

A Comparison of Relative Efficiency of Islamic Banks and Interest Based Banks of Bangladesh

MAINUL ISLAM CHOWDHURY¹

A. F. M. ATAUR RAHMAN

Abstract

Conventional (interest based) banks and Islamic banks operate side by side in Bangladesh, as in many other countries. Although they offer comparable services and products to their customers their operations are stemmed in very different bases. Conventional banks operate on pure profit maximizing approach but their Islamic counterparts want to optimize profit without violating Shariah. So theoretically we may expect to have some variation in their level of efficiency. This exercise aims to compare the relative efficiency of these two groups of institutions using Data Envelopment Analysis (DEA). Firm level accounting data of 43 commercial banks have been used in the exercise. Looking at the issue of efficiency from four different perspectives the paper finds that there is no conclusive evidence that one or the other group is unquestionably superior to the other. Rather they operate almost at the same level of efficiency.

Introduction

The recent global financial meltdown has drawn a renewed interest to Islamic financial institutions especially towards Islamic banks, which can be more resilient to such crises as they do not deal with debt instruments and keep themselves out from market speculation. In 2008 the Standard & Poor's 500 Index and the Dow Jones Industrial Index in the US fell by 38.5% and 33.8%,

¹ Authors are, respectively, Lecturer and an Associate Professor at the Department of Economics, North South University, Dhaka.

respectively. By contrast, the Dow Jones Islamic Financial Index showed a modest loss of 7% for that year (Tayyebi 2009). Islamic banking industry is growing at a rate of 15% every year (Rashid and Nishat, 2009) globally, which is an indication of their greater acceptability in the financial world. The major difference between an Islamic bank and a conventional one is that while the latter deals with interest, Islamic banks run on a profit loss sharing mode (PLS) and avoid any transaction involving interest. This, however, puts Islamic banks into a more difficult situation than their “regular” counterparts. Islamic banks have to adhere to the laws of the land (which are not always designed for an interest free environment) where they are operating and to the financial guidelines of Islam (Samad 2004). In many cases they need to deal with individuals and institutions that may not necessarily follow the *Shariah*¹ regulation. For example, in the case of liquidity shortage they cannot borrow from the inter-bank money market or from the central bank where they may have to deal with interest. They cannot take part in repo and reverse repo auctions because those are done on interest bearing terms. Islamic banks also avoid swaps or foreign exchange options like forwards, which expect gain out of speculation.

The issue of efficiency for financial institutions is important in the sense that it is an indicator of profitability for owners, viability for regulators, and worthiness for researchers (Rahman and Chowdhury, 2009). The literature on bank efficiency is simply overwhelming. But these mostly focus on conventional banking institutions. The number of studies focusing on the efficiency of Islamic banks is relatively small, and among them only a few use data on Bangladesh. This exercise is an attempt to fill that gap. In this exercise, we used Data Envelopment Analysis (DEA) to measure the relative efficiency of conventional banks vis-à-vis Islamic banks as groups using 2008 data.² There were 48 banks operating in Bangladesh in 2008. We took 43 of them in our sample leaving 5 specialized banks (SBs) out. SBs are different from usual commercial banks as they are neither (operationally) profit-oriented nor focused for extending financial services to general public. Depending on banking operation we categorized each bank in one of the 3 broad categories i.e., conventional banks, Islamic banks, and banks having a dual operation (hereafter dual banks). There are 27 conventional banks, 10 dual banks and 6 Islamic banks in our sample. We compared their relative efficiency following four different perspectives, namely production perspective,

¹ Islamic religious jurisdictions are sometimes called *Shariah*

² In 2008 there were 6 full fledged Islamic Banks in Bangladesh. First Security Islamic Bank converted its conventional banking operation to Islamic banking in 2009.

intermediation perspective, investor's perspective, and regulator's perspective. The overall average efficiency scores considering production perspective were 74.47%, 73.53% and 87.85% for conventional, dual, and Islamic banks, respectively. These figures were 81.34%, 78.30% and 78.67%, respectively, considering intermediation perspective.

The rest of the paper is organized as follows. Section 2 provides a brief review of the existing literature. Section 3 describes the methodology followed by the description of the data in section 4. Section 5 presents the result of the analysis and section 6 concludes.

Literature Review

There are few studies that discuss the issue of efficiency among Islamic banks. Samad (2004) examined the comparative performance of Bahrain's 6 Islamic banks and 15 conventional commercial banks for the period from 1991 to 2001. The author measured the performance of these banks in terms of profitability, liquidity risk and credit risk using nine financial ratios. The paper found no major difference in performance between Islamic and conventional banks with respect to profitability and liquidity. However, he found a superiority of Islamic banks in terms of credit performance.

Yudistira (2004) calculated technical and scale efficiency of 18 Islamic banks of 12 countries following DEA. The study took intermediation perspective using total loans, other income and liquid assets as outputs, and staff costs, fixed assets and total deposits as inputs. They found that Islamic banks suffered little inefficiency during the global crisis of 1998-99. This would suggest the interdependence of Islamic banks to other financial system. They found little difference in efficiency scores among banks but later they found that they could explain the difference using country specific factors.

Batchelor and Wadud (2004) investigated the efficiency of Islamic Banks of Malaysia using DEA. They compared technical and scale efficiency measures of Islamic banks and dual banks of both local and foreign ownership. It was found that foreign banks increased efficiency levels to achieve full efficiency over the six-year period considered, while domestic banks made smaller improvement in efficiency and the Islamic banks experienced a general decline in efficiency, which was solely attributed to scale inefficiency.

Another study by Mokhtar et al. (2006) compared Islamic banks, dual banks and conventional banks in Malaysia using stochastic frontier approach and intermediation perspective. They used total deposits and total overhead expenses as input, and total earning assets as output. The paper identified an improving trend in the efficiency of Islamic banking industry although the level was lower than that of conventional banks. However, they found that Islamic banks were more efficient than dual banks while dual foreign banks were more efficient than their domestic counterparts.

Cihák and Hesse (2008) presented a cross-country empirical analysis of Islamic banks' impact on financial stability using z-scores as a measure of stability. Their sample covered 77 Islamic banks of 20 countries for a period from 1993 to 2004. They used a panel regression analysis using z-score as the dependent variable. They found that small Islamic banks tend to be financially stronger than small commercial banks, large commercial banks tend to be financially stronger than large Islamic banks, and small Islamic banks tend to be financially stronger than large Islamic banks. The authors suggested that it may become significantly more complex for Islamic banks to adjust their credit risk monitoring system as they become bigger. Given their limitations on standardization in credit risk management, monitoring the various profit-loss-arrangements becomes rapidly much more complex as the scale of the banking operation grows, the resulting problems related to adverse selection and moral hazard becoming more prominent. Another possibility is that small banks concentrate on low-risk investments and fee income, while large banks do more PLS business.

There are some studies that investigated the efficiency of Islamic banks using Bangladeshi data. Sarker (1999) analyzed performance of Bangladeshi Islamic banks measured five efficiency criteria (productive efficiency, operational efficiency, allocative efficiency, distributive efficiency and the stabilization efficiency) involving financial ratios. However, the study did not compare the performance of Islamic banks with other commercial banks. Therefore, generalization of the result was not feasible. The paper argued that Islamic products have different risk characteristics and consequently different prudential regulation should be erected.

Ahmad and Hassan (2007) analyzed the asset quality, capital ratios, and operational ratios such as net profit margin, net interest income, income to asset ratio, non-interest income to asset ratio and liquidity ratios of commercial banks in Bangladesh for seven years from 1994 to 2001. The study found no difference between Islamic banks and private commercial banks in terms of asset quality

performance. In capital ratio measures, Islamic banks are in general better capitalized than other banks. Private commercial banks showed best performance in the category of operational ratios. Islamic banks on an average were the preeminent performer in terms of lowest non-performing to gross loan ratio, capital funds to total asset ratio, capital funds to net loans ratio, capital funds to short-term loan ratio, capital funds to liabilities ratio, non-interest expense to average asset ratio, and most of the liquidity ratios. Therefore, they concluded that Islamic banks are outperforming others in capital adequacy and adequate liquidity. Except Return on Equity Ratio, Islamic Banks were at par with the industry in all other cases.

Rashid & Nishat (2009) compared the financial performance and its deviations among different conventional and Islamic banks in Bangladesh. They looked at profitability status, riskiness and performance of Islamic Banks with the industry average and across different generations of banks. Then they identified points-of-riskiness for Islamic Banking Sector. The study considered 12 important financial ratios and common size income statement and balance sheet information of Islamic banks for 2001 to 2006. Results showed poor performance of Islamic banking sector in almost every aspect, especially in the areas of profit maximization, investor management and operating inefficiency.

Summarizing these exercises we see that we can not make any definite conclusion regarding the superiority of Islamic banks on conventional banks or vice versa considering different efficiency criteria. Rather they are more or less comparable groups. In some studies authors found Islamic banks to be more efficient while others pointed out some deficiencies. This is true not only for Bangladesh but also for cross country analysis.

Methodology

DEA efficiency measures can be done in input or output orientation. Efficiency can be defined either maximizing output to a given input mix or minimizing inputs given an output mix. In case of input orientation DEA method tries to decrease inputs keeping outputs constant. That is, to what proportion we can reduce input without negotiating output. Conversely, in output orientation, DEA method tries to maximize outputs keeping input level fixed. We used the input oriented radial measure all through in our exercises, that is, radial reduction³ of input while keeping output constant. First we assumed constant returns to scale

³ Radial reduction of input refers to a condition where all the inputs are reduced by the same proportion.

(CRS) and then variable returns to scale (VRS) to get the effect of scale. The CRS measure will give us the total efficiency measure, which includes scale efficiency and technical efficiency. The VRS measure takes the level of production into consideration and extracts the effect of efficiency entrapped in input output mix only, i.e., given the level of production whether a DMU is optimally using its input mix compared to other DMUs operating at the same level. In that sense it can be termed as technical efficiency as well. Scale efficiency gives us the idea about how well the institution is performing given the level of production, i.e., efficiency comparison between the best performing DMU(s) in a pool regardless of the level of production and a technically efficient DMU for a particular level of production. Total efficiency compares an institution with the best performing institution of the group irrespective of its level of production.

First, we determined banks' relative efficiency in 0.00 to 1.00⁴ scale. Mathematically, we solved the following linear program

$$Max\lambda_o = \frac{\sum_{i=1}^s v_i x_{io}}{\sum_{j=1}^r \omega_j y_{jo}}$$

$$\text{Subject to } \sum_{i=1}^s v_i x_{im} \leq \sum_{j=1}^r \omega_j y_{jm} \text{ for all } m=1,2 \dots n$$

$$\text{And } v_i \geq 0 \text{ for all } i=1,2, \dots s \text{ and } \omega_j \geq 0 \text{ for all } j=1,2, \dots r$$

Where λ_o is the efficiency measure of O^{th} DMU in a pool of n DMUs. There are r inputs denoted by y_j and s outputs denoted by x_i . Solution of the above linear program will give us CRS efficiency measure.

We can get VRS efficiency measure from this model simply by changing the optimizing function. The problem will look like

$$Max\lambda_o = \frac{\sum_{i=1}^s v_i x_{io} + c_o}{\sum_{j=1}^r \omega_j y_{jo}}$$

$$\text{Subject to } \sum_{i=1}^s v_i x_{im} + c_o \leq \sum_{j=1}^r \omega_j y_{jm} \text{ for all } m=1,2, \dots n$$

$$\text{And } v_i \geq 0 \text{ for all } i=1,2, \dots s \text{ and } \omega_j \geq 0 \text{ for all } j=1,2, \dots r$$

⁴ Efficiency score of 1.00 is defined in Charnes and Cooper (1985) as the state of production when none of its inputs can be decreased without either (i) decreasing some of its outputs, or (ii) increasing some of other outputs none of its outputs can be increased without either (i) increasing one or more of its inputs, or (ii) decreasing some of its other outputs

After determining efficiency following constant returns to scale for individual DMU, we measured efficiency following variable returns to scale and from both measures we calculated the measure of scale efficiency.

In the second step, we tried to determine scale efficiency. To determine that we calculated scale efficiency as $\lambda_0 = \lambda_0$ (CRS) I λ_0 (VRS), if λ_0 equals to 1 then the DMU is scale efficient. If λ_0 is less than 1 then the DMU is operating under scale inefficiency. To determine whether this inefficiency is due to increasing returns to scale (IRS) or decreasing returns to scale (DRS)⁵ we then calculated efficiency score assuming non-increasing (NIRS) returns to scale. If then inefficiency is due to increasing returns to scale, however if then inefficiency is due to decreasing returns to scale⁶.

The whole process is explained in Figure 1.

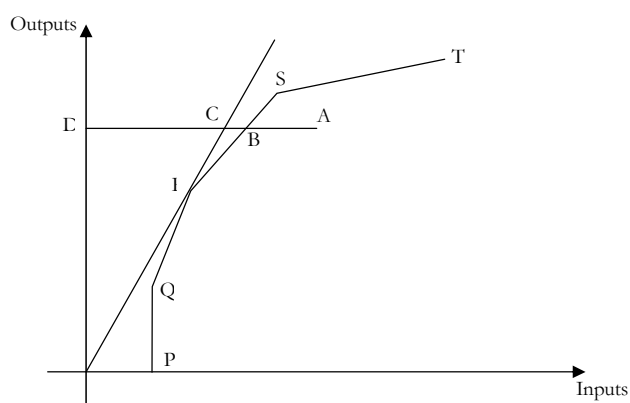


Figure 1: Total, technical and scale efficiency

In Figure 1, suppose input magnitude is placed along abscissa and output magnitudes are placed along ordinate. PQRST represents the most efficient frontier. If a certain bank operates on this frontier, the bank will be considered as technically efficient or even totally efficient. But suppose a bank operates at point I. In that case its total efficiency, technical efficiency and scale efficiency will be

$$\text{Total efficiency} = \frac{DC}{AD} \quad \text{Technical efficiency} = \frac{DB}{AD}, \text{ and } \text{Scale efficiency} = \frac{DC}{DB}$$

This is a very simple two dimensional version of this problem.

⁵ Inefficiency may arise from overuse or under use of inputs. If inefficiency is due to IRS a DMU can increase its efficiency by increasing the scale of operation and vice versa.

⁶ For further discussion see Norman and Stoker (1991)

The above efficiency measures are radial efficiency measure in the sense that it argues for equi-proportionate reduction in all inputs. This, however, can leave slacks in inputs, which introduce non-radial measure of efficiency that does not leave any slack. However, in that case the reduction is not proportional and thus we will have one reduction factor for each input. Here we use the non-radial efficiency measure proposed by Färe and Lovell (1978). By comparing non-radial efficiency and radial efficiency one can make comments about over- or under-utilization of a certain input. Suppose following non radial measures, contraction factors forth inputs are λ_i and corresponding radial reduction factor is λ^* . Now if $\lambda_i < \lambda^*$ then that will indicate an over-utilization of a certain input factor. If $\lambda_i > \lambda^*$ then that will indicate an under-utilization and for the case where $\lambda_i = \lambda^*$ we would expect to have optimum usage of i^{th} input.

Prudent use of DEA methodology lies in the choice of inputs and outputs. For financial institutions choosing the set of inputs and outputs can be tricky. Sometimes it depends on the perspective that we are looking at. There are two major perspectives regarding input-output combination for banks, production perspective and intermediation perspective. These two arguments, although suitable for academic investigations, may not necessarily be very useful for either owners or regulators. Following Rahman and Chowdhury (2009) we used two more sets of inputs and outputs putting ourselves in the shoes of investors and regulators.

Data

Out of 48 scheduled banks operating in Bangladesh 7 are operating as full fledged Islamic banks. Besides 10 other banks including some foreign banks are running Islamic banking operation through 21 branches and windows. Recently seven other banks including Sonali, Janata, Agrani and Pubali have applied to Bangladesh Bank to open up Islamic banking windows. We included 43 banks in our data set. Out of these 43 banks, 27 banks were running conventional banking, 10 were dual banks (running Islamic banking operation through branches side by side conventional banking) and 6 were Islamic banks in 2008.

We picked four sets of input output specifications following four different arguments. They are explained below with brief motivation.

Production perspective

Banks are considered as firms to produce loans and deposits (through their aggressive marketing operation, prudent planning and proper quality control) by

using capital and labors. Both deposits and loan accounts are considered as equally important indicator of their success.

Inputs: Total labor (total operating expenses) and total capital

Outputs: Total loans, total deposits and total fee-based income (non interest income).

Intermediation perspective

Banks are considered as firms to intermediate funds from ultimate savers to borrowers. The primary idea of banking is to facilitate financing operation bridging maturity mismatch. In this process accountability is obviously maintained. So success depends on how much of deposit is converted into loan. The growing importance of borrowed funds and non loan investments in banking operation tempted us to include them in our specification.

Inputs: Deposits and borrowed funds

Outputs: Loans, investments and percentage of performing loan in total loan (1-NPL)

From investor's perspective

Investors, when they take decision to invest, are typically interested in their return. Depending upon investor's planning horizon return can be long or short. However, we expect that rational stable investors would like to invest in shares of a banking firm if that firm shows short term profit prospect and long term survival potential. From that perspective we have chosen inputs and outputs here. However it is true that not all banking firms are open to investors. Some are state owned and some are not listed in the stock market. Yet we think that these arguments are important irrespective of their ownership structure. The second and fourth factors in output specifications capture the level of riskiness.

Inputs: Capital, expense on deposit and loans taken and other expense.

Outputs: Total asset, percentage of performing loan in total loan (1-NPL), net profit, ratio of total deposits and borrowings with respect to capital

From regulators' perspective

Regulators perceive the whole situation from a different perspective. They are less concerned about the profitability of a certain institution rather they are more

concerned about the long term viability and safety of depositor's money. They are also interested in non-profit oriented issues like availability of banking services in rural areas etc. Considering these factors we picked the following inputs and outputs.

Inputs: Deposits, borrowed funds and capital

Outputs: Percentage of performing loan in total loan (1-NPL), return on asset, rural-urban branch ratio, non interest income/interest income⁷ and total asset/off balance sheet activities

All data were collected from different offices and departments of Bangladesh Bank. Stock variable figures were for 31st December 2008. Flow variables were for the year between 1st January 2008 and 31st December 2008. All figures are in crore taka.

Results

Looking through production perspective we have found that the average total efficiency score of banks is 76.12%. This figure tells that an average bank from this pool can reduce their input by 23.88% without reducing output if they had the best practice in the trade. Eight institutions achieved 100% efficiency score and they come from all three groups of banks.

Table 1 compares the total, technical and scale efficiency of different groups of banks following production perspective. The overall average efficiency (total efficiency) of 27 conventional banks, 10 dual banks and 6 Islamic banks included in the sample were found to be 74.47%, 73.53% and 87.85%, respectively. The relatively high average efficiency score of the Islamic banks can be due to their low operating expense (which is used as an input) of 89.65 crore *taka* compared to 165.01 and 147.96 crore *taka* of the dual operation banks and conventional banks, respectively, while their total deposit and lending volumes are comparable to that of other groups taking into consideration their volume of operation. If we look at technical efficiency, which extracts the efficiency of input-output mix taking into consideration the scale of operation, we find that Islamic banks are still as a group moving ahead. The average technical efficiency of Islamic banks is 90.60% against 79.16% and 74.46% for conventional and dual banks, respectively. Standard deviations in case of both total and technical efficiency are also low for Islamic banks which indicate that the performances of all banks

⁷ Non-profit income /Income from profit for Islamic Banks

within that group are quite at par. If we look at scale efficiency we find that 9 banks out of the total pool are scale efficient of which 6 are conventional banks, 2 are Islamic banks and the remaining one is a dual operation bank. The source of inefficiency in most cases (28 out of 34 inefficient banks) is increasing returns to scale which means banks could improve their efficiency by increasing their scale of operation.

Table 1: Relative Efficiency of Commercial Banks (Model 1)

	Total Efficiency			Technical Efficiency			Scale Efficiency		
	Conventional	Dual	Islamic	Conventional	Dual	Islamic	Conventional	Dual	Islamic
Average	74.47%	73.53%	87.85%	79.16%	74.46%	90.60%	94.23%	98.53%	97.13%
St. Dev.	18.65%	18.02%	10.61%	17.09%	17.51%	11.42%	11.84%	1.97%	4.63%
Max	100%	100%	100%	100%	100%	100%	100%	100%	100%
Min	43.18%	45.86%	75.25%	44.72%	48.43%	75.27%	58.94%	94.69%	88.56%
No. of Efficient Banks	3	1	1	10	4	2	3	1	1

Table 2 shows that from intermediation perspective 3 conventional banks, 1 dual operation bank and 1 Islamic bank achieved 100% efficiency. The average total efficiency level of Islamic banks is lower than that of conventional banks under this approach. In case of technical and scale efficiency the performance of conventional and Islamic banks are comparable while dual banks are a little behind. Higher standard deviations for Islamic banks indicate that performances of different Islamic banks are more dispersed. If we look at scale efficiency, the source of inefficiency in case of conventional and dual banks is decreasing returns to scale but in case of Islamic banks inefficiency occurs in most cases due to increasing returns to scale. This means that by increasing the scale of operation Islamic banks can probably attain superior efficiency level.

Table 2 : Relative Efficiency of Commercial Banks (Model 2)

	Total Efficiency			Technical Efficiency			Scale Efficiency		
	Conventional	Dual	Islamic	Conventional	Dual	Islamic	Conventional	Dual	Islamic
Average	81.34%	78.30%	78.67%	88.22%	85.77%	88.26%	92.86%	90.37%	92.04%
St. Dev.	11.59%	12.38%	17.01%	12.28%	14.20%	15.58%	9.76%	9.04%	15.05%
Max	100%	100%	100%	100%	100%	100%	100%	100%	100%
Min	57.45%	58.79%	61.22%	57.46%	63.18%	66.44%	63.5%	69.6%	61.66%
No. of Efficient Banks	5	1	2	6	1	3	6	1	2

Following the third approach which we call investors' perspective the average total efficiency of all banks reaches 87.58%. Table 3 shows that 16 banks attained 100% efficiency under this approach of which 4 are Islamic banks, 3 are dual banks and the rest 9 are conventional banks. The average total efficiency of Islamic banks is 96.69% with a lower standard deviation than their competitors. So, Islamic banks as a group have a room for reducing input usage only by a little more than 3%. Therefore, from the investors' perspective Islamic banks' input-output mix are quite optimal.

Table 3 : Comparative Total Efficiency (Model 3)

	All Banks	Conventional	Dual Operation	Islamic
Average	87.58%	86.74%	84.39%	96.69%
Standard Deviation	13.64%	14.36%	13.76%	5.15%
Max	100.00%	100.00%	100.00%	100.00%
Min	56.74%	56.74%	65.01%	89.52%
No. of efficient banks	16	9	3	4

From regulator's perspective none of the groups' performance is very buoyant. The overall total efficiency of all banks is 62.12% (Table 4) meaning banks can reduce their input by as much as 37% but can still produce the same level of output. Though efficient banks come from all the groups, Islamic banks are lagging behind conventional banks in terms of efficiency score. The performance of Islamic banks is also very dispersed under this approach. This low performance can be due to a very high average deposit collection (which is considered to be an input under this approach) by Islamic banks compared to the other groups of banks but limited investment opportunities complying *shariah* law which makes Islamic banks' ROA and ROE ratios comparatively low. Ratio of non performing loans is also higher for this group but if we ignore the performance of one particular bank in this group then the average NPL ratio of this group becomes lower than that of other groups. Rural-urban branch ratio for Islamic banks (0.33) is lower than that of conventional bank group (0.49). This high ratio for conventional banks is largely due to the strong presence of four nationalized banks namely *Sonali*, *Janata*, *Agrani* and *Rupali* banks in rural areas. The ratio of non-interest income to interest income⁸ is low for the Islamic banks group which

⁸ See footnote 6.

also negatively affects their performance under this approach. The ratio of total asset to off-balance sheet activities which is another output considered under this approach is higher for the Islamic banks group (8.7) compared to 6.3 and 4.5 for conventional and dual banks, respectively.

Table 4 : Comparative Total Efficiency (Model 4)

	All Banks	Conventional	Dual Operation	Islamic
Average	62.12%	67.75%	45.61%	57.35%
Standard Deviation	25.91%	21.96%	28.33%	31.05%
Max	100.00%	100.00%	100.00%	100.00%
Min	14.81%	26.62%	14.81%	19.13%
No. of efficient banks	7	4	1	2

Conclusion

The paper looks at the comparative efficiency of Islamic banks operating in Bangladesh vis-à-vis conventional and dual banks. We used DEA method under four different input-output settings. The result is mixed. In some specifications Islamic banks' performance is better than conventional banks but for some other specifications they fall behind the conventional (interest based) banks. But the difference in either side is very small. This is somewhat intuitive as, they operate in the same market and compete for the same depositor's money. It is true that due to some non-economic personal factors some consumers are inherently inclined to Islamic banks and they would not like to go to conventional banks whenever they need some banking service, but that "hardcore", consumer group is relatively small. Most of the banking service users are "economic agents" and would like to patronize the institution that gives them higher return. It has also been found that Islamic banks can improve their performance by increasing their volume of operation. Islamic banks' performance as a group is most impressive under the investor's perspective. Under the regulator's perspective Islamic banks are lagging behind.

References

1. Samad, Abdus (2004), "Performance of Interest-Free Islamic Banks vis-à-vis Interest-Based Conventional Banks of Bahrain", *IIUM Journal of Economics and Management* 12, no.2
2. Ahmad, A. U. F. & M. K. Hassan (2007), "Regulation and performance of Islamic banking in Bangladesh", *Thunderbird International Business Review*, 49(2), 251-277.
3. Batchelor, Valli Boobal and I.K.M. Mokhtarul Wadud (2004), "Technical and Scale Efficiency of Islamic Banking Operations in Malaysia: An Empirical Investigation with A Longitudinal Perspective", *Labuan Bulletin of International Business & Finance*, 2(1), 51-69
4. Charnes, A. and W. W. Cooper (1985), "Preface to topics in data envelopment analysis". *Annals of Operations Research*. R. Thompson and R. M. Thrall. 2: 59-94
5. ?ihák, Martin and Heiko Hesse (2008), "*Islamic Banks and Financial Stability: An Empirical Analysis*", IMF Working Paper No. WP/08/16
6. Färe, R. and C. A. K. Lovell (1978), "Measuring the technical efficiency", *Journal of Economic Theory* 19(1), pp. 150-162
7. Mokhtar, H.S.A., N. Abdullah and S.M. Al-Habshi (2006), "Efficiency of Islamic Banks in Malaysia: A Stochastic Frontier Approach", *Journal of Economic Cooperation* 27, 2, 37-70
8. Norman, Michael and Stoker Barry (1991), *Data Envelopment Analysis: The Assessment of Performance*, Wiley, New York
9. Rahman, A.F.M. Ataur and Mainul Islam Chowdhury (2009), An Investigation into the Efficiency of Commercial Banks in Bangladesh, Book chapter published from UPL, forthcoming
10. Rashid, Mamunur and Ainun Nishat (2009), "Disparity of Performance Indicators of Islamic Banks: Study on Bangladesh", *International Journal of Business and Management*, Vol 4, No.8
11. Sarker, A. A. (1999), "Islamic Banking In Bangladesh: Performance, Problems and Prospects", *International Journal of Islamic Financial Services*, Vol. 1, No. 3
12. Tayyebi, Aziz (2009), "Do Western Financial Markets Have Lessons to Learn from Islamic Finance?" *Financial Services Review*, June 2009.
13. Yudistira, Donsyah (2004), "Efficiency in Islamic Banking: An Empirical Analysis of 18 Banks", *Islamic Economic Studies*, Vol. 12, No. 1, pp. 1-19.