Analysis of Comparative Efficiencies of Islamic Banks Across Nine South and Southeast Asian Countries

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Abstract

The purpose of this paper is two folds: (i) obtain the overall technical efficiencies (TE), pure technical efficiencies (PTE), and scale efficiencies of the Islamic bank of the nine South and Southeast Asian (SSEA) countries during 2011-2016. (ii) compare them among the Islamic banks of the SSEA. The paper applied the Bootstrap Data Envelope Analysis (DEA) for obtaining three efficiencies in the production of loan and earning assets and found that the average TE, PTE, and SE of the Islamic banks in the region were 77.3 percent, 81.2 percent, and 95.3 percent respectively. The comparison of PTE efficiencies across the Islamic banks found: (i) the average TE of the Islamic banks of Malaysia was 81.9 percent and was higher than the average of other countries in the region; (ii) the average managerial efficiency (PTE) of the Islamic banks of Malaysia, excluding Brunei, Singapore, and Thailand, was 87.0 percent and was higher than the average of other countries in the region; (iii) among countries of the South and Southeast Asia, excluding Singapore and Maldives, the Islamic banks of Pakistan were more scale efficient than other countries in the region. The average scale efficiency of Pakistan's Islamic banks was 96.8 percent. The underlying reason for the Islamic banks of Malaysia and Pakistan most efficient in the region is because they were the forerunners. They were the first countries to introduce Islamic banks. Secondly, the banks of counties survived through competition with conventional banks operating side by side in the Islamic banks. The policy prescription suggests that bank regulators allow the opening of more Islamic banks to compete with conventional banks for improving PTE efficiency.

Keywords: Bootstrap DEA; Technical efficiency comparison; Islamic banks; South and Southeast Asia

JEL Classifications: C13; C14; G21; G22

Introduction

There are three types efficiencies banking industry focuses on. They are (i) TE, the overall technical efficiency, (ii) PTE, the pure technical efficiency, also called managerial efficiency, and (iii) SE, the scale efficiency, originating from the operational size of the firms. The study of cross-country efficiency is important for several reasons. In the competitive world, the survival of a bank and a different breed of banking system like Islamic banks depends on survival skill in banking competition. Second, banks of an individual country must first ascertain their relative efficiency level before making attempts for improving their efficiencies at par or exceeding others. Third, the efficiency of the banks is important for deposit mobilizations and loan financing, and thus play an important role in the economic growth of a country. This role of the banking sector is well emphasized in the work of Joseph Schumpeterian (1911) and later to Goldsmith (1969), McKinnon (1973) and Shaw (1973).

This paper studied the bank efficiencies of the Islamic banks of nine South and Southeast Asia countries (SSEA): Indonesia, Malaysia, Brunei, Singapore, Maldives, Thailand, Bangladesh, Sri Lanka, and Pakistan deserve examination for a number of reasons.

The survey of literature, provided in Section 2, shows no evidence of studies of the efficiencies of the Islamic banks in the region as a group. There are a large number of Islamic banks operating in SSEA side by side and competing with conventional banks (interest-based banks). The average technical efficiencies of the Islamic banks in the region is unknown and it deserves exploration.

Although there are a large number of Islamic banks competing with conventional banks in the SSEA region, and the Islamic banks of some countries were operating longer than those of other countries, yet their comparative level of technical efficiencies are unknown. We have no evidence of comparative efficiency levels across the Islamic banks of the region.

In the establishment of Islamic banks, Malaysia, Bangladesh and Pakistan were pioneers in the region. The Islamic banks in these countries were established early in the 1980s, whereas the establishment of Islamic banks in other countries, like Indonesia, Sri Lanka, Thailand, and Singapore, were of recent development. Banks of these countries are newcomers. Bankers, depositors, and the people of the region, in particular, need to know how banks across these countries are performing in terms of various efficiencies.

The study of efficiency is important for both the macroeconomics and the microeconomics point of view. Bank efficiency, from the macroeconomics point, is important for economic growth. The growth of banking and its efficiency is essential for economic development. Bank inefficiency and the subsequent failures have catastrophic impacts on economic growth and employment. The 2008-2009 global financial crisis caused by large scale bank failures in the U.S. testifies the claim.

From the microeconomics point of view, the inefficiency of banks both increases the cost of intermediation and affects the allocation of funds as well as the profitability of these banks resulting in bank failure (Samad, 2014). The increased efficiency in banks' deposit mobilization and loan advancement is key to successful entrepreneurs for enhancing the economic growth of a country (Schumpeter, 1911).

There are cross country efficiency studies of banking sectors but they did not cover the South and Southeast Asia. Samad (2021) studied cross country efficiencies of the Islamic banks of the GCC countries. Samad (2013) investigated the efficiency of Islamic banks using the time-varying Stochastic Frontier function on the Islamic banks of 16 countries. Rosman et. al (2013) explored efficiencies of MENA and Asian countries Islamic banks but their studies did not cover countries under this study.

The study of the efficiency of the South and Southeast Asian is an important contribution to the banking literature, particularly on Islamic banking, because there is no study of the efficiencies of the Islamic banks as a group as well as of comparative efficiencies of banks across countries. This paper also contributes an estimate of overall bias-corrected technical efficiencies (BC-TE), bias-corrected pure technical efficiencies (BC-PTE) and the scale efficiencies (SE) of the Islamic banks of the region and the comparative level of efficiency across countries.

In estimating the overall bias-corrected technical efficiencies (BC-TE), bias-corrected pure technical efficiencies (BC-PTE) and the scale efficiencies (SE) of the Islamic banks, this paper applies the Bootstrap DEA methodology developed by Simar-Wilson (1998)

This paper is organized as follows: a brief description of the characteristic features of the Islamic banks is outlined in section 2. Section 3 provides the survey of the literature. Data, methodology, and models are discussed in section 4. Section 5 provides empirical results. Conclusions are presented in Section 6.

Key Characteristics Feature of Islamic Bank

The Islamic bank is a different breed of the financial institution. The basic principles of the operation of the Islamic bank are derived from the Quran and Sunnah, the corner-stone of Muslims' way of life. All activities including the banking business are guided by the Quran and the Shariah law.

First, Islamic banks only finance/engage to do business that are permitted in the Shariah law. Islam prohibits the consumption and production of any harmful activity, such as wine, alcohol, and destructive weaponry. Since these are not permitted, Islamic banks do not finance the production and consumption of these kinds of businesses, irrespective of high profit prospects.

Second, the most unique feature of Islamic banking is the avoidance of *riba* (usury) in all financial transactions. This is because, the Quran, the Divine book of Islam strongly prohibits *riba* in business transactions. The Quran says: "... whereas Allah permitted trading and forbidden *riba*" (Quran: 2: 275). However, neither the Quran nor the Prophet of Islamic did define what *riba* is. At present, *riba* is interpreted as interest. The present scholars of Shariah agreed that the predetermined fixed rate of return is not permitted in the business transactions of the Islamic bank and financing.

Third, the prohibition of *riba* (usury) in Islam gave birth to the rise in the profit and loss sharing (PLS) mode of production. The PLS is the most important characteristic of the Islamic banks that distinguishes the Islamic banks from the interest-based conventional banks. The key features of profit and loss sharing (PLS) are that (i) Both parties (bank and borrower) share the outcome of business venture (profit or loss); unlike conventional bank equity contracts where banks do not bear the risk of financing investments, Islamic banks share the risk of investment. That is, if there are losses, Islamic banks share the losses of investments (ii) Unlike conventional banks' equity contracts where banks enjoy the fixed rate of return from investments, even when there are losses for the project, there is no predetermined rate of returns on investments for Islamic banks. Justice requires that both partners of business must share the risk of the business. Thus, the key features of the Islamic banking and finance are, PLS, the avoiding of fixed interest, and Shariah based business conduct.

Survey of Literature

A survey of the efficiency studies of the Islamic banks can be classified in two broad categories: Studies of the efficiency of the Islamic banks, and studies of efficiency banking sector including conventional and Islamic. As efficiencies are the main focuses of this paper, the survey of literature will concentrate on studies of the efficiencies of Islamic banks.

El-gamal and Inanoglu (2004) estimated the comparative cost efficiency of the Turkish banks during the period 1990-2000 using the data envelopment analysis (DEA) method. They found that the Islamic banks were more efficient due to Islamic banks' asset-based financing mechanism.

Sufian and Majid (2006) investigated the comparative efficiency of the foreign and domestic banks of Malaysia during 2001-2005. They found that banks' scale inefficiency dominated over the pure technical efficiency during the period. They also found that the foreign banks were more technically efficient than the domestic banks.

Kumar et al (2008) examined three efficiencies, technical efficiency, pure technical efficiency, and scale efficiency, of the 27 public sector banks of India for the year 2004. The empirical evidence of the paper showed that public sector banks were technically 88.5 percent efficient i.e. the inefficiency of the banks was 11.5 percent. Only 7 banks were technically efficient. The regression results of the paper found that the off-balance activities positively affected the Indian bank efficiency.

Samad (2013) investigated the efficiency of Islamic banks using the time-varying Stochastic Frontier function on the Islamic banks of 16 countries. Mean efficiencies between the pre-global financial crisis and the post-

global crisis were estimated at 39 and 38 percent respectively and the difference was not statistically significant suggesting that the efficiencies of Islamic banks did not deteriorate during the global financial crisis.

Samad (2013) empirically estimated the technical efficiencies (TE) of Islamic banks of Bangladesh and compared these with conventional banks in deposit mobilizations and loan financing in 2010. TE was estimated applying the stochastic frontier production function. The paper found the mean TE of Islamic banks and conventional banks in loan financing was 59.6 percent and 62.8 percent respectively, and for deposits, the mean efficiency was 0.61 and 0.60 respectively. Parametric tests such as Satterthwaite-Welch t-test, ANOVA F-test, and Walch F-test, found no statistical evidence of significant differences between the TE of Islamic and conventional banks.

Samad (2017) estimated the loan and the deposit efficiencies of the Islamic banks of Malaysia during 2008-2012 applying the Data Envelopment Analysis (DEA) technique. The study found that the Islamic banks of Malaysia enjoyed the higher TE in deposit mobilizations than in the loan financings. The average technical efficiency of loan financing was 83 percent, 88 percent, 87 percent, 97 percent, and 94 percent in 2008, 2009, 2010, 2011, and 2013 respectively whereas the average technical efficiency in deposit mobilizations was 87 percent, 94 percent, 94 percent, 96 percent, 92 percent, and 96 percent in 2008, 2009, 2010, 2011, and 2012 respectively. Whereas in loan financing, only four banks in 2008, two banks in 2009, three banks in 2010, two banks in 2011-2012 were efficient in both technical efficiency and scale efficiency. On the other hand, in deposit mobilization, four banks in 2008 and 2009, five banks in 2010 and 2011, three banks in 2012, and five banks in 2013 were efficient in technical efficiency and scale efficiency. Most of the Islamic banks in Malaysia were operating below the optimum scale of production.

Applying both parametric method (SFA) and non-parametric frontier methods (DEA), Hassan (2006) estimated various efficiencies, such as the cost, profit, allocative, technical, pure technical and scale efficiency of 43 Islamic banks in 21 countries from Middle East, Asia, Africa and Europe over the period 1995-2001. He found that Islamic banks were more cost inefficient than profit inefficient suggesting Islamic banks were more efficient in profit-making and in technical inefficiency. The technical efficiency dominated the scale efficiency. His findings confirmed the findings of Yudistira (2004). Yudistira examined the cross-country technical efficiency of 18 Islamic banks of GCC, East Asian, African and Middle Eastern countries during the period 1997-2000 and found that the overall technical inefficiency score of Islamic banks was on average just over 10%.

Sufian and Noor (2009) applied the panel DEA method and estimated the technical efficiencies of the MENA Islamic banks and the Asian Islamic banks and then compared their technical efficiency over the period 2001-2006. They found that the efficiency of the MENA Islamic banks was higher than that of the Asian Islamic banks. Pure technical inefficiency was less prominent than the scale inefficiency. Scale inefficiency was the major source of inefficiency.

Using the DEA Noor and Ahmad (2012) investigated the efficiency of 78 Islamic banks operating in 25 countries in the world during the period 1992–2009 and found that the technical efficiency of the Islamic banks has increased during and after the global financial crisis period. The financial crisis of the period has decreased trust in the conventional banking system in favor of the Islamic banking system. They further found that the pure technical efficiency scores of the sampled Islamic banks were higher than their scale efficiency scores which contradicted the findings of Sufian and Noor (2009) and Yudistira (2004).

Using the data of 25 Islamic banks in GCC countries for the period 2003-2009 and applying the DEA method, Srairi and Kouki (2012) found: (i) the overall technical inefficiency of GCC Islamic banks was the result of pure technical inefficiency (29.3%) rather than that of the scale inefficiency (17%); (ii) the overall technical efficiencies of the Islamic banks increased during and after the global financial crisis.

Applying the DEA, Rahman and Rosman (2013) and Rosman et al. (2014) compared the technical efficiency levels of the Middle Eastern Islamic banks with those of their Asian counterparts during 2007-2009 and 2007-2010 and found the technical efficiency of the Middle Eastern Islamic banks declined, while the technical efficiency of the Asian Islamic banks increased.

Hassine and Limani (2014) examined 22 MENA Islamic banks during 2005-2009 and found that the pure technical inefficiency was the main source of Islamic banks' technical inefficiency.

Bahrini (2016) examined the technical efficiencies of the 33 MENA Islamic banks during and after the global financial crisis using the DEA and bootstrap DEA and found that the technical inefficiencies of the MENA Islamic banks were mainly attributed to pure technical inefficiencies (17.9%) rather than scale inefficiencies (9.1%).

This survey shows: (i) no evidence of studies on the efficiencies of the Islamic banks of the South and Southeast Asian countries, Indonesia, Malaysia, Brunei, Singapore, Maldives, Thailand, Bangladesh, Sri Lanka, and Pakistan as group; (ii) there is no evidence of comparative studies of efficiencies such as, the overall bias-corrected technical efficiencies BC-TE), bias-corrected pure technical efficiency (BC-PTE) and the scale efficiency—across the Islamic bank of the region. So, this study is a pioneering work for this region and provides an important contribution in the efficiency literature of the Islamic banks.

Data and Methodology

This paper uses the panel data for the period 2011-2016 in estimating the bootstrap DEA efficiency. Data of fixed capital, employee wages, bank deposit, gross loans, and earning assets for the period were obtained from BankScope data source. Values of variables for Malaysia, Indonesia, Brunei, Maldives, Thailand, Sri Lanka, Bangladesh, and Pakistan during 2014-2016 were expressed in constant U.S. dollar.

First, this paper applied the Bootstrap-DEA Method for obtaining bias corrected technical efficiency. In spite of the wide application, the DEA method suffers from serious shortcomings, according to Simar and Wilson (1998). (i) The DEA method is deterministic. That is, the efficiency score obtained by the DEA does not allow for random error such as machine failure or power out etc. It thus overestimates the efficiency scores of the DMU and leads to biased efficiency (Simar and Wilson, 1998). (ii) The DEA methodology score does not provide a confidence interval. This paper, thus, employs the bootstrap-DEA approach introduced by Efron (1979). The main idea or objective of bootstrap is to simulate the data generating process (DGP) with repeated sampling. That is, it replicates repeated sampling from the data. As the replicated data set approximates the original data, the sampling distributions of the sample mean and standard deviations generated from the repeated sampling are close to the original ones.

The bootstrap-DEA was first introduced by Simar and Wilson (1998) and it provides estimated efficiency scores of each DMU generated from numerous repeated sampling. The bootstrap-DEA, thus, provides the bias-corrected efficiency scores together with the confidence interval at α level. So, bootstrap-DEA efficiency scores are more accurate and have statistical properties which the DEA method efficiency scores lack.

Empirically, an estimate of the radial Debreu-Farrell output-based measure of technical efficiency can be calculated by solving a linear programming problem for each data point k ($k=1, \dots, K$):

$$\begin{aligned} \hat{F}_k^0(Y_k, X_k, Y, X|CRS) = \theta \\ \text{s.t.} \quad & \sum_{m=1}^K z_k Y_{km} \geq Y_{km} \theta, m=1, \dots, M \\ & \sum_{n=1}^N z_k X_{kn} \leq X_{kn}, n=1, \dots, N \\ & Z_k \geq 0 \end{aligned}$$

Where Y is $K \times M$ matrix of available outputs, X is $K \times N$ matrix of available inputs. CRS specifies constant returns to scale. For variables to scale (VRS) a convexity constraint $\sum_{k=1}^K Z_k = 1$

θ is a scalar and represents the efficiency score of each decision making unit (DMU). The range of $\theta \leq 1$, with a value of 1 indicating a point on the frontier and hence a technically efficient DMU; i.e. output of the DMU cannot be increased without increasing inputs. A DMU is inefficient when the value of $\theta < 1$; that is, a given output can be produced by reducing inputs of the DMU.

Bias is calculated as follows:

$$\text{Bias}(\hat{\theta}_k) = E(\hat{\theta}_k) - \hat{\theta}_k.$$

$$\text{Bias}(\hat{\theta}_k) = B^{-1} \sum_{k=1}^K (\hat{\theta}^*_{*k}) - \hat{\theta}_k.$$

The bias-corrected efficiency score can be expressed as:

$$\tilde{\theta}_k = \hat{\theta}_k - \text{bias}(\hat{\theta}_k) = 2 \hat{\theta}_k - B^{-1} \sum_{k=1}^K (\hat{\theta}^*_{*k}).$$

The DEA is a linear programming technique, originally developed by Charnes et al. (1978), for constructing the best practice frontier from the observed inputs and outputs of all the sampled Decision-Making Units (DMUs). By comparing DMUs outside the frontier (inefficient DMUs) with those that lie on the frontier (efficient DMUs), this method can provide efficiency measures for each DMU (Coelli et al., 2005). The DEA has two versions. The DEA model proposed by Charnes, Cooper, and Rhodes (1978) is known as the CCR model. It measures the efficiency of the DMU under the assumption of constant returns to scale (CRS). As all DMUs do not operate under the CRS, Banker, Charnes, and Cooper (1984) proposed a DEA model called the BCC model. The BCC model assumes that DMUs operate under a variable return to scale (VRS) (increasing, constant or decreasing returns to scale). The difference between the CCR and BCC models can be illustrated by the following graph:

Figure 1: CRS and VRS efficiency frontiers (Coelli et al, 2005).

The line through the points Q and C represents the CRS efficiency frontier and the curve (ABCD) represents the VRS efficiency frontier. Each DMU that is on the frontier is technically efficient. For this reason, the particular DMU "F" is technically inefficient. When we refer to the CRS frontier, the distance FQ measures the technical inefficiency of the DMU "F". However, when we consider the VRS frontier, the technical inefficiency of the DMU "F" is only the distance FB. The difference between the CRS and the VRS frontiers is the distance QB which is a measure of scale inefficiency.

The overall technical efficiency score (under the CRS frontier): $TECRS = PQ/PF$

The pure technical efficiency score (under VRS frontier): $TEVRS = PB/PF$

The scale efficiency score: $SE = PQ/PB$

From this, we can deduce that $TECRS = TEVRS \times SE$ which means that the overall technical efficiency (OTE) of a particular DMU is the product of two efficiencies: pure technical efficiency (PTE) and scale efficiency (SE).

Suppose that there are no DMUs to be evaluated. Each DMU_j, $j = 1, \dots, n$ uses m different inputs, noted ($i = 1, \dots, m$), to produce s different outputs, noted ($r = 1, \dots, s$). The technical efficiency score for a particular DMU, called DMU_o, is determined by solving the following linear programming problem. The technical efficiency score θ for a particular DMU, called DMU_o, is determined by solving the following linear programming problem:

$$\begin{aligned} \theta^* &= \text{Min } \theta \\ \text{s.t. } \sum_{j=1}^n \lambda_j x_{ij} &\leq \theta x_{io} & i &= 1, \dots, m; \\ \sum_{j=1}^n \lambda_j y_{rj} &\geq y_{ro} & r &= 1, \dots, s; \\ \lambda_j &\geq 0 & j &= 1, \dots, n; \end{aligned}$$

$\theta < 1$ Means that the evaluated DMU is technically inefficient. $\theta = 1$ Indicates a point on the frontier and hence a technically efficient DMU. In order to estimate the efficiency scores of all the DMUs in the sample, the above problem must be solved n times, once for each DMU $_j$, $j = 1, n$ (Coelli et al., 2005).

Input-Output Controversy and Model Selection

In a firm's production, like a coal mine, the inputs and outputs are easy to find. The output is the amount of coal and the inputs are labor and capital. However, in the multiproduct firms such as a bank which produces a series of services and uses a vector of inputs, deciding inputs and outputs are controversial. Which are the bank's inputs and which are the bank's outputs are a debatable issue for a long time.

Based on the production approach (Benston, 1965), a bank is a producer of services for the bank account holders and it produces deposit accounts and loan services with labor and capital. In this sense, the number of deposit accounts or deposits can be used as output. Depositors' income which is equivalent to interest paid to depositors is an important factor for mobilizing total deposits.

Under the intermediation approach, first used by Sealey and Lindley (1977), the bank is a financial intermediary which collects deposits from the savers and channels funds to borrowers. It treats earning assets as outputs and deposits as inputs. In this sense, loans, investments in securities, and advances are the outputs of a bank and labor, capital, deposits, and expenses related to them are inputs of a bank

Based on Sealey and Lindley (1977), this paper estimates the following model using bootstrap DEA based on the assumption of Banker, Charnes, and Cooper* (1984):

Model 1:

$$\text{loani} = \beta_0 + \beta_1 \text{Fixed capital} + \beta_2 \text{salary} + \beta_3 \text{Deposit}$$

Where

loani = total loans + total earning assets. They are considered as output.

prem= bank fixed capital, salary= Salaries, and Depo = total deposits. They are considered as bank inputs used for producing outputs.

Descriptive statistics of inputs and output variables used for estimating technical efficiencies are provided in Table 1.

Table 1: Descriptive statistics of inputs and output variables for Efficiency Estimate
(All values are in constant dollar)

	Inputs for DEA Model			Output for DEA Model	
	WAGE	CAPITAL	DEPOSITS	LOANS	EARNASSET
Mean	27762.43	31248.35	2889310.	2427496.	3399466.
Median	11975.00	8458.000	1364184.	1260166.	1626164.
Maximum	190534.0	1028517.	23268496	18658282	25319612
Minimum	140.0000	4.000000	43.00000	225.0000	6140.000
Std. Dev.	39596.85	75097.63	3942223.	3334893.	4685625.
Skewness	2.221717	8.786129	2.274235	2.441312	2.259164
Kurtosis	7.407805	110.5465	9.119032	10.17270	8.797715
Jarque-Bera	465.1776	142005.6	695.1515	900.3146	646.0942
Probability	0.000000	0.000000	0.000000	0.000000	0.000000
Observations	285	287	287	287	287

Three inputs, in Table 1, are employee expenses measured by wages, fixed capital measured by capital, and deposits. They are used in producing bank outputs, loan financing and earning assets. The means of three inputs are \$27762.43, \$31248.35, and 2889310. Among three inputs, deposits of banks are the largest inputs. The low probabilities of the Jarque-Bera statistics shows that the null-hypothesis of normal distribution cannot be accepted.

* Banker, Charnes, and Cooper (1984) estimated the technical efficiency based on the assumption that firms normally operate under the variable returns to scale instead of the constant returns to scale assumed by Charnes, Cooper, and Rhodes (1978)

Empirical Results

The estimated efficiency score of the overall bias-corrected technical efficiencies (BC-TE), bias-corrected pure technical efficiency (BC-PTE) and the scale efficiency (SE) of the Islamic banks of nine countries in the region is presented in Table 3, Table 4, and Table 5.

Table 2: Overall Standard Technical (TE), Bias-corrected Technical Efficiency (BCTE), Biases, and Interval Value During 2011-2016

Country	# of banks	TE	BC-TE	Bias	BCTELOW ER	BCTEUPP ER
Malaysia	17	0.875	0.819*	0.048	0.826	0.873
Indonesia	10	0.749	0.723*	0.013	0.709	0.745
Bangladesh	8	0.769	0.758*	0.043	0.699	0.765
Pakistan	6	0.814	0.786*	0.028	0.771	0.809
Brunei	1	0.761	0.754*	0.008	0.746	0.760
Singapore	1	0.936	0.800*	0.13	0.761	0.921
Thailand	1	0.767	0.751*	0.012	0.745	0.764
Sri Lanka	1	0.782	0.774*	0.014	0.758	0.780
Maldives	1	0.778	0.770*	0.007	0.759	0.775
All Banks average		0.797	0.773*	0.020	0.756	0.790

Note: BCTELOWER and BCTEUPPER represents the 95% confidence level lower-limit and upper-limit value of bias-corrected technical efficiencies. c*= Efficiency score significant at a 5 % level.

The (TE) score shows the constant returns to scale efficiency obtained from the Data Envelope Analysis (DEA). The bias-corrected technical efficiency (BC-TE) scores were obtained by bootstrap DEA method. The BC-TE scores are estimated at a 5 percent level of significance and are within the lower and upper bound of the confidence level.

Table 2, shows the average BC-TE of all Islamic banks in the region was 77.3 percent. This result suggests that the average technical inefficiency of all banks of the region was 22.7 percent. Comparative results of the overall bias-corrected technical efficiencies (BC-TE) across banks of the region showed that the banks of Malaysian had the highest average BC-TE over all the Islamic banks in the region. The average BC-TE of Malaysian Islamic banks was 81.9 percent. This suggests that the average technical inefficiencies of the Malaysian Islamic banks were 18.1 percent.

The average overall BC-TE of the Islamic banks of Pakistan was the second. The average BC-TE of the Pakistan Islamic banks was 78.6 percent suggesting that the average inefficiency was 21.4 percent. The average overall BC-TE of the Islamic banks of Indonesia, Bangladesh, Brunei, Thailand, Sri Lanka, and Maldives were below the regional average of 77.3 percent suggesting that the inefficiencies of the banks of these countries were higher than the regional average of 22.7 percent. The average BC-TE of Islamic banks of Indonesia were the lowest in the region with the exception of Brunei, Thailand, Sri Lanka, and Maldives. The average BC-TE of the Indonesian Islamic banks was 72.3 percent.

Table 3: Standard Pure Technical Efficiency (PTE), Bias-corrected Pure technical Efficiency (BCPTE), Bias, and Interval Value During 2011-2016

Country	# of banks	PTE	BC-PTE	Bias	BCPTELOW ER	BCPTEUPP ER
Malaysia	17	0.904	0.870*	0.034	0.840	0.899
Indonesia	10	0.797	0.782*	0.014	0.769	0.793
Bangladesh	8	0.829	0.816*	0.013	0.803	0.826
Pakistan	6	0.837	0.807*	0.029	0.781	0.833
Brunei	1	0.868	0.855*	0.013	0.842	0.865
Singapore	1	0.957	0.864*	0.093	0.802	0.952
Thailand	1	0.866	0.855*	0.010	0.844	0.863
Sri Lanka	1	0.815	0.801*	0.014	0.790	0.812
Maldives	1	0.782	0.766*	0.017	0.749	0.779
All Banks average		0.836	0.812*	0.024	0.790	0.832

Note: BCTELOWER and BCTEUPPER represents the 95% confidence level lower-limit and upper-limit value of bias-corrected technical efficiencies. c*= Efficiency score significant at 5 % level.

Table 3 shows the average bias-corrected pure technical efficiency, also known as managerial efficiency, of all banks in the region was 81.2 percent. The average managerial efficiency (PTE) of the Islamic banks of Malaysia, excluding Brunei, Singapore, and Thailand, was higher than the average of the region. The average efficiency of the Malaysian Islamic banks was 87 percent compared to 81.2 percent of the region. Although the average PTE of Brunei, Singapore, and Thailand Islamic banks was higher than the regional average of 81.2 percent, the result should be interpreted with caution. Because only one bank in each of these countries was in operation during 2013-2016 under this study. The average estimation bias (BIAS) of all banks in the region was 0.02.

Table 4: Average Scale Efficiency (SE) Score of Southeast Asian Islamic Banks during 2016-2011

Country	Total observation	SE Score	Total CRS (Scale efficient)*	IRS	Total DRS	Total Banks	% scale efficient
Malaysia	107	0.916	54		53	17	50.4
Indonesia	60	0.942	29		31	10	48.3
Bangladesh	52	0.932	13		39	8	44.2
Pakistan	38	0.968	21		17	6	55.2
Brunei	6	0.878			6	1	0
Singapore	3	0.978	3			1	100
Thailand	4	0.887			4	1	0
Sri Lanka	4	0.967	1		3	1	25.0
Maldives	3	0.994	3			1	100
Total	277		124		153	46	
All Banks average		0.953					45.6

*Number in the column represents the number of times during 2011-2016 the banks in the country were operating under the constant returns to scale (CRS), decreasing returns to scale (DRS), and increasing returns to scale (IRS).

Table 4 shows, among countries of Southeast Asia, the Islamic banks of Pakistan were more scale efficient during the period 2011-2016, excepting the banks of Singapore and Maldives. The average scale efficiency of the Islamic banks of Pakistan was 55.2 percent. Banks of Malaysia and Indonesia followed the efficiency of Pakistan. The average scale efficiency of the Islamic banks of Malaysia and Indonesia was 50.4 percent and 48.3 percent respectively.

The 100 percent scale efficiency of Singapore and Maldives Islamic banks should be interpreted cautiously because there is only one Islamic bank under this study in each of the countries. Secondly, the efficiency score represented the result of only three years (2013-2016). Similarly, the 100 percent scale inefficiency of Brunei and Thailand Islamic banks should be interpreted cautiously because there was only one Islamic bank in these countries under this study. Secondly, the estimated inefficiency score was the result of only three years (2013-2016).

The higher scale efficiency of the Islamic banks of Pakistan and Malaysia, among the Islamic banks of Southeast Asia, could be due to the reason they were the pioneers of Islamic banks. They were the first countries after Egypt to introduce Islamic banks. As these countries were the first to introduce Islamic banks to operate side by side with conventional banks, banks of these countries acquired and learned more operational, competitive and survival skills than the Islamic banks of other countries.

Results of comparative efficiencies: overall technical efficiency (BC-TE), managerial efficiency (BC-PTE), and Scale efficiency (SE) show that SE dominated other efficiencies. The average SE of all banks in the region was 95.3 percent suggesting that the scale inefficient was only 4.7 percent. The average managerial efficiency, BC-PTE, of all banks in the region was 81.2 percent suggesting the average inefficiency of bank management was 18.8 percent. The average technical efficiency (BC-TE) of all banks in the region was 77.3 percent i.e. inefficiency in resource allocation was 22.7 percent.

Results of comparative analysis of all three efficiencies: (BC-TE), (BC-PTE), and (SE) across all banks in the region showed that the average overall technical efficiency (BC-TE) and the management efficiency (BC-PTE) of the Malaysian Islamic banks were highest among the Islamic banks of the South and Southeast Asian countries. The average BC-TE and BC-PTE of Malaysian Islamic banks was 81.9 percent and 87.0 percent respectively. Pakistan was the second highest in BC-TE. The average overall BC-TE of the Islamic banks of Pakistan was 78.6 percent.

In terms of scale efficiency (SE), the Islamic banks of Pakistan were more scale efficient than the Islamic banks of all countries under study in the region. Whereas the scale efficiency of Pakistan's Islamic banks was 55 percent during 2011-2016, the scale efficiency of Malaysian Islamic banks was 50 percent during the same period. Thus, the scale efficiency of Malaysian Islamic banks ranked second in the region.

Figure 2: The growth of the three types of bank efficiencies—BC-TE, BC-PTE, and SE

Figure 2 shows that bank technical efficiencies (BC-TE) increases from 2011 to 2013 and remains stable in the region i.e. South and Southeast Asia during 2013-2016. Bank managerial efficiency, BC-PTE, fluctuated over from 2011 to 2013 and then remains stable. The scale efficiency of banks in the South and Southeast Asia, under study, remained stable until 2015. In general, all three efficiencies: BC-TE, BC-PTE, and SE, remained relatively stable. This stability of efficiency could be explained by the stability of economic growth of these countries. The per capita GDP of these countries were stable.

Comparative Efficiencies of Islamic Banks Across Countries

Comparative growth trend of all three efficiencies: the overall bias-corrected technical efficiencies (BC-TE), bias-corrected pure technical efficiency (BC-PTE), and the scale efficiency (SE) of the Islamic banks across countries in the region is presented in figure 3, figure 4, and figure 5. The growth of the overall technical efficiency (BC-TE) of the Islamic banks of Malaysia, Indonesia, Brunei, Singapore, Thailand, Maldives, Sri Lanka, Bangladesh, and Pakistan are presented in figure 3.

Figure 3: Growth of Islamic Banks' Overall Technical Efficiency (BC-TE) Across Countries

Figure 3 shows the fluctuation of BC-TE of Islamic banks across the countries. However, Islamic banks of Malaysia and Bangladesh show the growth of overall BC-TE from 2014 until 2016. On the other hand, Pakistan and Thailand show a declining growth of BC-TE since 2014. Only the Islamic banks of Singapore were 100 percent efficient. However, this result of Singapore banks should be interpreted carefully because there was only one Islamic bank in Singapore under this study.

The growth of the managerial efficiency (BC-PTE) of the Islamic banks Malaysia, Indonesia, Brunei, Singapore, Thailand, Maldives, Sri Lanka, Bangladesh, and Pakistan are presented in figure 4.

Figure 4: Growth of Islamic Banks' Managerial Efficiency (BC-PTE) Across Countries

Figure 4 shows that the average managerial efficiency, BC-PTE, of Islamic banks across the countries remain unstable. However, the managerial efficiency of the Islamic banks of Malaysia and Bangladesh shows an increasing trend from 2014 to 2016. On the other hand, Pakistan and Thailand show a declining trend of BC-PTE since 2014. Only Singapore Islamic banks showed that their managerial efficiency was 100 percent. This result of Singapore banks should be interpreted carefully because there was only one Islamic bank in Singapore under this study.

The trend of the scale efficiency (SE) of the Islamic banks of Malaysia, Indonesia, Brunei, Singapore, Thailand, Maldives, Sri Lanka, Bangladesh, and Pakistan is presented in bar figure 5.

Figure 5: Growth of Islamic Banks' Scale Efficiency (SE) Across Countries

Figure 5 shows that the average scale efficiency (SE) of Islamic banks across the countries remain fluctuating. However, the scale efficiency score of the Islamic banks of Bangladesh, Brunei, Sri Lanka and Pakistan showed a decreasing trend from 2014 to 2016. On the other hand, the banks of Pakistan and Thailand show a declining trend of BC-PTE from 2014. Only Islamic bank of Singapore was 100 percent scale. This result of Singapore bank should be interpreted carefully because there was only one Islamic bank in Singapore under this study.

Comparing efficiencies across the Islamic banks, the paper provides policy prescriptions. The underlying reason the Islamic banks of Malaysia and Pakistan for superior efficiency is that they were pioneers in permitting Islamic banks to operate and compete side by side with conventional banks. By allowing persians of establishment, more Islamic banks were opened, intensified banking competition, and consequently enhanced technical efficiencies of the banking system. The paper, therefore, suggests that the banking policy making body of a country should open up different breeds of banks including Islamic banks.

Summary and Conclusions

First, the paper outlines the importance of this study in the introduction. Several reasons are provided for studying technical efficiencies of the Islamic banks across countries. The efficiency is a key factor for the survival of a bank.

As the Islamic banks are different breeds of banks, key features are discussed in the section of feature of Islamic banks. A survey of literature provided various researches on the efficiency of the Islamic banks including cross country studies and the survey showed that there was no comparative cross-country study of the efficiencies of the Islamic banks of the nine countries of the south and southeast Asia.

In comparing technical efficiencies across the Islamic banks of nine South and Southeast Asian countries, this paper, first, obtained three efficiencies of the Islamic banks of Indonesia, Malaysia, Brunei, Singapore, Maldives, Thailand, Bangladesh, Sri Lanka, and Pakistan.using the Bootstrap Data Envelope Analysis (DEA) with panel data of 2011-2016. This paper obtained overall technical efficiencies (TE), pure technical

efficiencies (PTE), and scale efficiencies. The average overall TE of the region was 77.3 percent indicating the average inefficiencies of the banks 22.7 percent. This result suggests that the Islamic banks of the region misused on average 22.7 percent of their resources.

The Bootstrap DEA results found that the average PTE of the Islamic banks of the region was 81.2 percent suggesting that the banks' average managerial inefficiencies were 19.8 percent. The average SE of the Islamic banks of the region was 95.3 percent suggesting the banks' average scale inefficiencies were 4.7 percent.

After obtaining technical efficiencies, the paper, secondly, made a comparative analysis of the technical efficiencies across the Islamic banks of the region. Results of the comparison of the average TE, PTE, and SE among the Islamic banks across the regions showed that the Islamic banks of Malaysia were relatively more efficient in both TE and PTE. The average TE and PTE of the Malaysian Islamic banks was 81.9 percent and 87.0 percent respectively and was higher than the regional average of 77.3 percent and 81.2 percent respectively.

The average overall BC-TE of the Islamic banks of Indonesia, Bangladesh, Brunei, Thailand, Sri Lanka, and Maldives were below the regional average of 77.3 percent suggesting that the inefficiencies of the banks of these countries were higher than the regional average of 22.7 percent. An examination of the bar graphs shows an increasing trend of average growth of BC-TE and BC-PTE of the Islamic banks of Malaysia and Bangladesh from 2014 to 2016.

The comparative scale efficiency results showed that the Islamic banks of Pakistan were more scale efficient among the Islamic banks in the region, with the exception of the Islamic bank of Singapore. The average SE of Pakistan's Islamic bank was 96.8 percent compared to the region average of 95.3 percent. Only Singapore Islamic bank was 100 percent efficient in all technical efficiencies: TE, PTE and SE. However, this result should be noted that there was only one Islamic bank in Singapore and the bank's efficiency was only for 2013-2016.

The Islamic banks of Malaysia and Pakistan excelled beyond the banks of the other countries. The reason for this is because they were the first to introduce the Islamic banks to operate side by side with conventional banks; the Islamic banks of these countries acquired more efficiencies over periods when they were operating side by side and competing with conventional banks.

The paper provides policy prescription that the banking policy making body of a country should provide opportunities for opening of different breeds of banks including Islamic banks for intensifying competition and enhancing efficiency of the banking system. The paper is not a conclusive study for the cross-country efficiency of the Islamic banks. This paper did not study the cross-country scale efficiency of the Islamic banks. The paper also did not examine deposit efficiency and profit efficiency of the Islamic banks. Bank numbers and bank Data are limited. Future research can address these issues and study those efficiencies in their research papers.

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