# The Impact of Monitoring Mechanism on Efficiency Change and Productivity Growth of Private Commercial Banks in Bangladesh

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## Abstract

This paper focuses on understanding the effects of monitoring mechanism (i.e., board quality as well as ownership structure) on efficiency and productivity changes of private commercial banks in Bangladesh over the period from 2007 to 2016. Two non-parametric methods - data envelopment analysis and malmquist productivity index - were used to determine the efficiency and productivity of private commercial banks in Bangladesh. Based on constant returns to scale, five inputs and two outputs have been used to determine the efficiency scores and to identify any improvement in productivity over the period. It was found that private commercial banks of Bangladesh are at the efficiency level of 80.84%. The productivity of all private commercial banks does not follow any trend. Out of twenty two (22) PCBs, only nine (9) banks could manage to increase productivity. Hypothesis test (one sample t-test) are conducted to validate the results. The impact of stock market crisis period on the overall productivity and efficiency of the banks is also evident.

## Introduction

Banks have attracted the attention of several researchers because of scandals worldwide (Deutsche Bank Spying Scandal; Urban Bank in the Philipines, and Barclays in London). The world economy has also experienced several financial crises: Asian crisis of 1997, Global financial crises of 2007-2008, and the European sovereign debt crisis of 2014. According to Kashif (2008), deterioration of asset portfolio and distorted credit management were the main reasons for worldwide financial crises. The banking Industry of Bangladesh is also going through tough times. In year 2010, financial scandals in both public and private banks and financial markets are experiencing market crashes. According to Asian Development Bank (ADB), the 2010 financial market (stock market) crisis occurred due to commercial banks' excessive investment in stock market, weak corporate governance mechanism, and poor reporting standards. ADB also pointed out the weak enforcement capacity of Bangladesh Security Exchange Commission (BSEC), the regulatory authority of the capital market of Bangladesh.

Bank as principal source of financial intermediation plays a vital role in the economic development of any country. In order to maintain long-term success, commercial banks have to operate efficiently by minimizing cost. The concept of efficiency estimation was developed and modeled by Farrell in 1957. According to Hollingsworth and Parkin (1998), efficiency can be defined as the utilization of scarce resources to ensure maximum level of output. Parkin (1998) defines efficiency as the allocation of scarce resources that maximizes the revenue. Efficiency varies depending on knowledge, technical know-how, production process, and the environment where production occurs or services are rendered (Mahbub, 2016). Bank efficiency is imperative to know because bank poses an important role in economic development and capital market making (Kanagaretnam et al., 2010). Measuring bank efficiency helps policymakers formulate appropriate policies for smooth functioning of commercial banks (Mester, 1997).

However, the concept of corporate governance is well accepted as a determinant of bank performance (Bebchuk & Spamann, 2010). It is evident that banks' operating under prudent regulation of corporate governance structure are generally more efficient in resource allocation, while banks operating under weak system of corporate governance engage in more risky businesses (Caprio et al., 2007; Beltratti & Stulz, 2012). Several studies identified that efficient structure of corporate governance may reduce agency problem. It also helps to boost the performance of the organization (Kyereboah

et al., 2006). Research is available for measuring the banking efficiency worldwide, but the majority of the studies have been undertaken in developed countries (Ayumardini, 2015; Bozec et al., 2010; Lehman et al., 2004; Isik & Hasan, 2002). Studies addressing efficiency estimation on financial institution in Bangladesh are scant (Ahmed & Liza, 2013; Yasmeen, 2011; Uddin & Suzuki, 2011). Studies regarding the identification of efficiency based on corporate governance structure are yet to be developed. Based on this gap, this study attempts to understand how efficient are the private commercials banks in Bangladesh in complying with corporate governance guidelines (i.e., monitoring mechanism)? Is there any growth in the productivity of the private commercial banks in Bangladesh over a period of time? Is there any effect of the stock market crisis on banking efficiency and productivity growth in Bangladesh?

The rest of the paper is structured as follows: Section two deals with a theoretical overview and hypothesis development, section three presents the methodology, and section four present the results of the study. The last section presents the conclusions with the policy implications based on the findings.

## Literature Review

Banking efficiency is considered to be an important factor at macro and micro levels. The effective and efficient uses of resources are key to survival in the banking industry. In order to maintain long term success, commercial banks have to operate businesses by minimizing cost (Mester, 1997). It is said that efficiency is a necessary condition for productivity improvement (Sumanth, 1998). Zeineb and Mensi (2018) investigated the effect of corporate governance on bank efficiency of Islamic banks in the Gulf region. Size of the Board, duality role of CEOs, and ownership structure are included as corporate governance variables. Risks are considered to measure efficiency by using non-parametric method of data envelopment analysis (DEA). They found that GCC Islamic banks allow highly risky activities to achieve a greater level of operating efficiency. Ayumardani (2015) found that the Islamic banks showed a greater level of efficiency than the conventional banks in compliance with strong corporate governance guidelines. A similar study was conducted by Wang et al. (2012) on bank holding companies of U.S.A for the period of 1980 to 2003. Measuring the performance through DEA model, they stated that size of board, outside (independent) directors, CEO duality, and average director's age negatively affected operating performance. Salim et al. (2016) studied the relationship between corporate governance and banks efficiency over the years of 1999-2013 in Australia. They found that size of the board and the numbers of committee meetings have a positive significant impact on efficiency. Their study also revealed that

overall efficiency of the banking industry was improved after introducing good corporate governance.

Bozec et al. (2010) attempted to analyze governance-performance relationship in Canada over a five-year period from 2001 to 2005. Using the two step approach of DEA analysis and panel data regression, they found the evidence that better governed firms would be more efficient. Tanna et al. (2011) also investigated on board structure and efficiency of UK banks using DEA for period of 2001 to 2006. They found that board size and composition have a positive impact on the efficiency of banks. Pi and Timme (1993) conducted a study to understand whether agency cost and duality of CEO and chairman have any impact on the performance of a bank. They found that efficiency of banks with the duality role (Chief Executive Officer and the chairman) in a board is significantly lower than the efficiency of those banks without the duality role. Similar findings by Isik and Hassan (2002) indicate a strong association between the efficiency score and management structure. Adams and Ferreira (2009) found that board size, duality role, number of members in a board, and shareholding of BODs have a significant impact on the efficiency and performance of the company. Yiwei et al. (2011) studied the association between asset size and the efficiency of banks in Eastern and Central Eastern Europe and found no relationship between size of the assets and bank efficiency.

Isik and Hassan (2003) examined financial reforms in banking industry of Turkey using of Malmquist Productivity Index (MPI) for the period 1981 to 1990. Their results found that financial reforms made significant changes in the productivity of Turkish banks. Angelidis and Lyroudi (2006) used MPI on Italian banks and found that the total factor productivity has increased during that period. Zhang et al. (2012) examined Chinese banks for the period of 1999 to 2008 by using MPI methods and found that productivity growth would be attributed to changes in efficiency along with technical change.

Varesi (2015) attempted to measure the productivity of Albanian banking sector using Malmquist DEA method. The results showed that medium and small size banks are more productive than the large banks. Ahmed and Liza (2013) performed a study on commercial banks for the period of 2002 to 2011 using the DEA method in Bangladesh. The 3rd generation local commercial banks are found to be more efficient than 1st generation and 2nd generation banks. Yasmeen (2011) examined the association between technical efficiency and productivity growth. Her finding is evident that dynamic convergence and challenges exist among the private, public, and foreign banks in Bangladesh due to efficiency differences. Uddin and Suzuki (2011) undertook a study to investigate the banks' efficiency of 38 banks including state owned, private owned, Islamic and foreign banks over the period of 2001 to 2008. They found that private owned banks are more

efficient in terms of income. It is well documented that studies have been found but mostly about developed economics. Studies addressing productivity and efficiency changes in the banking sector are still scant in the developing economies. Research studies on efficiency estimation and productivity analysis are even hard to find in Bangladesh. Based on the research gap, the following research hypotheses have been developed:

> $H_1$: *Private Commercial Banks are technically efficient.*
> $H_2$: *There is an improvement in the productivity of private commercial banks over the period from 2007 to 2016.*

## The Methodology of the Study

Farrell (1957) developed the efficiency analysis model, which have become very popular while linking efficiency and productivity. It can be used in two ways to measure the efficiency (technical efficiency and allocative efficiency) of any organization. Technical efficiency is concerned with obtaining maximum benefit with available resources, whereas allocative efficiency is concerned with securing the highest benefit with given resources. According to Siems and Barr (1998), technical efficiency is about doing things right and allocative efficiency addresses doing the right things. The efficiency index can be calculated either by means of parametric or non-parametric approach. The parametric approach needs a functional form for determining the cost or profit frontier functions. Non-parametric approach is linear programming-based technique. It does not require any specific functional form to determine the best practice. It also does not consider any random error. The non-parametric approach is most popular among the researcher for measuring the efficiency of financial institutions (Clarke, 2007; Isik & Hassan, 2002). Productivity analysis shows both the technological change and efficiency change. The first measures (technological) shows the shift in production frontier while the second measures identify how far the firms are from the production frontier line. Productivity changes can be measured by using two approaches. One is econometric estimation of cost and production and the other one is construction of index using a non-parametric approach (Guarda & Rouabah, 2009).

Data Envelopment Analysis (DEA) was developed by Charnes, Cooper and Rhodes in 1978 (Charnes et al., 1978). The DEA approach is a linear programming technique. It is represented in the form of a ratio of inputs and output of every decision making unit (DMU). The efficiency score is presented through a relative number that ranges from Zero (0 or 0%) to One (1 or 100%) (Avkiran, 1999). DEA method is capable of handling various inputs and outputs at a time and ignoring the relationship among them along with different measurement units. Therefore, standardization of ratio of input

and output is not required (McEachern & Paradi, 2007). Therefore, efficiency can be measured in the following way:
The model for DEA analysis is as follows:

$$Max\ h_0 = \frac{\sum_{r=1}^{s} u_r\, y_{rj}}{\sum_{i=1}^{m} v_i x_{ij}} - - - - - - - - - (1)$$

where, $Max h_{o=} \frac{\sum_{r=1}^{s} u_r v_{rj}}{\sum_{i=1}^{m} v_i x_{ij}} \leq 1$, 'j' stands for individuals bank (1,2,--------n), $u$ and $v$ stand for the weight, $u_r > 0\ and\ v_i > 0$, 'r' stands for inputs of different companies, and '$i$' stand for outputs of different companies. The weight of the inputs and outputs must be greater than Zero. u's and v's are the variables under study. The efficiency score of bank following corporate governance guidelines and maximum attainable score would be one (1). The above DEA model is a fractional linear program. The linearization process was carried out by setting the denominator equal to a constant and maximizing the numerator. The resultant linear program is as follows:

$$Max h_o = \sum_r u_r y_{rj_0}$$

Subject to:

$$\sum_r u_r\, y_{rj_0} - \sum_i v_i\, y_{rj_0} \leq 0 \quad (j = 1,2, - - - - - - n)$$

The dual linear programming of the problem is written as follows:
$Min(\lambda)\theta_0$

Subject to:
$\sum_{i=1}^{N} \lambda_i\, y_{ri} \geq y_{ro} \quad r = 1,2,------- s$
$\theta_0 X_{k_0} - \sum_{i=1}^{N} \lambda_i\, X_{ji} \geq 0 \quad j = 1,2,-------k$
$$\lambda \geq 0$$

The value of 'θ' is the efficiency score; the value of one (1) indicates that DMUs are technically efficient and on the production frontier.

*Malmquist Productivity Index (MPI)* was first developed by Malmquist in 1953. The malmquist productivity index (MPI) (another format of DEA frontier) is used to measure the productivity changes in each of the DMU under a study over time. Fare et al. (1994) was first to suggest this index. MPI are used to identify the relative performance of any DMU for different time period based on a base period. The MPI is calculated under the assumption of CRS with output orientation (Thanassoulis, 2001). According to Fare et al. (1994), the output-oriented MPI can be computed by using the following equation:

$$M_0 = [\frac{d_0^t(x_0^t,y_0^t)}{d_0^t(x_0^{t+1},y_0^{t+1})} \frac{d_0^{t+1}(x_0^t,y_0^t)}{d_0^{t+1}(x_0^{t+1},y_0^{t+1})}]^{1/2} ------------------------------(2)$$

$M_0$ measures the productivity from two different time period where x stands for inputs and y stands for output. The index uses technology for time period 't' and for the next period 't+1'. Furthermore, the equation can be derived as follows:

$$\overline{M_0} = \frac{d_0^t(x_0^t,y_0^t)}{d_0^{t+1}(x_0^{t+1},y_0^{t+1})}\left[\frac{d_0^{t+1}(x_0^{t+1},y_0^{t+1})}{d_0^t(x_0^{t+1},y_0^{t+1})} * \frac{d_0^t(x_0^{t+1},y_0^{t+1})}{d_0^t(x_0^t,y_0^t)}\right]^{1/2} \quad \text{---------------(3)}$$

In the above equation, the first ratio measures the *efficiency change* as of Farrell for the time period from *t* to *t+1*. The second ratio (inside the bracket) is the geometric average of two ratios used to measure the *technical change*. It should be noted that all the components are calculated based on the geometrical average of MPI. If MPI score is greater than one (1), the productivity increases along with the improvement in technical efficiency and progression in technology; if the score is less than one (1), the productivity decreases along with the decrease in technical efficiency and technological progression; If the score is equivalent to one (1), the productivity is stable along with the technical efficiency and technical progress.

## Data, Variable Determination, and Measurement Issues

The population of the study is considered as all the listed private commercial banks of Bangladesh in Dhaka Stock Exchange (DSE). The study period for the sample is considered from the year 2007 to 2016. Corporate governance guidelines have been formulated in a structured form in 2006 which is to be complied with all the listed companies. Also, major changes were made after 2016. Among the thirty (30) private commercial banks, only twenty two (22) were selected from the perspective of conventional banking practices based on ten (10) years of data availability after listed at stock exchange.

**Table 1.** Input and output variables for DEA and MPI analysis

| Input | Description |
|---|---|
| Board Quality | Percentage of independent director to total number of directors |
| Ownership Concentration | Percentage of institutional shareholdings |
| | Percentage of directors shareholdings |
| Cost of Fund | Total interest expense to total deposit |
| Capital Intensity | Total assets to total number of employees |
| **Output** | **Description** |
| Growth | Percentage change in the book value of total assets |
| Profitability | ROA (Net profit after tax to total assets) |

In the case of Bangladesh, where large data set is not readily available, parametric approach is found difficult to be implemented. In this respect, non-parametric method has been considered as an appropriate technique to

estimate the efficient frontier and the best practice firms. It is assumed that monitoring mechanism can be described by its ownership structure and board quality. Board quality (percentage of independent director to total members of board of directors) and ownership concentration (percentage of ownership by the directors and institutions) are considered two aspects of governance system for monitoring mechanism. Generally, studies on corporate governance focus on the presence of independent director in the board as a determinant of effective management (Chaity et al., 2020; Bhattacharyya et al., 1997; Lin & Zhang, 2009; Berger et al., 2009; Andres & Vallelado, 2008).

Other issues such as corporate performance, profitability, investment, and growth of the company are considered for measuring the performance of an organization (Andres & Vallelado, 2008; Chaity et al., 2020). For measuring input prices/cost, cost of fund (total interest expense/ total deposit) and capital intensity (total asset/ total number of employees) are considered. Growth (percentage changes in the book value of total assets) and profitability (ROA) are used for measuring the performance of a bank (Kumbhakar & Lozano-vivaz, 2005; Wang & Kumbhakar, 2009; Chaity et al., 2020). The variables for input and output along with the description of measurement are summarized in the table below:

## Data Analysis and Findings

**Table 2.** Descriptive Statistics

| Variables (Inputs and Outputs) | | Number of Observations | Mean | Std. Deviation |
|---|---|---|---|---|
| Cost of Fund (COF) | | 220 | 0.73 | 6.72 |
| Capital Intensity (CI) | | 220 | 61.84 | 29.82 |
| Percentage of Institutional Shareholding (INSTSHARE) | Ownership | 220 | 32.83 | 16.8.47 |
| Percentage of Director Shareholdings (DIRSHARE) | | 220 | 33.63 | 17.41 |
| Percentage of Independent Director in Board (INDPD) = Board Quality | | 220 | 11.71 | 9.74 |
| Growth of Total Asset (GROWTH) | | 220 | 20.54 | 11.15 |
| Return on Asset (ROA) | | 220 | 1.57 | 1.17 |

Table 2 reveals descriptive summary of input and output variables derived from two hundred and twenty (220) observations for the twenty two (22) PCBs over a period of 10 years (2007 to 2016). Cost of Fund (COF) shows 73.39%. The reason for high COF is because majority of the funds are

collected from deposit accounts. Most of the expenditure of banks is incurred due to interest given to deposit accounts. Capital intensity (CI) shows that almost 62% of assets are against each of the employee. The presence of institutional investor and the percentage of independent directors are considered for monitoring mechanism. The directors' shareholdings are found to be a little larger than the institutional shareholdings as 33.63% and 32.83% respectively. The percentage of independent directors in the board is on an average of 11% with a standard deviation of 9.74. On an average, 20.54% growth is observed in the private commercial banks (PCBs) of Bangladesh. ROA is found to be on an average of 1.57% with the standard deviation of 1.1.

**Efficiency Score Distribution (Data Envelopment Analysis)**

In line with the study of Anouze (2010) and Al-Hussain (2009), this study evaluates the efficiency of banks based on monitoring mechanism i.e., corporate governance guidelines. The input-oriented model and output-oriented model provide same values in case of the assumption of constant return to scale (CRS) (Ferrier & Valdmanis, 1996). Thus, Table 3 reveals the Data envelopment Analysis (DEA) efficiency scores of sample PCBs over the period of 2007 to 2016.

**Table 3.** Mean of Technical efficiency (DEA Score) of PCBs in Bangladesh

| Year | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Mean Score** | 0.72 | 0.82 | 0.83 | 0.71 | 0.77 | 0.81 | 0.91 | 0.83 | 0.83 | 0.84 |

The mean of year wise results of PCBs reveals that efficiency is increased in ten years. Financial market crisis also had impact on the financial institutions. The efficiency score (0.708) in the year 2010 was much lower compared to the other sample years. It can also be stated that there are slacks in using the available resources to produce the same level of outputs efficiently. On an average, the PCBs are using 80.84% of their resources and the level of inefficiency is 19.16% (1-.08084). Pre stock market crisis (Year 2007 to 2009), during the stock market crisis (Year 2010 and 2011) and post stock market crisis (Year 2012 to 2016), are three period based on stock market crises. It is clearly evident from the results that the efficiency of the PCBs declined during the period of stock market crisis. However, the efficiency of all the PCBs improved gradually after the stock market crisis since 2012.

**Efficiency Score Distribution (Malmquist Productivity index)**

The Malmquist productivity index (MPI) is based on the concept of production function. The function provides the maximum possible output (production) with respect to a set of inputs. The input and output-oriented

scores are equal in case of MPI (Thanassoulis, 2001). This study is based on output-oriented DEA-Malmquist model to put maximum weight on the output quantity for a given level of inputs.

**Table 4.** Mean score distribution of Total Factor Productivity of PCBS in Bangladesh

| Year | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|------|------|------|------|------|------|------|------|------|------|------|
| Mean Score | 1.09 | 1.12 | .000 | 0.85 | 0.60 | 0.73 | 0.84 | 1.29 | 0.90 | 0.99 |

Table 4 showed the mean productivity score of all PCBs in Bangladesh. It is also clearly identified that the productivity of all the PCBs declined during the stock market crisis (Year 2010 and 2011). After the market crisis, several market measures taken by the regulators helped increase the productivity again. Table A1 (Appendix) reveals the total factor productivity change (TFPCH). TFPCH measures changes of the productivity and growth over time. TFPCH growth can be characterized by adopting innovative methods, ideas, designs or technology. With the improvement in process, firms may find out more efficient ways of producing the maximum output with the given level of inputs. TFPCH growth can also occur through efficient use of factors of production (capital, labor and technology). From the table, it was found that both EFFCH and TFPCH are more than 1.00 in the year 2008. Thus, this indicates that the banking industry is doing well. EFFCH shows less than 1 in year 2009 and year 2010. During these two years, capital market experienced the crashes for the second time in Bangladesh. This crisis could have a significant impact on the banking industry. The lowest value of TECHCH in the year 2009 might be the result of financial crises. During those periods, banking industry struggled for survival rather than improvement in technology. With regard to TECHCH less than 1.00, there was no much improvement seen in different years. EFFCH has started to increase since 2011 but variation was found over the years till 2016. Though banking industry tried to increase their efficiency by generating revenue, banks experienced credit risk in the form of piled up non-performing loans. Out of twenty two (22) PCBs, only nine (9) banks could manage to increase productivity. Most of the banks improved their efficiency by using their existing offers and services.

**Hypothesis Testing**

In order to test the hypothesis, one sample t-test has been conducted for both DEA based technical efficiency (TE) score and Malmquist Productivity Index (MPI) for total factor productivity (TFP). Hypothesis 1 has been devised to test whether PCBs are technically efficient or not. The mean efficiency was found to be statistically significant at 1% level (Table 5). It can be concluded that the PCBs with strong monitoring mechanism are following the corporate governance structure and there is improvement in efficiency.

**Table 5.** Hypothesis Testing (DEA)

| Ha: mean < 1 | Ha: mean = 1 | Ha: mean > 1 |
|---|---|---|
| t = -12.5820<br>Ho: mean = 1(TE)DEA<br> degrees of freedom =      219 | | |
| Pr(T < t) = 0.000 | Pr(T > t) = 0.000* | Pr(T > t) = 0.0000* |

*1% level of significance; ** 5% level of Significance

In order to validate hypothesis 2, one sample t-test was conducted. The test statistics shows a 95% confidence interval that there is an improvement in productivity of PCBs in Bangladesh. It can be said that productivity of PCBs (complying with the corporate governance guidelines) has been increased over the time period from 2007 to 2016.

**Table 6.** Hypothesis Testing (MPI)

| Ha: mean < 1 | Ha: mean = 1 | Ha: mean > 1 |
|---|---|---|
| t =   1.8632<br>Ho: mean = 1(TFP) | degrees of freedom =      219 | |
| Pr(T < t) = 0.9681 | Pr(T > t) = 0.0638** | Pr(T > t) = 0.0319* |

*1% level of significance; ** 5% level of Significance

## Limitations and Future Research

This research study has some limitations. When measuring the efficiency of PCBs, only the ownership structure and board quality are considered as corporate governance variables. Comparison beyond these variables could have been done. Hence, this gives the future scope for further research. Furthermore, efforts should be taken to know the efficiency and productivity changes with respect to branch efficiency and cost efficiency of PCBs in Bangladesh.

## Conclusion

It is well documented in several studies that agency theory has a dominant role in corporate governance studies (Jensen & Meckling, 1976; Almasarah, 2012). It is required to maintain an adequate monitoring mechanism for the protection of the rights of shareholders. This study was conducted to understand efficiency and productivity changes of private commercial banks (PCBs) complying with the corporate governance guidelines. Efficiency of PCBs following the corporate guidelines is measured by employing non-parametric methodologies, Data Envelopment Analysis (DEA), and Malmquist Productivity Index (MPI). Technical efficiency (TE) by DEA approaches and productivity change (Total factor productivity i.e., MPI score) by MPI approach are used to determine the efficiency of private commercial banks (22) over the period of 2007 to 2016. The study is based on constant returns to scale (CRS) of DEA approach. The value of one (1)

indicates the decision-making units (DMUs) on the production frontier and is technically efficient. Five (5) inputs and two (2) outputs are used to determine the efficiency scores. Among them, ownership structure and board quality are taken as a proxy of corporate governance mechanism. It was found that PCBs of Bangladesh are showing an efficiency level at 80.84%. It can be stated that there is a slack in using the available resources to produce outputs efficiently. On average, the PCBs are using 80.84% of their resources and the level of inefficiency is 19.16%. It is evident that there is an increasing trend of efficiency level after the stock market crisis of 2010.

Total productivity of PCBs also decreased during the stock market crisis period. During the stock market crises, financial institutions, especially the banking industry, suffered the most. The results are also in line with previous studies (Kalluchi, 2018; Madhanagoal & Chandrasekaran, 2014). As for the Technological Change (TECHCH), not much improvement has been observed over the study period. Technical efficiency change (EFFCH) has increased since 2011, but variation is found in different years (up to 2016). This study was conducted based on technical efficiency using both the non-parametric (DEA and MPI) and parametric method (SFA). Hypothesis 6 and 7 are tested to show whether PCBs are efficient and if any changes occurred in productivity during the study period. PCBs of Bangladesh were found to be technically efficient and there is evidence of changes in productivity. The results are consistent with the study of Mahbub (2016), Al-Hussain (2009), Anouze (2011), and Lehman et al. (2004). Although the banking industry tries to increase their efficiency and productivity in terms generating revenues by providing services to customers, it still experiences problems in term of credit risk and non-performing loans.

The banking industry in Bangladesh suffers due to influential board structure. Family legacy, presence of political members, as well as influential bureaucratic members is common in any board structure. Despite the existence of several guidelines regarding this matter, those are hardly followed. There is a mandatory presence of an independent director on the board, but independent directors in PCBs is merely a post ornamented by a person with political influence, bureaucrats, and close kin with the owners, rather than giving important technical knowledge and experience. Institutional investors are holding very large amounts of shares in the banking industry. However, representation and active members are hardly found on board of directors. An active position of institutional shareholders in any board ensures the practice of good governance. Literature has also given the importance for the presence of active independent directors for effective administration of any board and management.

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## *Appendix*

**Table A1.** Malmquist Productivity Index Summary of Annual Means of PCBs in Bangladesh

| Year | EFFCH | TECHCH | PECH | SECH | TFPCH |
|------|-------|--------|------|------|-------|
| 2007 | 0.931 | 1.171 | 1.001 | 0.930 | 1.091 |
| 2008 | 1.190 | 0.947 | 1.064 | 1.118 | 1.127 |
| 2009 | 0.982 | 0.000 | 1.011 | .971 | 0.000 |
| 2010 | 0.822 | 1.043 | 0.862 | 0.954 | 0.857 |
| 2011 | 1.161 | 0.523 | 1.087 | 1.68 | 0.607 |
| 2012 | 0.990 | 0.738 | 1.033 | 0.959 | 0.731 |
| 2013 | 1.159 | 0.729 | 1.13 | 1.041 | 0.845 |
| 2014 | 0.922 | 1.407 | 0.949 | 0.972 | 1.298 |
| 2015 | 1.022 | 0.885 | 1.029 | 0.993 | 0.904 |
| 2016 | 1.008 | 0.988 | 0.974 | 1.036 | 0.996 |

(EFFCH = Technical Efficiency Change; TECHCH= Technological Change; PECH=Pure technical efficiency change; SECH=Scale efficiency change; TFPCH= Total factor productivity change)
Note: All Malmquist index averages are geometric means.