunisian banks. Also, our results show that private banks in Tunisia are more efficient than public banks, but there are differences among private banks. Privatized banks with majority foreign ownership are the most efficient while those with domestic ownership are the least.

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1 Introduction

In the early 90s, and with globalization, deregulation and technological advances experienced by the world, it is important to have a robust banking sector that is able to boost economic growth and development. However, the establishment of a strong banking sector that meets the requirements of the economy, needs a better allocation of financial resources and a well-defined regulatory framework to enable the banking sector to fulfill its role.

For these reasons, the State finds that it is legitimate to intervene in the banking sector to compensate for the lack of private initiative in the latter. Therefore, the regulations imposed by public authorities about the ownership of bank capital are often justified by the need to prevent concentration of economic power in the hands of a certain number of people, but this does not prevent the willingness of public authorities to have a grip on banks.

For some economists, this massive intervention of the state in bank capital may have a negative effect on bank efficiency. By definition the efficiency is the ability of banks to manage its resources with minimal cost to benefit from economies of scale.

For a long time, ownership of banking firms was a center of interest for economists. Previously, some economists have favored state ownership of banks because of imperfections and externalities that prevail in the financial market. In addition, the State was considered the only active player in the economy.

Indeed, these economists failed to anticipate the great failure of such property, where it seems clear from the substituted private property has become a source of motivation for innovation and efficiency. Given this new role and conditions under which banks operate, economists encourage reducing the role of the state and increasing private sector participation in the economic game.

In most developing countries, banks are still state-controlled. Tunisia is a developing country that has followed since the 80's outgoing economic policy while betting on its banking sector. Indeed, the Tunisian banking sector forms the core of the financial system the fact that, mainly the Tunisian business financing is done through bank loans.

However, despite this heavy weight of the banking intermediation for the financing of the Tunisian economy there is the presence of weak signals such as low levels of profitability, liquidity and capitalization. This imposes the study of the determinants of bank efficiency by examining essentially the impact of state participation in bank capital. At the theoretical reviews and empirical work, there is consensus on the positive impact of privatization on the efficiency of banks in several countries studied whatever developed or developing countries.

The purpose of our work fits into this field of research, to assess and measure the impact of ownership structure on the efficiency of Tunisian banks during the period 1999-2009. Our work focused on a specific well determinant of the efficiency which is ownership structure state owned/private bank. So our

problem is as follow: What is the impact of ownership structure on the efficiency of Tunisian banks?

The remainder of the paper is organized as follows: section 2 provides a review of the related literature. In section 3, we discuss the methodology and the econometric specification used to estimate the cost function. The data and variables are reported in Section 4. Section 5 reports the empirical results of the estimation. The paper's concluding remarks are provided in Section 6.

2 Brief literature reviews

Over the last two decades, there is growing literature on the efficiency of financial institutions. This literature shows that a majority of studies focused on cost efficiency. Empirical works concerning the measurement of bank efficiency are numerous and the results obtained differ from one country to another and from one bank to another and the period in which the studies have been performed.
Bhattacharya et al. (1997) through their empirical studies have examined the efficiency of 70 public banks, private Indian and foreign during the liberalization period (1986-1991) using the nonparametric approach DEA. Their result indicates that the Foreign owned banks are found to be somewhat more efficient than privately-owned domestic banks but government-owned banks are more efficient than both

Belén Villalonga (2000) through her study of public-private ownership and the relationship privatization-efficiency examined the efficiency of 24 Spanish companies that were privatized between 1985 and 1993. She confirmed the superior efficiency of private property (as opposed to public ownership) companies in Spain.

Barth et al. (2000), who have tried to present the impact of state ownership on bank efficiency in different countries. They concluded that the existence of a significant number of public banks in one country can negatively influence the efficiency of the banking system in general.

Philippatos and Yildirim (2003) used the parametric technique, SFA and DFA, to analyze the cost efficiency in the banking sector of 12 European transition nations for the financial year 1993/2000. Their findings indicate that, Foreign banks are more cost efficient but less profit efficient than domestically-owned private banks and state-owned banks.

Hasan and Morton (2003) investigated the cost efficiency of 193 banks in Hungary over the years 1993–1997 using a stochastic frontier model SFA. They found that the Foreign banks and banks with higher foreign ownership involvement are associated with lower inefficiency

Bonin et al. (2005), employed the stochastic frontier approach to examine cost efficiency in the banking systems of the 11 European transition nations over the period 1996–2000. They found the cost-efficiency scores of Foreign-owned banks are more cost efficient than other private banks.

Berger et al. (2005), from a study of Argentine banks during 1993-1999, show that the efficiency of state banks in the long run is lower compared to those of private banks. They showed, too, that banks selected for privatization have low levels of performance and that performance increases significantly after privatization.

Nakane and Weintraub (2005) studied the productivity of 242 Brazilian commercial banks during the period 1990-2002. The authors find that the ownership structure and bank size are important determinants of productivity. In particular, they found that public banks are less productive than private banks and that privatization greatly increases the productivity.

Fries and Taci (2005) employed the stochastic frontier approach to examine cost efficiency in the banking systems (289 banks) of the 15 East European countries over the period 1994–2001. They included several environmental variables (country-level variables) in the estimation of the cost function. They found that banking systems with a higher intermediation ratio have significantly lower costs. And a higher share of non-loan assets in total assets of a bank is positively associated with higher costs. They also found a significant positive association between GDP per capita and banking costs but no association between inflation and costs. Their findings are also, private banks are more efficient than state-owned banks, and privatized banks with majority foreign ownership are the most efficient and those with domestic ownership are the least. Berger et al. (2007), studied the influence of public ownership on efficiency of 38 Chinese commercial banks between 1994-2003. They found that the reduction of public ownership in the banking sector is favorable for improving its effectiveness. In addition they noted that most foreign banks have a high level of profit efficiency and that the level of efficiency of public banks has improved after the privatization process.

3 Methodology

This paper utilizes the stochastic frontier approach (SFA), as developed by Aigner et al. (1977) and applied to banks by Ferrier and Lovell (1990) to calculate measures of cost efficiencies for each bank in the sample. The stochastic cost frontier has the following general form:

$$TC_{it} = f(p_{it},\, y_{it},\, z_{it}\,;\, B) + \varepsilon_{it}, \qquad i = 1, 2, \ldots, N, \ \ t = 1, 2, \ldots, T \qquad (1)$$

The model can also be re-specified in log linear form as:

$$\ln TC_{it} = \ln f(p_{it},\, y_{it},\, z_{it}\,;\, B) + \varepsilon_{it} \qquad (2)$$

where
i, t index the bank and year, respectively,
TC represents the bank's total costs in logarithm form,

p is a vector of input prices in logarithm form,
y is a vector of outputs in logarithm form,
z is country-specific environmental variables,
B is a vector of all parameters to be estimated,
ε is an error term,
N is the number of banks,
T is the number of years.

This approach disentangles the error term in two components: component of inefficiency and a component of random error.

$$\varepsilon_{it} = \vartheta_{it} + \mu_{it}$$

The first one, μ_i captures cost inefficiency. The second one, ϑ_i captures measurement error and random effects, good and bad luck. It is assumed that ϑ_i is distributed as a symmetric normal $\vartheta_i \sim N(0, \sigma_\mu^2)$ and that μ_i is identically distributed as a half-normal $\mu_i \sim N(0, \sigma_\vartheta^2)$. Also, ϑ_i is distributed independently of μ_i. The stochastic frontier approach supposes that $\mu_i \geq 0$ and that is, higher bank inefficiency is associated with higher cost.

For our cost efficiency function, we use the transcendental logarithmic specification. Which can be specified as follows:

$$\ln TC_i = a_0 + \sum_i a_i \ln p_i + \sum_j \beta \ln Y_j + \frac{1}{2} \sum_i \sum_m a_{im} \ln p_i \ln p_m$$
$$+ \frac{1}{2} \sum_j \sum_k a_{jk} \ln Y_j \ln Y_k + \sum_i \sum_j \delta_{ij} \ln p_i \ln Y_j + \sum_i \varphi_i$$

(3)

where p_m and p_i are input prices and Y_j and Y_k are outputs quantities. In estimating Eq. (1) with this specific functional form, we impose constraints on symmetry

$$a_{im} = a_{mi} \text{ and } \delta_{ij} = \delta_{ji}, \ \forall \ i, j,$$

homogeneity in prices, and adding-up,

$$\sum_m a_{im} = \sum_m a_{mi} = \sum_j \delta_{ij} = 0, \ \forall \ i$$

We follow Jondrow et al. (1982) that showed that the variability, σ, can be used to measure a firm's mean efficiency, where. Firm-level measures of inefficiency are usually given by the mean and mode of the conditional distribution of μ_i given ε_i. Jondrow et al. (1982), an estimate of the bank level inefficiency measures can be derived from the composite error term as follows:

$$E(\mu_i / \varepsilon_i) = E_i = \frac{\sigma\lambda}{1+\lambda^2} \left(\frac{\varnothing(\frac{\varepsilon_i\lambda}{\sigma})}{\Phi(\frac{\varepsilon_i\lambda}{\sigma})} + \frac{\varepsilon_i\lambda}{\sigma} \right)$$

where, E_i is the inefficiency level of the ith bank, $E(\mu_i / \varepsilon_i)$ is the expectation operator. The general procedure for estimating cost inefficiency from Eq. (3) is to estimate equation coefficients and the error term

$$\varepsilon_{it} = \vartheta_{it} + \mu_{it}$$

and to calculate efficiency for each observation in the sample.

4 The Data and Variables

4.1 Data

In this research, the data is taken from Tunisia's Professional Association of Banks and Financial Institutions APTBEF, which collect and publish yearly the balance sheets and other information on the Tunisian banking activities, the National Institute of Statistics (INS).and the Central Bank of Tunisia (BCT). We will give estimates of cost efficiency via a sample of 17 Tunisian universal banks observed. These banks are International Banking Union (UIB), Banking Union for Trade and Industry (UBCI), Attijari Bank Of Tunisia (ATTIJARI BANK), National Agricultural Bank (BNA), Arab International Bank Of Tunisia (BIAT), Amen Bank (AB), Tunisian Banking Company (STB), Bank of Tunisia (BT), Arab Tunisian Bank (ATB), Bank of Housing (BH), Tunisia And Emirates Bank (BTE), Franco-Tunisian Bank (BFT), Tuniso-Kuwaiti Bank (BTK), Citibank, Stusid Bank, Tunisian Qatari Bank (TQB), Tuniso-Libyan Bank (BTL). Four universal banks were not retained Bank for Financing Small/Medium Businesses (BFPME), Arab Banking Corporation (ABC), and Tunisian Solidarity Bank (BTS). The data are annual covering the period 1999-2009.

4.2 Variable outputs and inputs

One of the crucial issues to build a model for the assessment of banking efficiency is the identification of appropriate inputs and outputs. Five approaches are well established in the banking literature, and they are usually used in production/cost banking studies. These are the production, the intermediation, the asset, user-cost and value-added approaches. In the present study, the choice of cost, price and output variables included in the specification is determined by the availability of data and by our view on the way that banks operate and what they

produce. In this paper we follow the value-added approach (see, Berger and Humphrey (1992), Humphrey and Pulley (1997), Dietsch and Lozano-Vivas (2000), Carvallo and Kasman (2005)) to identify banking outputs and inputs. Therefore, this study considers deposits as input and output at the same time. This choice is justified by the fact that in the Tunisian context, the banking sector operates with a logic where the banks use the labor and capital factors to collect deposits, and at the same time use the funds at their disposal (the sum of deposits) to pursue a massive policy of loans. It seems more logical that the deposits of Tunisian banks are read as an input and an output at the same time. Furthermore, the specification assumes three input prices and three output quantities. The first input price is the price of labor. This price is defined as the ratio of personnel expenses (PE) scaled by total assets (TA). The second input price is the price of physical capital. This price is calculated by dividing fixed capital depreciation by fixed assets. The third input price is the price of purchased funds. This price is calculated as the ratio between total interest expenses and total deposits. The outputs estimated in the value-added approach are: 'total deposits'; and 'total loans'.

4.3 Environmental Variables

As in Dietsch and Lozano-Vivas (2000), Carvallo and Kasman (2005), Environmental variables are categorized in three groups. The first group is called "main conditions" and includes a measure of density of population and income per capita. The income per capita of a country, however, affects numerous factors related to the demand and supply for deposits and loans. Because a high level of GDP per capita in a country affect positively savings and the repayment capacity of households. Thereafter, it has a positive effect on bank efficiency. Finally, the density of population is measured by the ratio of inhabitants per square kilometer. We suppose that banking services supply in areas of high population density would engender lower banking costs.

The second group of environmental variables, named "bank structure and regulation" includes an average capital ratio, and intermediation ratio. The average capital ratio is calculated as the ratio between total capital stock (TCS) and total assets (TA). A low Average capital ratio could generate higher banking costs. Usually, an inverse relationship exists between inefficiency and average capital ratio (Carvallo and Kasman, 2005) "because less equity implies higher risk taken at greater leverage" (Dietsch and Lozano-Vivas, 2000). Therefore, a lower capital ratio leads to lower efficiency levels. The second type intermediation ratio is calculated by dividing total loans by total deposits. Higher intermediation ratio could be associated with lower costs of the banking sector, this situation generate higher banking efficiency. For this reason, we will anticipate an inverse relationship between intermediation variable and inefficiency. The intermediation

variable captures the ability of domestic banking industries to convert deposits into loans.

The final group of environmental variables named "financial performance" consists of variables such as return on assets (ROA = net income/total assets), return on equity (ROE = net income/capital stock) and non-performing loans (NPL). Usually, the level of non-performing loans (NPL) is positively related to bank inefficiency. Finally, an inverse relationship exists between ROE, ROA and bank inefficiency.

5 Empirical results

5.1 The Efficiency Correlates

In our empirical work we measure the cost efficiency of Tunisian universal banks during the period 1999-2009 through the SFA method. We will consider the environmental variables in our estimation to assess their influence on the efficiency levels of banks, thus, the efficiency scores are estimated using the software R version 2.11.1.

The following table summarizes the average values of different variables to be used in the model. It presents the estimation results of the cost frontier. Overall, the estimation results show good fit and the signs of the variables are in line with other studies and the theory.

The estimation results reveal a number of important characteristics of the cost function of banks and the correlates of bank inefficiencies in Tunisian economy. Most coefficients for input prices and output have a positive sign, and are statistically significant at the 0%, 0.1%, 1% and 5% significance level.

All coefficients for input prices and output have a positive sign. The price of labor and the price of physical capital are significant but and the price of funds is not significantly related to costs. The loans variable is significantly but the deposit variable is not significantly related to costs. It seems, however, as if, in general, higher prices or higher output generate higher total costs.

Half of the coefficients on the environmental variables in the estimation of the cost function are statistically significant at the 0.1% and 5% confidence level. The coefficient estimate of the per capita income is negative and statistically not significant. Therefore, it has a partial effect on the endogenous variable. This implies that an increase in GDP lowers total costs and increase cost efficiency. The high level of per capita income affect positively the saving (S) and it has a positive effect on the capacity of household repayment, and thereafter generate a positive effect on the banking efficiency and increase cost efficiency. The coefficient on density of population is significantly negative and indicates that banking services supply in areas of low population density would engender higher banking costs, thereafter generate a negative effect on the banking efficiency and reduce cost efficiency.

Table 1: Parameter estimates

Variable	Coefficient	Standard Error	z value	Pr(>|z|)
(Intercept)	-1.8705962	1.4161312	-1.3209	0.186528
Ln P1	0.3008485	0.1641317	1.8330	0.066807.
Ln P2 Ln Y1	0.0299879	0.0141458	2.1199	0.034014 *
Ln P3	0.2141552	0.1772052	1.2085	0.226849
Ln DP	-0.8796345	0.3009654	-2.9263	0.003091.
Ln NPL	0.0792104	0.0291244	2.7197	0.006534 **
Ln P1 Ln P1	0.0389793	0.0118848	3.2798	0.001039 **
Ln P1 Ln P2	-0.0488731	0.0213202	-2.2923	0.021886 *
Ln P1 Ln P3	-0.2531849	0.0207821	-12.1829	< 2.2e-16 ***
Ln P1 Ln Y1	0.2276029	0.0160253	14.2028	< 2.2e-16 ***
Ln P1 Ln Y2	-0.2212200	0.0152104	-14.5440	< 2.2e-16 ***
Ln P2	0.4386608	0.1100579	3.9857	6.727e-05 ***
Ln P2 Ln P2	0.0134447	0.0044071	3.0507	0.002283 **
Ln P2 Ln P3	-0.0666682	0.0137114	-4.8623	1.161e-06 ***
Ln P2 Ln Y2	-0.0225105	0.0148318	-1.5177	0.129084
Ln P3 Ln P3	0.1192338	0.0089482	13.3249	< 2.2e-16 ***
Ln P3 Ln Y1	-0.2277194	0.0188760	-12.0640	< 2.2e-16 ***
Ln P3 Ln Y2	0.2634313	0.0133160	19.7831	< 2.2e-16 ***
Ln PIB/H	-0.0269522	0.0169328	-1.5917	0.111450
Ln RCM	-0.0195992	0.0090261	-2.1754	0.030832.
Ln RI	0.0011939	0.0070206	0.1701	0.864965
Ln ROA	-0.0090780	0.0057633	-1.5751	0.115228
Ln ROE	-0.0097735	0.0044181	-2.2105	0.027126.
Ln Y1	0.4859460	0.1934302	2.5123	0.011996 *
Ln Y1 Ln Y1	0.1349659	0.0159910	8.4401	< 2.2e-16 ***
Ln Y1 LN Y2	-0.2705731	0.0236485	-11.4415	< 2.2e-16 ***
Ln Y2	0.3105944	0.1695806	1.8315	0.067019
Ln Y2 Ln Y2	0.1468898	0.0085304	17.2196	< 2.2e-16 ***
sigmaSq	0.0206800	0.0156417	1.3221	0.186132
gamma	0.9561888	0.0367181	26.0413	< 2.2e-16 ***
time	-0.0035914	0.0130181	-0.2759	0.782639

'***'significant at 0.00 level ; '**' significant at 0.001 level
'*' significant at 0.0 1 level; '. ' significant at 0.05 level

The coefficient estimate of the return on equity (ROE) is negative and statistically significant at 5% level of significance, and indicates that banks with greater ROE exhibit lower level of inefficiency and increase cost efficiency. On the other hand, the coefficient of the return on assets (ROA) variable is negative, though not statistically significant. Higher ROA level generates higher cost efficiency. The non-performing loans (NPL) are significantly negative, suggesting that a high level of (NPL) generates higher cost inefficiency, which might suggest riskier banks are also more inefficient.

Similarly, we find that the coefficient estimate of average capital ratio is negative and statistically significant at 5% level of significance. This implies that an increase in average capital ratio lowers total costs and increase cost efficiency. Moreover, we observe a positive and statistically not significant relationship between cost and the intermediation ratio. Therefore, its affect partially the total cost. A higher amount of loans per unit of deposits thus increases banking costs and reduce cost efficiency.

Table 2: Average cost efficiency scores, 1999–2009

banks	Average cost efficiency
AB	0,882002655
ATB	0,972587627
Attijari Bank	0,924679618
BFT	0,661201064
BH	0,963158945
BIAT	0,972990482
BNA	0,736057682
BT	0,897569391
BTE	0,766223091
BTK	0,821161982
BTL	0,758401691
BTQ	0,692515264
CITI BANK	0,970047927
STB	0,938175027
SUSID BANK	0,8541905
UBCI	0,962673536
UIB	0,939155573
Average	0,865458356

We found an average cost-efficiency scores between 66,12% (BFT) and 97,29% (BIAT) with an average of 86,5%. In detail, the results illustrate that the average cost inefficiency score in Tunisia is 13,5%, indicating that the average bank in the sample could reduce its cost by 13,5% if it was to match its performance with the best-practice bank.

Several arguments can be provided to explain the level of cost inefficiency in the banking industry in Tunisia. This level inefficiency can be explained by the support policy implemented by the Central Bank of Tunisia (BCT) to banks that carry a high level of non-performing loans (NPL).

Table 3: Evolution of non-performing loan ratio

Years	1999	2000	2001	2002	2003	2004
NPL %	18,8	21,6	19,6	20,8	23,9	23,7
Years	2005	2006	2007	2008	2009	-
NPL %	20,9	19,3	17,6	15,5	13,2	-

Source: The Annual Report of the Central Bank of Tunisia (BCT) and
Tunisia's Professional Association of Banks and
Financial Institutions APTBEF

The lack of transparency and its insufficiency resulting from the political pressure that dominates the state investment decisions, creates an environment of uncertainty in expectations of banks, which leads them to overestimate the quality of projects proposed to it, this situation pushes banks Tunisian to continue to be obstructed by large volumes of non-performing loans (NPL), which constitute the main source of inefficiency and vulnerability of the Tunisian banks. It is necessary to mention that these banks benefit from the intervention policy of the central bank as a last resort ultimately hampering any effort to minimize cost. The bad portfolio quality of the Tunisian banking sector with reference to the high volume of non-performing loans (NPL), generate low profitability of banks Tunisian compared to international standards.

Table 4: Average cost efficiency by capital structure

Private banks		Public banks	
banks	cost efficiency	banks	cost efficiency
ATB	0,972587627	BNA	0,736057682
Attijari Bank	0,924679618	BH	0,963158945
UBCI	0,962673536	STB	0,938175027
UIB	0,939155573	BFT	0,661201064
CITI BANK	0,970047927	BTE	0,766223091
BTK	0,821161982	BTL	0,758401691
BIAT	0,972990482	BTQ	0,692515264
AB	0,882002655	SUSID	0,8541905
BT	0,897569391	BANK	
Average	0,926985421	Average	0,796240408

Table 4 presents the average cost efficiency of Tunisian banks by capital structure. The results indicate that publics banks (79.62%) are, in general, less cost efficient than private banks (92.69%). This classification can be explained by the fact that the majority of the public banks in Tunisia that are currently created to promote some political agenda. In addition, the low level of cost efficiency of public banks is essentially comes back to the specialization of these banks, in spite of the enactment of the law 2001-65 of 10 July 2001 which consists of the universality of banking. The big bank National Agricultural Bank (BNA) has a low score of cost efficiency, and it was a bank that specializes in agricultural loans, the sector is the main source of increased bad debts with the tourism sector. Moreover, this inferiority efficiency score of public banks can be explained by the bad organization of these, because of the insufficiency of the competitive spirit. It is necessary to mention here, that the public banks constitute a sector where the role of the state is primordial. Subsequently, it exerts forces regulation and a protection for public banks, which do not put them under an obligation to act in an efficient manner.

Also, the public banks have the highest volumes of NPLs 38% for STB and 34.8% for the BNA in 2007. Thereafter, they are less efficient than those of the private banks that have the lowest volume of NPL, with 7% for BT or 16.5% for UBCI. The three public banks BNA, STB and BH, were burdened for a long time

by debts of state, also, these banks are submitted to a public control, which can lead to decrease the efficiency level.

This policy of financing of real estate, agriculture and tourism sectors (40% of loans to the tourism sector are considered non-performing), through the pursuing a policy of easy credit, contributed to the heaviness of non-performing loans (NPL).

We remark that if we go beyond an analysis by bank, we find that it is possible to derive values rather higher for certain public banks than private banks. For this, we decompose the state banks into two categories: public banks mixed (Public banks owned wholly or mainly to the Tunisian state in association with foreign states) and public banks domestic (Public banks owned wholly or mainly to Tunisian state and Tunisian enterprises). Also, we decompose the private banks into two categories: Privatized bank, foreign (Private banks, foreign bank subsidiaries) and privatized bank, domestic (Private banks, other than subsidiaries of foreign banks).

Table 5: Average cost efficiency by ownership structure

Private banks		Public banks	
Privatized bank, foreign	Privatized bank, domestic	Public bank, mixed	Public bank, domestic
0,931717711	0,917520842	0,767832636	0,82464818

The empirical analysis suggests that, on average, private banks with foreign ownership are the most efficient (93.17%) and those private banks with domestic ownership are the least (91.75%). This superiority efficiency score of foreign banks can be explained by better resource management and better organization of foreign banks through the spirit of know-how. Finally, Public bank, domestic are significantly more efficient than Public bank, mixed.

6 Conclusion

Tunisia has adopted significant banking sector reforms over the last 20 years, especially since the signature of the Association Agreement between Tunisia and the European Union in 1995, which includes partially privatizing of their banking system. The main objective of this paper is to examine the influence

of ownership structure on the bank efficiency of 17 Tunisian universal banks over the period 1999–2009 using a stochastic frontier model.

The results indicate that private banks are significantly more cost efficient than public banks, but there are differences among private banks. Privatized banks with majority foreign ownership are the most efficient and those with domestic ownership are the least. Also public banks with majority domestic ownership are more efficient and those with mixed ownership are the least.

This paper also investigates the sources of inefficiency. It indicates generally the deterioration of different financial indicators of Tunisian banking system. Tunisian banks continue to be obstructed by large volumes of non-performing loans (NPL), which constitute the main source of their inefficiency and their vulnerability. The bad portfolio quality with reference to the high volume of NPL, generate low profitability of Tunisian banks compared to international standards.

References

[1] D. Aigner, C.A.K. Lovell and P. Schmidt, Formulation and estimation of stochastic frontier production function models, *Journal of Econometrics*, **6**, (1977), 21-37.

[2] T.A. Barry, L. Lepetit and A. Tarazi, Ownership structure and risk in publicly held and privately owned banks, *Journal of Banking and Finance*, **35**, (2011) 1327-1340.

[3] J. Barth, G. Caprio and R. Levine, Banking systems around the globe: Do regulation and ownership affect performance and stability?, *Policy Research Working Paper*, **2325**, (2000).

[4] Belén Villalonga, Privatization and efficiency: differentiating ownership effects from political, organizational, and dynamic effects, *Journal of Economic Behavior and Organization,* **42**(1), (2000), 43-74.

[5] A.N. Berger, G.R.G. Clarke, R. Cull, L. Klapper and G.F. Udell, Corporate governance and bank performance: A joint analysis of the static, selection, and dynamic effects of domestic, foreign, and state ownership, *Journal of Banking and Finance*, **29**, (2005), 2179-2221.

[6] A.N. Berger, I. Hasan and M. Zhou, Bank ownership and efficiency in China: What will happen in the world's largest nation?, *Journal of Banking and Finance*, **33**, (2009), 113-130.

[7] A.N. Berger, I. Hasan and M. Zhou, Bank ownership and efficiency in China: what lies ahead in the world's largest nations, *Bank of Finland Research Discussion Papers*, **16**/**2007**, (2007).

[8] A.N. Berger and D.B. Humphrey, *Measurement and efficiency issues in commercial banking*, in Z. Griliches, (Ed.), *Output Measurement in the Service Sectors*, vol. **56**, National Bureau of Economic Research Studies in Income and Wealth, The University of Chicago Press, Chicago, p. 245-279, 1992.

[9] A. Bhattacharya, C.A.K. Lovell and P. Sahay, The impact of liberalisation on the productive efficiency of Indian commercial banks, *European Journal of Operational Research*, **98**, (1997), 332-345.

[10] J.P. Bonin, I. Hasan and P. Wachtel, Bank performance, efficiency and ownership in transition countries, *Journal of Banking and Finance*, **29**, (2005), 31-53.

[11] O. Carvallo, and A. Kasman, Cost efficiency in the Latin American and Caribbean banking systems, *Journal of International Financial Markets Institution and Money*, **15**, (2005), 55-72.

[12] M. Dietsch and A. Lozano-Vivas, How the environment determines banking efficiency: A comparison between French and Spanish industries, *Journal of Banking and Finance*, **24**, (2000), 985-1004.

[13] G.D. Ferrier and C.A.K. Lovell, Measuring cost efficiency in banking: Econometric and linear programming evidence, *Journal of Econometrics*, **46**, (1990), 229-245.

[14] S. Fries and A. Taci,. Cost efficiency of banks in transition: Evidence from 289 banks in 15 post-communist countries, *Journal of Banking and Finance*, **29**, (2005), 55-81.

[15] M. Garcı´a-Cestona and J. Surroca, Multiple goals and ownership structure: Effects on the performance of Spanish savings banks, *European Journal of Operational Research*, **187**, (2008), 582-599.

[16] I. Hasan and K.Marton, Development and efficiency of the banking sector in a transitional economy: Hungarian experience, *Journal of Banking and Finance*, **27**, (2003), 2249-2271.

[17] G. Iannotta, G. Nocera and A. Sironi, Ownership structure, risk and performance in the European banking industry, *Journal of Banking and Finance*, **31**, (2007), 2127-2149.

[18] J. Jondrow, C. Lovell, I. Materov and P. Schmidt, On the estimation of technical efficiency in the stochastic frontier production function model, *Journal of Econometrics*, **19**, (1982), 233-238.

[19] Y.-S. Kang and B.-Y. Kim, Ownership structure and firm performance: Evidence from the Chinese corporate reform, *China Economic Review*, **23**, (2012), 471-481.

[20] X. Lin and Y. Zhang, Bank ownership reform and bank performance in China, *Journal of Banking and Finance*, **33**, (2009), 20-29.

[21] M.I. Nakane and D.B. Weintraub, Bank privatization and productivity: Evidence for Brazil, *Journal of Banking and Finance*, **29**, (2005), 2259-2289.
[22] H.S. Yildirim and G.C. Philippatos, Efficiency of Banks: Recent Evidence from the Transition Economies of Europe--1993-2000, *Working Paper*, University of Saskatchewan, (2003), www.yorku.ca/yildirim/CEEefficiency.pdf.