Cost Efficiency of the Syrian Banking Sector: Using Parametric and Non-Parametric Analysis

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Abstract

This study aims at measuring the cost performance efficiency of Syrian banking sector during the period 2006-2010. The selected period has been going through a lot of reforms to build an effective, efficient, competitive, and stable banking system. The study employs both parametric Stochastic Frontier Analysis (SFA), and non-parametric Data Envelopment Analysis (DEA). These methods are used to evaluate the cost efficiency of Syrian banks. The study utilizes a one stage SFA model that includes input, outputs and the environmental variables (ownership structure, size, deregulation, market structure, and capital ratio) of cost efficiency measurements. Moreover, the traditional DEA model has been used with the aim of comparing the results of the SFA model. The results of SFA analysis indicate that the cost efficiency of Syrian banks is estimated to be, on average, 58.8%, while the DEA model results shows an average of 69.5%, the results also show that private banks are more efficient than state-owned banks using both SFA and DEA analysis. The study also found that large banks are more efficient than smaller banks.

Keywords: Cost efficiency, Data Envelopment Analysis, Stochastic Frontier Analysis, Syrian Banking Reform.

1. Introduction

Financial institutions including banks play a major role in the economies of all countries around the world, particularly those countries that pursue policies of the open economy, hence, and with no doubt the efficiency of banking institutions are of a great importance, and vital requirements to guarantee positive contribution towards economic growth. Given the rapid changes facing banking institutions, with the competitive pressures at local and global levels, banks' management always seek to find alternative solutions to reduce the costs of providing services and enhance the production efficiency process. The banking sector in Syria has been facing a number of challenges, and has been a part of a new era of open economy, a process which has started in the year 2001. Investigating the Syrian bank efficiency helps in shedding light on the banking sector performance and enables decisions to foresee the sector contribution to the future development of the Syrian economy.

The reforms of the Syrian economy system which began in 2001(According to Law 28 of 2001) has included the establishment of private banks in Syria with the aim of moving the country from a "planned economy supplemented with some market elements" to a "socialist market economy". As a part of these national economic reforms, the Syrian government has also liberalized and deregulated the operations of the Syrian banking sector. The liberalization and deregulation program applied on the Syrian banking sector includes amongst other things: removing the credit ceiling on deposits and loans, reducing the systemic risk of the banking sector, gradually privatizing state-owned banks, encouraging state-owned banks to seek listing on the stock exchange and relaxing foreign bank entry into the local market (According to Law 28 of 2001).[(1)] An officially stated objective of the liberalization and deregulation program is to enhance the efficiency and productivity levels of the Syrian banking sector. Therefore, it is important to investigate the efficiency levels of Syrian banks over the reform period. Assessing the effects of the liberalization and deregulation program on Syrian banking efficiency will enable banks' management to improve the way in which they allocate resources across the various investment opportunities available to them. This study adds to the limited literature that compares the cost efficiency results derived from the two most widely used approaches with bank efficiency measurement, namely the stochastic frontier approach (SFA), a parametric approach, and data envelopment analysis (DEA), a non-parametric approach. The rationale for using two different methods is well described by (Berger, and Humphrey 1997), who suggest that

1 http://www.banquecentrale.gov.sy/

policy and research issues that rely upon firm-level of efficiency estimates may be more convincingly addressed if more than one frontier technique is applied on the same set of data to demonstrate the robustness of the explanatory results obtained. In other words, while each of the two approaches nurtures its own theoretical discourse, they should not be viewed as mutually exclusive but, more complementary methods.

2. Literature Review

Shrimal et al., (2007) paid attention to cost efficiency of commercial banks in South Asian countries namely Bangladesh, India, Pakistan and Srilanka over1997-2004, focusing on effects of bank size, state ownership and stock exchange listing on efficiency performance. The results show that, the average efficiency of South Asian banks declined over the 1997–2004 period from 0.9096 in 1997 to 0.8956 in 2004. Among the four countries, Indian banks were found to be the most efficient, while Sri Lankan banks the least efficient. The result also revealed that the state- owned banks are less efficient than private ones, **Yao et al., (2007)** argue that ownership reforms and hard budgetary constraints may be important for raising Chinese banking efficiency levels. .The empirical results show that the average level of technical efficiency over the sample period is about 63%. (Yao et al., 2007) find that Chinese joint-stock banks are more efficient than their state-owned counterparts, **Ariff and Can (2008**) use the DEA technique to investigate the cost and profit efficiency of 28 Chinese commercial banks over the period from 1995 until 2004. They show that the overall cost efficiency score (79.8%) is much higher than the overall profit efficiency score (50.5%), suggesting that the most important inefficiencies are on the revenue side, **Berger et al., (2009)** use the stochastic frontier approach to analyze the profit and cost efficiency of Chinese banks over the period from 1994 until 2003. They find that foreign banks and non-big state-owned banks are the most efficient Chinese banks, followed by the Big banks with private banks being the least efficient. With regard to the profit side, the mean profit efficiency level is 46.7%. Foreign banks are the most efficient, followed by private banks and non-big four state owned banks, **Dong (2009)** employs both parametric SFA and non-parametric data DEA methods to assess and evaluate the cost efficiency of Chinese banks over the period from 1994 until 2007, a period characterized by far-reaching changes brought about by the banking reforms. The cost efficiency of Chinese banks is found to be 91% on average, based on SFA model, over the period from 1994 until 2007. Based on the results of the DEA and New DEA models, the average cost efficiency for Chinese banks over the sample period is about 89% and 87%, respectively. (Dong 2009), find that Chinese banking efficiency has deteriorated after China's admission to the

WTO, suggesting that the significant external environmental changes which arose from China's WTO entry may have had a negative impact on its banking efficiency. **AL-Hussain (2009)** clarifies the relationship between the efficiency of the structure of corporate governance and the performance of the banks, because the structure of corporate governance in the banking sector is one of the basic components in enhancing the efficiency and performance of the banks, The study found that there is a strong relationship between the efficiency of the structure of corporate governance and bank performance, when using return on assets as a standard of performance, but when using earnings per shares, there is a positive, but weak relationship, **Zakarneh (2010)** measure the level of efficiency of Jordanian banks for the period from 2005 to 2009 .The results of this study revealed that a number of Jordanian banks were efficient over the period of this study except in year 2008 because of the global economic crisis that affected the Jordanian banking sector in this year. The results analysis indicates that all output variables were associated with Jordanian banks efficiency.

3. Methodology and Data

3.1The Population and sample of the study

The study sample will include four state-owned banks, and includes all private banks operating in the study population with the exception of the Islamic banks. (The sample includes eleven private banks and four state-owned banks).The five year period which is covered by the study corresponds to the period over which the Syrian government has implemented various banking reforms. These changes are expected to have a significant impact on Syrian banks' performance.

3.2 Methodology

3.2.1The Stochastic Cost Frontier Function

The single equation that is used to estimate the cost efficiency using stochastic frontier function for panel data set can be written as the following:

$$\mathbf{Ln\ TC}_{it} = f(Qit, Wit, \beta) + v_{it} + u_{it} \qquad i = 1,\ldots, i,\ t = 1,\ldots t \qquad (1)$$

Where ln TC_{it} is the logarithm of the total cost of bank *i* at time *t*;

f (Qit, Wit, β) is the deterministic cost frontier; *Qit* and *Wit* are a vector of outputs and prices of input in logarithmic form at time *t*; v_{it} is a two-sided normal disturbance term with zero mean and variance, and u_{it} is a non-negative

random disturbance term capturing the effects of cost inefficiency and is usually assumed as half-normal distribution. Additionally, v_{it} and u_{it} are independently distributed from each other. To include control variables, *Zit*, along with the outputs and input prices in a stochastic cost frontier model, which can be written as follows:

$$\mathbf{Ln\ TC}_{it} = f(Q_{it}, W_{it}, Z_{it}, \beta) + v_{it} + u_{it} \qquad i = 1,\ldots, i, \qquad t=1,\ldots t \qquad (2)$$

Where *Zit* are a vector of environmental variables in the deterministic kernel of the stochastic production frontier accounting for systematic differences across banks due to bank ownership structure, bank size, market structure characteristics, banking deregulation, and capital ratio.

Empirical Specification for SFA

Under the intermediation approach, we assume that banks have three output variables and three input prices. The translog specification gives our empirical cost frontier model as follows:

$$\ln\frac{TC}{W_3} = b_0 + \sum_{i=1}^{3} b_1 \ln(Q_1) + \sum_{m=1}^{2} c_i \ln(\frac{W_i}{W3}) + \frac{1}{2}\sum_{i=1}^{3}\sum_{j=1}^{3} j_{ij} \ln(Q_i)\ln(Qj)$$
$$+\frac{1}{2}\sum_{m=1}^{2}\sum_{n=1}^{2} h_{mn} \ln(\frac{W_m}{W_3})\ln(\frac{W_n}{W_3}) + \sum_{i=1}^{3}\sum_{m=1}^{2} i_{im} \ln(Q_i)\ln(\frac{W_m}{W_3}) + u_{it} + v_{it} \qquad (3)$$

Where:

TC: The natural logarithem of total cost.

Q_i : Output quantities which are total loans, other earning assets and non-interest income.

W_1 : The price of labor.

W_2 : The price of deposits.

W_3 : The price of physical assets.

b, c, j, i, h : The parameters to be estimated, the inefficiency term and error term.

Second Stage Regression

Then we added the environmental variables and their interactions with the outputs and input prices in equation (2) are incorporated into the cost frontier function in the following specification in model:

$$CE_{it} = d_1 STATE_{it} + d_2 SIZE + d_3 LIST_{it} + d_4 HHI_t + d_5 MS_{it} + d_6 CR_{it} \quad (4)$$

Where:

$STATE_{it}$: Dummy variable that takes a value of one if banks *i* in year *t* is a state-owned bank and zero, otherwise.

$SIZE_{it}$: Represent the size of bank *i* in year *t*, is taken to be the natural logarithm of total bank assets.

$LIST_{it}$: Dummy variable which takes a value of 1 if bank *i* was publicly listed in year *t*, and zero otherwise.

HHI_i : A proxy for market concentration in year t.

MS_{it} : The market share of the bank *i* in year *t*.

CR_{it} : The capital ratio of the bank i in year t, calculated by total equity / total asset.

3.2.2 Data Envelopment Analysis (DEA)

DEA is a methodology for analyzing the relative efficiency and managerial performance of productive units, having the same multiple inputs and multiple outputs. It was initially suggested by Farrell (1957), and Fare *et al.*, (1985). It allows us to compare the relative efficiency of banks by determining the efficient banks as benchmarks and by measuring the inefficiencies in input combinations in other banks relative to the benchmark. Since the mid-eighties, DEA has become increasingly popular in measuring efficiency in different banking industries. Following (Fare *et al.*, 1985), a sequence of linear programmes is applied to construct efficient cost frontiers from which the measures of cost efficiency are calculated for this study.

$$\min_{l,x_i} \; w_{i0}\, x_{i0}$$

subject to

$$\sum_{j=1}^{n} l_i y_{ri} - y_{r0} \geq 0, \;\; r = 1,2,...,s \qquad (5)$$

$$\sum_{j=1}^{n} l_i x_{ij} - x_{i0} \leq 0, \;\; i = 1,2,...,m$$

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

$$l_j \geq 0, \;\; j = 1,2,...,n$$

Where n is the number of the banks; x_{i0} is the cost minimizing factor of input quantities to evaluate the firm, by given the factor of input prices $W_{i0}$and output levels Y_{r0}.The measure of cost efficiency is bounded between zero and one; A cost efficiency of one represents a fully cost efficient bank.

The SFA and DEA models are estimated by using the computer program FRONTIER 4.1.Which was developed by (Coelli, 1996).[(2)]

Second Stage Regression

The environmental variables and their interactions with the outputs prices of inputs; are incorporated into the Data Envelopment Analysis function in the following specification in model:

$$CE_{it} = d_1 STATE_{it} + d_2 SIZE + d_3 LIST_{it} + d_4 HHI_t + d_5 MS_{it} + d_6 CR_{it} \qquad (6)$$

(2) http://www.uq.edu.au/economics/cepa/coelli.htm

Where the dependent variable; CE_{it} is the cost efficiency of the i_{tn} bank calculated in the first stage. The definitions of the independent variables on the right hand side of this equation are the same as those given earlier in the SFA model. The results from this second stage regression enable one to analyze the potential determinants of cost efficiency.

To analyze the determinants of cost efficiency the researcher uses Tobit Analysis by stata program.

3.2.3 Defining the output and input prices

The intermediation approach in defining the outputs and inputs price of banking services has been used by (Sealy and Lindley, 1977).This approach considers financial institutions mainly as mediators of funds between savers and investors. Under this approach it is assumed that banks collect deposits to transform them using labor and capital in loans, meaning that deposits are considered as input. This approach is considered appropriate when analyzing banks that operate as independent entities (Bos and Kool, 2006).

Syrian banks collect deposits and use labor and fixed capital to transform these inputs into loans, investments and non-interest income. Under this treatment, the outputs are specified as total loans (Q1), which include short term customer loans, medium and long term customer loans. The other earning assets (Q2) are comprised of balances due from the central bank and other depository institutions, inter-bank loans, short term investments, long-term investments, trading securities. The non-interest income (Q3) is comprised of net fees and commissions, gains on foreign exchange transactions, gains on investment and other operating income. The inputs are specified as the total deposits plus other borrowed funds (X1) which include short and long term deposits, short and long term saving deposits, deposits from the central bank, deposits from commercial banks and, government deposits. Total physical capital (X2) is the book value of total fixed assets less the book value of accumulated depreciation, and (X3) is the labor input is using the total number of employees as a proxy.

The input prices are defined using the following three variables. First is the price of deposits plus other borrowed funds (W1) which is calculated by the ratio of total interest expenses on borrowed funds to total borrowed funds. Total interest expenses consist of interest paid on total deposits and interest on interbank borrowing. Second is the price of physical capital (W2), also called the user cost of capital, which is defined as the ratio of other operating expenses to the book value of fixed assets (net of depreciation). Other operating

expenses are calculated as the operating expenses less expenses on employees (that is, wages, salaries and other benefits provided to employees). Last is the price of labor (W3). It is measured by the ratio of personnel expenses (that is, wages, salaries and other benefits paid to employees) to the number of employees. Table (1) presents a summary of all the variables and their components.

Table (1):Variables Construction

Variables		Description		Formulation
TC	-	Total costs	-	Interest exp + Personnel exp + Commission Exp + Fee Exp.
	-	**Output**		
Q1	-	Total loans	-	Which include short term customer loans, medium and long term customer loans
Q2	-	Other earning assets	-	Short term investments, long-term investments, trading securities.
Q3	-	non-interest income	-	Net fees and commissions, and other operating income.
	-	**Input**		
X1	-	total deposits	-	Short and long term deposits.
X2	-	Total physical capital	-	Book value of total fixed assets.
X3	-	Number of employees	-	Number of employees.
	-	**Price of input**		
W1	-	price of deposits	-	T. interest expenses/ total deposits.
W2	-	price of physical capital	-	Other operating expenses / T. fixed assets.
W3	-	price of labor	-	T. employees cost/ number of employees.
	-	**Environmental variable**		
Z1	-	Size of banks	-	Logarithm of Total assets.
Z2	-	Capital ratio	-	Total equity / total asset.
Z3	-	HHI	-	Proxy for market concentration.
Z4	-	Market share	-	Total sales to every bank /total sales for all banking sector.

3.3 Data analysis

3.3.1Cost Efficiency Based on SFA model

As mentioned earlier on the advantages of using SFA to estimate the cost efficiency and using the input and output data measurement, Table (2) present the average efficiency Scores for the sample of the study.

Table (2) Average Efficiency Scores for Syrian Banks Basis on SFA

year	**Mean**	**S.d**	**Min**	**Max**	**Observation**
2006	0.490	0.158	0.364	0.869	9
2007	0.572	0.234	0.428	0.968	11
2008	0.577	0.261	0.370	0.998	12
2009	0.604	0.173	0.363	0.991	14
2010	0.624	0.203	0.362	0.965	15
Mean	**0.581**	**0.158**	**0.362**	**0.998**	**61**

Source: calculated by the researcher

Table (2) illustrates the trend of average cost efficiency in Syrian banking sector over the sample period. The Syrian banking sector shows an overall increasing trend in cost efficiency over the study period. Generally, the results show relatively medium average cost efficiency for Syrian banks, with efficiency scores that range between 49% in 2006 and 62% in 2010 an increase of 13.4%. The average cost efficiency for the sample period is 58.1%. The mean cost efficiency remains at a relatively medium level and varies very little during the period from 2006 until 2010. This is related to the fact that the process of financial development has started in the year 2001 but the implementation process was a little bit slow reaching its highest point in 2010.During the mentioned period there has been an increase in the number of banks operating in Syria during this period and especially private banks, which led to the creation of an atmosphere of competition among these banks to acquire high market share. Also and in 2009 the government approves the establishment of the Damascus Securities Exchange, which helps to enhance competition between these banks.

Average SFA Cost Efficiency Scores by Bank Type

Having examined the efficiency of the total Syrian banking sector over time, and to be able to test the hypothesis on the effect of the ownership type on the level of efficiency continue to analyze the levels of cost efficiency in more detail by the groups of different banking; Table (3) displays the value of the average degree of cost efficiency in Syria accordance with the ownership, specifically the big four state-owned banks and privet banks. These banks operate in the same market and facing each type a different set of rules. In light of these regulatory environment variable and changing, and we expect to find a different performance, either through a group of banks and over time. We seek to identify and also to explain this difference of performance expected.

Table (3) Average SFA Cost Efficiency Scores by Bank Type

Year	state banks (N=4)	private banks (N=11)
2006	0.559	0.435
2007	0.588	0.564
2008	0.405	0.663
2009	0.412	0.681
2010	0.696	0.598
Mean	**0.532**	**0.588**

Source: calculated by the researcher

Table (3) refers to the average efficiency of banks using the SFA according to the type of the bank (state bank, private bank) and the results show that the private banks are more efficient than state banks, where the proportions were as follows, respectively (53.2%, 58,8%). This result is consistent with the findings of previous studies, such as (Fries and Tice, 2005), (Yao et al, 2007), and (Shrimal et al 2007), but also varied with the study (Dong, 2009). Where the private banks are different from state banks in terms of its work where it is seeking to make profits and to increase their capital through the selection of staff efficient, good governance and the use of modern techniques, unlike governmental banks that seek to achieve social welfare and that are still operating in the methods of semi-traditional in its dealings bank. And maybe a little difference in the percentage of this study; due to the newness of private banks operating in Syria.

Average SFA Cost Efficiency by Size Groups

In order to investigate the influence of size on efficiency, we divide banks into three different categories on the basis of the log size of their total assets, that is a big bank if its total log assets are greater than 11 billion S.P a medium bank if its total log assets between 10 - 11 billion S.P, a small bank if its total log asset under 9 billion S.P. The table (4) shows that the banks which are small in size are more efficient than medium-sized banks and large size in this model where the average cost efficiency for each of them 65.7%, 58.4%, 53.1%, respectively.

Table (4) Average SFA Cost Efficiency by Size Groups

Year	small bank	Medium bank	Large bank
2006	0.869	0.435	0.456
2007	0.493	0.586	0.651
2008	0.601	0.654	0.400
2009	0.679	0.661	0.452
2010	0.643	0.587	0.697
Mean	**0.657**	**0.584**	**0.531**

Source: calculated by the researcher

This result is consistent with the findings of previous studies such as (Darrat *et al.*, 2002), and (Chen *et al.*, 2005), but varies with the study of (Dong, 2009). Such result is expected as most large banks operating in Syria are state-owned banks, where it is characterized by large size in terms of capital and number of branches, but still utilizing conventional methods in conducting their operations. They also lack of modern technology and management expertise. Private banks on the other hand, though trying to adopt more advanced technology, however, they are still new and still in an early stage of establishment and expansion.

3.3.2 Cost Efficiency Levels Based on DEA model

DEA is a non-parametric technique which aims to evaluate the efficiency of decision making units (DMUs). DEA techniques has been applied to identify the level of cost efficiency for each bank on an annual basis during the period from 2006 until 2010.Table (5) provides the basic cross sectional efficiency scores over the period from 2006 until 2010.

Table (5) Average Efficiency Scores Basis on DEA (2006-2010)

	Mean	S.D	Min	Max	Observation
2006	0.806	0.230	0.486	1.00	9
2007	0.656	0.261	0.203	1.00	11
2008	0.646	0.281	0.237	1.00	12
2009	0.719	0.213	0.283	1.00	14
2010	0.676	0.217	0.401	1.00	15
Mean	**0.695**	**0.238**	**0.203**	**1.00**	**61**

Source: calculated by the researcher

In table (5), Syrian banks showed an average cost efficiency score of 80.6% in 2006 declining to .67% in 2010. The average cost efficiency score for

the whole period equal to 69.5%. Generally, the average of the cost efficiency scores shows a decreasing trend over the period from 2006 until 2010.

Average DEA Cost Efficiency Scores by Bank Type

To uncover the effect of bank ownership type (public, private) average cost efficiency scores has been calculated using DEA method on a classified sample the level each type of ownership is reported in table (6)

Table (6) Average DEA Cost Efficiency Scores by Bank Type

Year	State banks (N=4)	Private banks (N=11)
2006	0.743	0.856
2007	0.674	0.646
2008	0.611	0.663
2009	0.725	0.716
2010	0.601	0.704
Mean	**0.671**	**0.717**

Source: calculated by the researcher

Note also that the evolution of DEA cost efficiency scores for different bank types often display erratic trajectories. Relatively speaking, however, we find that the private banks have tended to exhibit the greatest efficiency. These results are consistent with previous SFA findings. This result is consistent with the findings of previous studies, such as (Fries and Tice, 2005), (Yao *et al.*, 2007), and (Shrimal *et al*., 2007), but not in line with the study of (Dong, 2009). Moreover, except for the period 2009, the DEA cost efficiency levels of the state banks have significantly improved over the period analysis. These results suggest that the reforms focused on the state banks have enhanced their cost efficiency over this period.

Average DEA Cost Efficiency by Size Groups

Taking bank size into consideration, the sample has been divided into small and large banks using the total assets as a determinant factor. Table (7) presents the DEA cost efficiency results.

Table (7) Average DEA Cost Efficiency by Size Groups

Year	small bank	Medium bank	Large bank
2006	0.486	0.856	0.828
2007	0.394	0.720	0.858
2008	0.483	0.684	0.730
2009	0.712	0.684	0.792
2010	0.573	0.666	0.751
Total	0.529	0.722	0.791

Source: calculated by the researcher

From the DEA model across the defined three different size groups although the results do not show a consistent pattern among different size groups across each year, the less efficient banks appear to be the small banks. This result is consistent with the findings of previous studies such as (Dong, 2009), and (Chen *et al*., 2005), but conflicting with the study of (Darrat *et al.*, 2002).

3.3.3 Determinants of Cost Efficiency

In the previous sections, the cost efficiency scores have been presented as using the SFA and DEA models. They have been used to find the efficiency score for each bank. To be able, to see the influence of external factors on efficiency scores, this section presents the Tobit regression analysis results. According to the theoretical and empirical literature, the determinants of bank efficiency stem from the nature of bank ownership, size, market deregulation, and market structure. To achieve the following Tobit models is used:

$$CE_{it} = d_1 STATE_{it} + d_2 SIZE + d_3 LIST_{it} + d_4 HHI_t + d_5 MS_{it} + d_6 CR_{it}$$

Where:

CE_{it} The dependent variables as previously stated takes a value between 0 and 1, which represent the cost efficiency measure using both SFA and DEA model specifications.

$STATE_{it}$ Is a dummy variable that takes a value of one if banks *i* in year *t* is a state-owned bank and zero, otherwise.

$SIZE_{it}$ Is dummy variable representing the size of bank *i* in year *t*, is taken to be the natural logarithm of total bank assets.

$LIST_{it}$ Is a dummy variable which takes a value of 1 if bank *i* was publicly listed in year *t*, and zero otherwise.

HHI_i Is a proxy for market concentration in year t.

MS_{it} Is the market share of the bank *i* in year *t.*

CR_{it} Is the capital ratio of the bank i in year t.

The model also investigates whether the impact of these environmental variables are the same for each of the SFA, and DEA models. If the pull models provide the same information content, then the effects of policies and other decisions which are based on this information is more reliable and valuable. The (dependent variables), as previously stated takes a value between 0 and 1, which represent the efficiency measure using both SFA and DEA model specifications. Table 5-9 presents the results from the Tobit analysis.

Table (8) Tobit Regression Analyses

Determinants of efficiency		**SFA**	**DEA**
Ownership indicators	State-owned banks Privet bank	-0.0316057 0.673 (-0.42)	0.1066466(1) 0.241(2) (-1.18)(3)
Size indicator	Log (total assets)	0.0170223 0.685 (0.41)	0.1953622 0.000 (3.92)*
Market deregulation indicator	Listed banks	0.0070516 0.928 (0.09)	0.1306152 0.169 (1.39)
Capital ratio	Total equity / total asset	0.3087085 0.188 (1.32)	0.2906496 0.300 (1.05)
Market structure indicators	log HHI	-0.2390321 0.636 (-0.78)	1.014268 0.009 (2.71)*
	Market share	-0.0664927 0.682 (-0.41)	0.0362627 0.856 (0.18)
	Intercept	1.241738 0.363 (0.91)	-5.044061 0.004 (-3.04)*
	Log- likelihood Prob chi2	13.786598 0.4403	-8.4107106 0.0004

(1) The coefficient
(2) The significance level
(3) T-statistic

As mentioned earlier cost efficiency for the sample under study has been determined using both SFA and DEA. The results in the above table suggest that cost efficiency in the Syrian banking sector is not affected by Ownership structure using both SFA and DEA model for cost efficiency specifications. This result coincided with a number of previous studies such as (Fries and Tice, 2005), (Yao *et al*., 2007), and (Shrimal *et al*., 2007), but also varied with the study of (Dong, 2009).

The results also indicate a positive effect of size on bank cost efficiency but not significant using the SFA analysis, however, coefficient associated with the size variable is found positive and significant for DEA analysis. This indicates that bank size is an important factor that drives the variation in efficiency across banks'. There may be a number of reasons for the positive relationship between bank size and efficiency. First, larger banks may have experienced economies of scale and scope from growth and joint production and these lead to higher efficiency. Second, larger banks may have a more professional or specialized management team which has greater ability to control costs and increase revenues. Third, larger banks can be assumed to possess more flexibility in financial markets and be better able to diversify credit risk in an uncertain environment (Cole and Gunther, 1995).

The results also indicate a positive but a non significant effect of listed vs. unlisted banks. This indicates that listed banks are not necessarily more efficient than those not listed on the stock exchange. The reason for this could be that stock markets are relatively a new established market and what really matter is the bank operating activities. Moreover, stock markets are expected to respond more strongly to profit measures than to cost efficiency measures (Chu and Lim, 1998). Moreover, even if some Syrian banks are publicly listed, the government still maintains some bank ownership.

For market structure conditions measured by (Herfindahl-Hirschman index) and market share (in terms of the proportion of total sales) as determinants of efficiency in our regression equations. The results show that the coefficient associated with these two variables is positive and significant in the DEA analysis. But posses a negative and insignificant when SFA is used as a tool to measure efficiency, this finding contradict other findings (Dong, 2009).

Although the finding of Tobit analysis using SFA and DEA provided a

Conflicting results with regard to the direction of the effect of the market structure on cost efficiency, however as mentioned earlier, the SFA techniques is considered more reliable in determining the bank cost efficiency.

The results also indicate that capital ratio which is constructed using ratio of equity contribution on total asset, is positive to cost efficiency but not statistically significant in both SFA and DEA analysis.

3.4 Results

3.4.1 The results of the theoretical and analytical framework

1- The study shows that the efficiency term is not based on a specific concept; however it's based on the allocation of limited resources.

2- Syrian government has provided a number of reforms to help in developing banking system in order to meet the challenges of financial globalization.

3- The literature review indicates that the Syrian banks also suffer from several shortcomings that limit their effectiveness; the most important of these shortcomings is the control of state banks of the banking activity, which has weakened the competition among the banks.

3.4.2 Proof of the Assumptions Validity

This study utilizes the SFA and DEA, to measure cost efficiency in the Syrian banking sector over the period from 2006-2010.

The results of the study can be summarized as follows:

1- The cost efficiency of Syrian banks is found to be 58.8% on average, based on the SFA model, however, based on DEA the average cost efficiency is found to be equal to 69.5%.

2- Results also show that private banks are more efficient than state-owned banks in both SFA and DEA analysis.

3- Large banks tend to be relatively more efficient than smaller banks when SFA has been used.

4- Market structure measured by HHI (Herfindahl-Hirschman index) has been found significant using DEA analysis.

5- The size of asset banks has been found significant using DEA analysis.

References

- Al-Hussain, A. H. (2009), Corporate Governance Structure Efficiency and Bank Performance in Saudi Arabia, Doctor of Business Administration Thesis, University of Phoenix, United States.
- Ariff, M. & Can, L. (2008), "Cost and Profit Efficiency of Chinese Banks: A Non-parametric Analysis", China Economic Review, vol. 19, no. 2, pp. 260-273.
- Berger, A.N., Hasan, I. & Zhou, M. (2009), "Bank Ownership and Efficiency in China: What will happen in the world's Largest Nation?" Journal of Banking & Finance, vol. 33, no. 1, pp. 113-130.
- Chu, S.F. & Lim, G.H. (1998), "Share Performance and Profit Efficiency of Banks in an Oligopolistic Market: Evidence from Singapore", Journal of Multinational Financial Management, vol. 8, no. 2-3, pp. 155-168.
- Cole, R.A. & Gunther, J.W. (1995),"Separating the Likelihood and Timing of Bank Failure", Journal of Banking & Finance, vol.19, no. 6, pp. 1073-1089.
- Dong.Y. (2009), Cost Efficiency in the Chinese Banking Sector: A Comparison of Parametric and Non-parametric Methodologies, Doctor of Business Administration Thesis, Loughborough University, U.K.
- Shrimal, P., Michael. S. & Wickramanayake .J. , (2007), "Cost Efficiency in South Asian Banking: The Impact of Bank Size, State Ownership and Stock Exchange Listings", International Review of Finance, vol. 7, issue 1-2, pages 35-60.
- Yao, S., Jiang, C., Feng, G. & Willenbockel, D. (2007), "WTO Challenges and Efficiency of Chinese Banks", Applied Economics, vol. 39, no. 5, pp. 629-643.
- Zakarneh, M. (2010), Study of Bank Efficiency: An Empirical Study of Commercial Banks in Jordan using DEA during the period 2005-2009, Master of Accounting Thesis, Yarmouk University, Jordan.

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