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# Determinants of Commercial Banks' Efficiency in Bangladesh: Does Crisis Matter?

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## Abstract

Banks play a crucial role in bringing stability and economic development through their expected contribution in proper financial resource mobilisation across the economy. Despite the importance, there is little focus in recent literature which provided the empirical evidence how the global financial crisis affect the bank efficiency in Bangladesh. Thus, this paper aims to examine the effect of the global financial crisis and other factors on the efficiency of Bangladesh commercial banks. By employing the Data Envelopment Analysis (DEA) method, we computed the technical efficiency of individual banks operating in the Bangladesh banking sector during 2000 to 2013. The empirical findings indicate that the Bangladesh banking sector has exhibited the highest efficiency level during 2001, while efficiency seems to be at the lowest level during 2010. The study finds that crisis along with bank size, capital adequacy ratio, return on average equity and real interest rate have a significant effect on bank efficiency in Bangladesh. In order to keep the sound financial development of Bangladesh, banks operating in the Bangladesh banking sector have to consider all the potential technologies which could improve their profit efficiency levels, since the main motive of banks is to maximise shareholders' value or wealth through profit maximisation.

**Keywords:** Bank Efficiency, Commercial Banks, Financial Crisis, Post-Crisis, Bangladesh.

**JEL Classification Code:** G01, G21, G32.

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## 1. Introduction

Banks play a crucial role in bringing stability and development of the economy through their expected contribution in the proper mobilisation of financial resources across the economy (Husain & Abdullah, 2008). Efficient intermediation of bank increases economic growth and

financial stability, but insolvency leads to economic crisis. Further, the efficiency of banks not only contributes to the productivity in the economy but also makes the economy more enduring to negative and external shocks (Athanasoglou, Delis & Staikouras 2008a). Therefore, efficiency is vital for the growth and stability of the whole economy. Over the last few decades, most of the emerging countries have liberalised their monetary policies as well as encouraging foreign banks' entry into the local banking market, thus, influencing the competition intensity (Mirzaei, Moore & Liu, 2013) which might result in the reduction in bank profits as banks might not be able to earn economic rent by utilising their monopolistic power and hence, affect the banks' financial performance and efficiency levels.

Since the early 1970s, the banking industry in Bangladesh has become an important tool for the financial system. The government of Bangladesh set few requirements for all financial institutions including commercial banks to fulfil some economic objectives. In Bangladesh, four types of banks are operating namely, government-owned specialised banks or state-owned development financial institutions

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(DFIs), nationalised commercial banks or state-owned commercial banks (SCBs), domestic private commercial banks (PCBs), and foreign commercial banks (FCBs). Operating the banks in an efficient way is the most important issue in the Bangladesh banking sector after the formation of the National Commission on Money, Banking and Credit in 1986 (Sufian & Kamarudin, 2013). In order to strengthen the regulation and supervision of the Bangladesh banking sector, the World Bank assisted the Central Bank of Bangladesh (CBB) in 1991 (Sufian & Kamarudin, 2013). The efficiency of the banking area is essential to preserve the soundness of the banking system.

The financial crisis in both advanced and transition economies and associated fiscal cost of crisis resolution (Honohan & Klingebiel, 2003) has cultivated a new wave of interest among the researchers to re-examine bank efficiency. Bank efficiency has been the main focus of a considerable amount of literature, with most of the empirical study related to the United States (US), as well as western and developed countries (Athanasoglou et al., 2008a; Athanasoglou, Brissimis & Delis, 2008b; Fries & Taci, 2005; Girardone, Molyneux & Gardener, 2004; Heffernan & Fu, 2010; Qin & Pastory, 2012). The literature on bank efficiency focusing on developing countries, however, is scarce. Some researchers such as Abd Karim (2001), Barry, Lepetita and Tarazia (2010), Chantapong (2005), Dacanay (2007), Ferrier (2001), Girardone et al. (2004), Guru, Staunton and Balashanmugam (2002), Manlagñit (2011), Parinduri and Riyanto (2014), Sufian (2010), Sufian and Habibullah (2010) and Vu and Nahm (2013) have made significant contribution in the banking literature focusing on ASEAN countries.

Most recently, Vu and Nahm (2013) recognised that among the foreign banks operating in Vietnam, those headquartered in Australia, Japan, the US and Europe outperform than those headquartered in Asia as well as the domestic banks. Ferrier (2001) also supported previous studies and found that among the ASEAN countries, Philippines banks suffer from the least cost efficiency. Later on, Dacanay (2007) examined the profit and cost efficiency of Philippines commercial banks during 1992 to 2004 and revealed that the cost inefficiency of the bank has increased as a result of the Asian financial crisis. Manlagñit (2011) supported Dacanay (2007) and added that assets quality and risk also affect the efficiency of Philippines banks. Parinduri and Riyanto (2014) however, identified that cost efficiency has increased in Indonesian banks after the 1997 Asian financial crisis. Girardone et al. (2004) found that post-crisis restructuring of the banking sector had a negative influence on bank performance and made local banks less efficient. The findings of Chantapong (2005) showed that profitability increased in the banks in ASEAN countries in

the post-crisis period due to lowering of credit exposure and the efficient management of expenses (Guru et al., 2002); and Malaysian banks showed higher efficiency than Thai banks (Sufian, 2010) during that period. The global financial crisis of 2007-2008 which started in the US economy also affected ASEAN countries and brought negative effects on the efficiency of Thailand banks (Sufian & Habibullah, 2010). In the case of Bangladesh, there were only a few studies focusing on bank efficiency (Bhuia, Baten, Kamil & Deb, 2012; Hoque & Rayhan, 2013; Sufian & Kamarudin, 2013). However, the studies only focus on the efficiency of the banks in Bangladesh but did not study the effects of any crisis or other determinants on the efficiency.

Numerous studies have been undertaken to focus on banking profitability especially internal and external determinants considering both cross country and a single country. The first group includes Athanasoglou et al. (2008a), Masood and Ashraf (2012) and Perera, Skully and Chaudhry (2013). The second group includes Husain and Abdullah (2008), Athanasoglou et al. (2008b), Heffernan and Fu (2010) and Qin and Pastory (2012). The second group mainly conducts their research based on developing economies. Different studies used different measures as profit proxy: such as Perera et al. (2013) considered return on average assets (ROAA), Athanasoglou et al. (2008b) and Husain and Abdullah (2008) considered return on assets (ROA); Qin and Pastory (2012) and Masood and Ashraf (2012) considered both ROA and return on equity (ROE), whereas, Heffernan and Fu (2010) conducted their study considering ROAA, ROAE, NIM and economic value was added as profit measure.

On the other hand, bank efficiency depends on different bank specific elements such as bank capitalization and profitability, macroeconomic elements such as gross domestic product (GDP) growth, inflation rate, real interest rate, and ownership effect (either private or government). Capitalization effects bank efficiency directly as it is really an issue of concern to have high capitalization or low capitalization. This is because low capitalization may lead the bank to expose default risk whereas high capitalization may result in higher cost and low profitability. Considering the issue, many studies have been conducted focusing on bank capitalization as an internal determinant of efficiency. Among others, Pancurova and Lyocsa (2013), Casu and Molyneux (2003), Mirzaei et al. (2013) and Barry et al. (2010) found that capitalization effects efficiency positively where Mohanty, Lin and Lin (2013) and Ab-Rahim, Md-Nor, Ramlee and Ubaidillah (2012) revealed that capitalization effects efficiency negatively. However, Fries and Taci (2005) argued that higher capitalization leads a bank to have low-cost inefficiency. Furthermore, bank efficiency is related to profitability indicating higher efficiency banks are more

profitable. Maudos (1998) and Casu and Molyneux (2003) found that bank profitability is positively related to efficiency. Samad (2008) concluded that ownership is not a statistically significant factor relating to bank efficiency. He found that domestic private banks outperform state-owned banks in terms of efficiency. However, Bonin, Hasan and Wachtel (2005) found that government-owned banks were not appreciably less efficient than domestic private banks.

The effect of the global financial crisis on the banks of Bangladesh is not focused enough on recent literature. Despite the importance, there is little focus in recent literature which provided the empirical evidence how the global financial crisis affect the bank efficiency in Bangladesh. Thus, this paper aims to examine the effect of the global financial crisis and other factors on the efficiency of Bangladesh commercial banks. This paper is expected to contribute to the banking literature by filling the gap in the impact of the global financial crisis, bank specific, macroeconomic and ownership on bank efficiency of Bangladesh commercial banks. The next section explains the research methodology, followed by the third section that discusses the analysis and findings and finally, the conclusion and policy recommendations are presented in the fourth section.

## 2. Methodology

### 2.1. Methods

In our study, we used the Data Envelopment Analysis (DEA) technique. The DEA is a mathematical programming approach to measure the efficiency relative to the assembled frontiers. The basic DEA is based on an idea of efficiency very similar to the microeconomic one. However, the DEA frontier is not produced by some unambiguous functional form, rather it is generated from the actual data for the assessed organisations. In general, the DEA frontier is formed of linear combination that links the set of observations in the data set under analysis that creates a convex Production Possibility Set (PPS). As a result, the DEA efficiency score for a particular Decision-Making Unit (DMU) is not defined by an absolute term rather it is defined relative to the other DMUs in the specific data set under consideration (Casu & Molyneux, 2003). In this study, we used variable returns to scale (VRS), first introduced by Banker, Charnes and Cooper (1984) to compute efficiency scores. The choice of VRS over a constant return to scale (CRS) is justified that all DMUs are not operating at an optimal scale due to imperfect competition and financial constraints (Barry et al., 2010). As a consequence, using of the CRS will result in measures of technical efficiency (TE) which are confounded by scale efficiencies (SE).

Just like Casu and Molyneux (2003), we used input-oriented (input minimization) approach to measure efficiency, since in the input-orientated models, the DEA method pursues to classify technical inefficiency as a relative decline in input usage as well as to quantify technical inefficiency as a proportional increase in output production. These two measures provide the same value under CRS, but different under VRS. It has both theoretical and practical implications, for example, in businesses where the importance is on cost-control, the choice would be an input orientation (Ferrier & Valdmanis, 1996).

Though there is no inclusive theory of the banking firm and no agreement on the explicit definition and measurement of banks' inputs and outputs, Berger and Humphrey (1997) denoted that the 'intermediation approach' may be more suitable for assessing entire financial institutions because of the inclusiveness of interest expenses, which often account for one-half to two-thirds of total costs. Besides, the 'intermediation approach' may be appropriate for assessing the significance of frontier efficiency to the profitability of financial institutions, since the minimization of total costs such as interest expenses, non-interest expenses and personnel expenses, not just production costs, is required to maximise profits. Following the previous studies (Barry et al., 2010; Casu & Molyneux, 2003; Molyneux, Altunbus & Gardener, 1996), the 'intermediation approach' is used in financial institutions as intermediaries between the supply and the demand of funds. The key significance of the intermediation approach is to consider deposits as inputs, and interest on deposits as an element of total costs. We, therefore, considered interest expenses, non-interest expenses, personnel expenses, and deposits as inputs whereas total loans, liquid assets and other earning assets as outputs. Finally, we used DEAP 2.1 software and the Two-Step approach, as proposed by Coelli, Rao & Battese (1998) to estimate efficiency score. The mathematical specification of DEA-VRS input-oriented model is as follows:

#### DEA VRS Input-Oriented Efficiency Estimation

Min  $\theta$

Such that:

$$\begin{aligned} \sum_{j=1}^n \varphi_j A_{ij} &\leq \theta A_{i0}; i = 1, 2, \dots, x \\ \sum_{j=1}^n \varphi_j B_{qj} &\leq B_{q0}; q = 1, 2, \dots, y \\ \sum_{j=1}^n \varphi_j &= 1 \\ \varphi_j &\geq 0; j \in 1, 2 \dots m \end{aligned} \tag{1}$$

Where  $\theta$  is the efficiency score,  $A_{ij}$  and  $B_{qj}$  are the amount of the  $i^{th}$  input consumed and the amount of the  $q^{th}$  output generated by the  $j^{th}$  bank, respectively. The index  $m$  refers to the number of bank observations,  $x$  equals the four inputs (interest expenses, non-interest expenses, personnel expenses, and deposits) and  $y$  refers to the three outputs (total loans, liquid assets and other earning assets) and  $\varphi$  is constant.

To further investigate the determinants of bank efficiency in Bangladesh, we use the efficiency measures derived from the DEA estimations as the dependent variable using STATA version 14, we then estimate the following Tobit regression model:

$$\theta_{it} = +\gamma_1 SIZE_{it} + \gamma_2 ROAE_{it} + \gamma_3 EQA_{it} + \gamma_4 GDPG_t + \gamma_5 INRST_t + \gamma_6 INF_t + \gamma_7 OWN_i + \varepsilon_{it} \quad (2)$$

$$\theta_{it} = +\gamma_1 SIZE_{it} + \gamma_2 ROAE_{it} + \gamma_3 EQA_{it} + \gamma_4 GDPG_t + \gamma_5 INRST_t + \gamma_6 INF_t + \gamma_7 OWN_i + \gamma_8 CRISIS_i + \gamma_9 PCRISIS_i + \varepsilon_{it} \quad (3)$$

Where,

$SIZE_{it}$  = log of total assets of bank  $i$  in year  $t$ ;

$ROAE_{it}$  = Return on Average Equity of bank  $i$  in year  $t$ ;

$EQA_{it}$  = Equity/Total Assets of bank  $i$  in year  $t$ ;

$GDPG_t$  = Gross domestic product (GDP) growth of Bangladesh in year  $t$ ;

$INRST_t$  = Real interest rate of Bangladesh in year  $t$ ;

$INF_t$  = Inflation rate (Consumer price index) of Bangladesh in year  $t$ ;

$OWN_i$  = Ownership Structure (1= if a bank is state owned commercial bank; 0= otherwise)

$CRISIS_i$  = The global financial crisis (1 = if the year is in the GFC period; 0= otherwise)

$PCRISIS_i$  = The post global financial crisis (1 = if the year is in the post GFC period; 0= otherwise)

The capital adequacy is estimated by equity over total assets (EQA) while the profitability ratio is defined as the Return on Average Equity (ROAE). Previous studies (Carbo, Gardener & Williams, 2003; Casu & Molyneux, 2003; Lozano-Vivas, Pastor & Pastor, 2002) found positive relationship between efficiency and return on equity as well as between efficiency and EQA which means more efficient banks earn more profit and higher EQA leads to higher efficiency level, because of low-risk propensity and low leverage that could result in low borrowing cost. The dummy variable OWN is introduced to detect whether there are efficiency differences between state-owned commercial banks and private owned commercial banks.

## 2.2. Data and Variables

In the present international setting, the need for comparable data from different countries imposes strong restrictions on the type of variables one is able to use, not least because of the various accounting criteria used in the five countries under investigation. To minimise possible bias arising from different accounting practices, broad variable definitions have been chosen as presented by Bureau Van Dijk- Fitch Solutions Bankscope. A sample of 31 commercial banks of Bangladesh was extracted from Bankscope database. Table 1 shows the descriptive statistics of the variables used in our analysis. The data were also extracted from the nonconsolidated income statement and balance sheet data corresponding to the years 2000–2013. All data are reported in USD (million). In order to maintain homogeneity, only state commercial banks (SCB) and private commercial banks (PCB) are included in the analysis for ownership. Further, we have collected the macroeconomic variables data from the World Bank database. We have considered 2007-2008 as crisis period and 2009-2013 as a post-crisis period. For banks with missing information, we have looked at the individual bank's websites to determine the appropriate classification. Finally, we calculated the efficiency score year by year and we got different observations in different years.

**Table 1.** Descriptive statistics

Variables	Observations	Mean	Std. Dev.	Min	Max
VRS	296	0.989	0.025	0.84	1.00
TA	296	1462.69	1571.93	35.31	10020.66
ROAE (%)	290	15.69	17.12	-88.43	54.22
EQA (%)	296	6.97	4.65	-12.94	32.15
GDPG (%)	296	5.79	0.81	3.83	7.06
INRST (%)	296	7.79	2.50	4.47	12.18
INFR (%)	296	6.83	2.41	2.01	10.7

VRS, TA, ROAE, EQA, GDPG, INRST, INFR refer to variable return scale, total assets, return on average equity, total equity / total assets, gross domestic product growth rate, real interest rate, inflation rate

In Table 1, the mean of total assets of commercial bank of Bangladesh is \$1,462.69 million, the average efficiency score (variable return scale) is 0.989, the mean of ROAE and EQA are 15.69% and 6.97% respectively. The bank assets are more volatile across the banks in Bangladesh. The average GDP growth, real interest rate, and inflation rate are 5.79%, 7.79%, and 6.83% respectively.

### 3. Results

#### 3.1 Bank Efficiency

Using DEA, we generate the Bangladesh commercial banks common efficiency frontier and then compare each bank with this common frontier. A bank falling closer to the frontier is supposed to be more efficient than the one falling farther away from it. Table 2 shows VRS based input oriented mean scores for each year alongside CRS and SE, for comparison. Although slightly different in magnitude, the VRS efficiency scores correspond with CRS and SE.

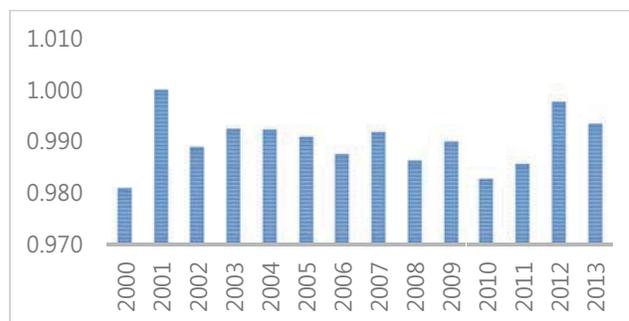
**Table 2.** Year-wise efficiency mean score and number of efficient banks

YEAR	VRS	CRS	SE	Efficient Banks	Total Banks	Efficient (%)
2000	0.981	0.967	0.985	12	16	75.00
2001	1.000	0.987	0.987	16	16	100.00
2002	0.989	0.977	0.988	13	16	81.25
2003	0.993	0.982	0.989	14	16	87.50
2004	0.992	0.976	0.983	15	17	88.24
2005	0.991	0.974	0.983	14	17	82.35
2006	0.988	0.981	0.993	15	18	83.33
2007	0.992	0.984	0.992	16	18	88.89
2008	0.986	0.983	0.997	14	20	70.00
2009	0.990	0.987	0.997	19	26	73.08
2010	0.983	0.978	0.995	18	31	58.06
2011	0.986	0.982	0.996	18	31	58.06
2012	0.998	0.992	0.995	22	26	84.62
2013	0.994	0.989	0.996	20	28	71.43

VRS, CRS, and SE refer to Variable Return Scale, Constant Return Scale, and Scale Efficiency respectively.

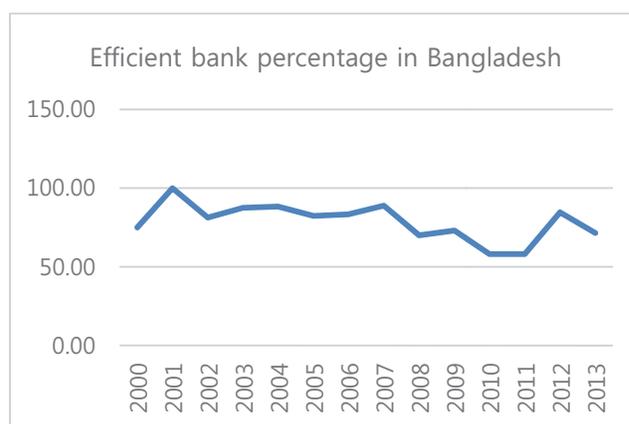
Generally, during the period of study, we noted the mean efficiency scores are relatively more volatile in commercial banks of Bangladesh. We find the highest mean efficiency in 2001 with the smallest variability, under output-oriented VRS versions. This indicates 2001 as the best year in the sample period in terms of banking sector efficiency in Bangladesh. If we analyse the crisis period of the study in Figure 1, we find that overall efficiency of the banks in 2008 is lower than in 2007 and 2009. However, the efficiency level declined sharply in 2010 which fall under the post-crisis effect which is similar to the findings of Sufian (2010) who did an analysis of the 1997 Asian financial crisis. The results suggested that banking efficiency was severely affected by the crisis that resulted in lower efficiency after the crisis. Though there was an upturn in efficiency in 2012, the overall efficiency is going to decline from 2013. This can be explained by the fact that the political instability of

Bangladesh could be one of the main reasons for the decline in the efficiency of the banks.



**Figure 1.** Trend of mean efficiency score (VRS) from the year 2000 – 2013

In terms of individual bank performance based on efficiency, we can see the downward trend of the contribution of the percentage of the banks to the efficiency frontier in Figure 2. The lowest contribution to the frontier was in 2010 and 2011 which was after the crisis. After that in 2012, there was a slight upturn of the contribution. However, due to the political instability, the trend again, declines. The year-wise and bank-wise efficiency score can be seen in Appendix.



**Figure 2.** The contribution of the banks in efficiency frontier from the year 2000-2013

#### 3.2 Determinants of Bank Efficiency in Bangladesh Banking Industry

We have also reported our Tobit regression findings on the equation we estimated in Table 3. We ran the equation (2 & 3) to see the crisis and post-crisis effect on determinants of bank efficiency in Bangladesh.

**Table 3.** Determinants of Bank Efficiency in Bangladesh.

Variables	Expected Sign	Model 1	Model 2	Model 3
Size	+	0.023** (0.011)	0.022** (0.011)	0.024** (0.011)
Return on average equity	+/-	-0.002*** (0.001)	-0.002*** (0.001)	-0.002*** (0.001)
Capital adequacy	+	0.008*** (0.003)	0.008*** (0.003)	0.008*** (0.003)
GDP growth	+	0.008 (0.011)	0.007 (0.011)	0.002 (0.013)
Real int. rate	+	0.016*** (0.006)	0.015** (0.006)	0.007 (0.011)
Inflation rate	-	-0.004 (0.004)	-0.005 (0.005)	-0.007 (0.005)
Ownership	+	0.013 (0.018)	0.014 (0.018)	0.015 (0.018)
Crisis			0.011 (0.023)	
Post-crisis				-0.058*** (0.020)
Number of obs.		290	290	290
LR $\chi^2$		32.96	33.17	33.96
Prob > $\chi^2$		0.0000	0.0000	0.0000
Pseudo $R^2$		0.7197	0.7243	0.7414

\*\*\*, \*\*, \* represent 1%, 5% and 10% significance level respectively, standard errors are in the parentheses.

In our analysis, we use three models where the first model represents the determinants of bank efficiency without any effect and model 2 and model 3 show the effect of crisis and post-crisis respectively. The two bank specific variables which are bank size and capital adequacy representing capitalization return positive coefficient and significant in all models. These results imply that bank size and the capital ratio has a positive impact on bank's technical efficiency in Bangladesh. Our results are in agreement with other studies (Carbo et al., 2003; Lozano-Vivas et al., 2002; Mester, 1996). The results explain that large banks can handle their resources efficiently at least technically and can maintain positive capital adequacy ratio, even during crisis and post-crisis period. Unfortunately, we find a negative relation of the ROAE variables representing profitability with efficiency during and after the immediate post-crisis years which imply that even the technically efficient and well-capitalised bank could have lower profitability.

Our next variables of interest are the macroeconomic variables. Referring to Table 3, the results show that GDP growth rate and inflation rate are not significant determinants of bank efficiency in Bangladesh though we find the expected sign. However, the real interest rate has

significant positive impact on bank efficiency though it is insignificant in the post-crisis period. The results show that bank efficiency does not rely on macroeconomic variables except real interest rate in Bangladesh, rather they mostly rely on bank specific variables. Further, to account for ownership, we incorporated the ownership dummy variable to distinguish between state-owned commercial banks and private owned commercial banks. Regardless of its asset size, concentration and other considerations, our binary dummy variable give equal weight to the two banks regardless of their shareholding, which may significantly differ. Our defined ownership dummy was not significant throughout the sample period, denoting that banks owned by the state are as efficient as private owned. These results may be aligned with Chantapong (2005), who found that efficiency gap between the state and private banks shrinks significantly during and after the crisis period. Finally, we use the dummy for crisis and post-crisis in model 2 and model 3 respectively. We find that during the crisis, the efficiency of the banks in Bangladesh was not affected. However, immediately after the crisis, bank suffers efficiency problem. This can be explained by the fact that crisis started in the United States but was later spread all over the world and Bangladesh was no exception, thus experiencing efficiency problem after the crisis.

## 4. Conclusions

To date, studies on bank efficiency are numerous. However, most of these studies have concentrated on the banking sectors of the western and developed countries. On the other hand, empirical evidence on the developing countries is relatively scarce. The present study attempts to fill in this gap by providing new empirical evidence on the bank efficiency in Bangladesh. By employing the Data Envelopment Analysis (DEA) method, we compute the technical efficiency of individual banks operating in the Bangladesh banking sector during the years of 2000 to 2013. The period covered in this study captures the recent global financial crisis in 2007 and 2008. The empirical findings indicate that the Bangladesh banking sector has exhibited the highest efficiency level during 2001, while efficiency seems to be at the lowest level during 2010. This study finds that bank size, capital adequacy ratio, return on average equity and real interest rate have a significant effect on bank efficiency in Bangladesh.

The empirical findings from this study present considerable policy relevance. Firstly, the empirical findings from this study clearly suggest that the decline in the efficiency of Bangladesh banks were mainly due to scale and the crisis effect. The results imply that banks operating

in the Bangladesh banking sector are either too small to benefit from the economies of scale or too large to be scale efficient. The results also suggest that during the crisis, the efficiency of the banks in Bangladesh was not affected. However, immediately after the crisis, the bank suffered efficiency problem. Thus, from the policy-making perspective, the results imply that the relatively smaller banks could raise their efficiency levels by expanding, while the larger banks would need to scale down their operations to be scale efficient. The results could also provide better information and guidance to bank managers, as they need to have a clear understanding of the impact of efficiency on the performance of their banks. Thus, banks operating in the Bangladesh banking sector have to consider all the potential technologies which could improve their profit efficiency levels since the main motive of banks is to maximise shareholders' value or wealth through profit maximisation.

Nevertheless, the study has also provided insights to policymakers with regard to attaining optimal utilisation of

capacities, improvement in managerial expertise, efficient allocation of scarce resources, and the most productive scale of operation of commercial banks operating in the Bangladesh banking sector. This may also facilitate directions for sustainable competitiveness of the Bangladesh banking sector operations in the future. Due to its limitations, this paper could be extended in a variety of ways. Firstly, future research could include more variables such as taxation and regulation indicators, exchange rates as well as indicators of the quality of the offered services. Secondly, in terms of methodology, the non-parametric Malmquist Productivity Index (MPI) method could be employed to investigate changes in productivity over time as a result of technical change or technological progress or regress could yet be another extension to the present paper. Finally, future research into the efficiency of the Bangladesh banking sector could also consider the production function along with the intermediation function.

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