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Stochastic Frontier Model for Cost and Profit Efficiency of Islamic Online Banks

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Abstract

Are Islamic online banks stable and efficient? This paper addresses this question. Parametric technique, Stochastic Frontier Analysis is used to evaluate and compare the cost and profit efficiency of the Islamic banks in Bangladesh over the period of 2001-2010. The specification of functional forms of Translog stochastic cost and profit frontier models are developed. Translog stochastic cost and profit frontier models were found preferable than Cobb-Douglas production function. In case of cost model, other earning assets are found negative but significant and price of labor is observed positive and significant. On the other hand, price of fund with the value of (-0.421) is found significant and negative for profit model, suggest that bank can control more personnel expenses than depositor profit expenses. The year-wise average cost inefficiency and profit efficiency were observed 43.9% and 82% respectively. IBBL was recorded as the most profit efficient bank and ICB limited bank was observed as the most cost inefficient bank. IBBL, Al-Arafah and EXIM banks were more stable in terms of cost efficient than other Islamic banks.

Keywords: **Islamic Banks, Efficiency, Stochastic Frontier Approach**

INTRODUCTION

An improvement in bank performance indicates a better allocation of financial resources, and therefore an increase in investment that favors growth. The performance evaluation of Islamic banks is especially important today because of the globalization effect. The globalization phenomenon has put Islamic banks in fierce competition with traditional banks in well-developed financial markets. Again, how should policymakers think about Islamic banks? Are they relics of a bygone era, propped up by subsidies and distorting financial-sector competition? Or, are they efficient and focused financial institutions that could, if unleashed, eventually dominate the retail financial landscape? A better understanding of these policy questions requires specific knowledge about the performance and the determinants of efficiency and profitability of Islamic banks. Although Islamic banks perform the many social and economic activities indeed increases its operational costs, which many critics think that the long run sustainability to be the main restriction of this newly introduced profit sharing banking system. Therefore, having elapsing more than two decades it is time to assess the performance of the Islamic bank in Bangladesh.

A number of recent studies have sought to apply various techniques to estimate efficiency of Islamic and Conventional based banking. On this basis, when the performance of banks are analyzing, there are two main efficiency concepts, cost and profit efficiencies are used. Despite the considerable development of the Islamic banking sector there have seen very limited studies done focusing on the cost and profit efficiency of Islamic banks using stochastic frontier analysis. Studies that evaluated efficiency of Islamic banks [Yudistira (2004); Brown and Skully (2005), Hassan (2005), Bader, Arif and Taufiq (2007), Viverita et al. (2007)] for Asia, Africa and Middle East; studies that compared the efficiency of Islamic banks with conventional banks [Al-jarrah and Molyneux (2003), Al-Shammari (2003), Hussein (2004), Mokhtar, Naziruddin and

Syed (2006)] for Malaysia; Bader, Shamsher, and Taufiq (2007), Ben Naceur and Omran (2008) for Middle East and North Africa (MENA), Sufian and Habibullah (2009) for the Chinese banking sector; Tahir, Bakar and Haron (2010) for Malaysia, Hasan (2003) for banks in Pakistan, Iran; Hamid (1999); Sarker (1999); Amin (2001); Rahman and Tawhidul (2011); Baten and Kamil (2010, 2011) for Bangladesh. Studies on Islamic banking efficiency using the stochastic frontier model are still lacking although several studies have been experienced on conventional banking, particularly in the US and Europe (Berger and Humphery, 1997; Goddard et al., 2001).

This study examines the cost and profit efficiency of Islamic banks in Bangladesh over the period 2001-2010, using parametric Stochastic Frontier Approach Technique. Data Envelopment Analysis focuses on measuring technological efficiency, based on technological and not economic optimization but unable to decompose the deviations of certain banks from the efficient production frontier into components: inefficiency and random error parts. The SFA decomposes random error terms and the production unit inefficiency and takes into account the existence of exogenous shocks and allows for incorporating both input allocative and technical efficiencies. The use of stochastic frontier models is flexible and easy to measure technical efficiency.

There is a fundamental question that arises after reviewing the brief literature on Islamic banking and efficiency measurement techniques. Do Islamic banks perform efficiently? Although the phenomenon of Islamic banking and finance has developed significantly in recent years, only very few studies have tackled this central question. This study would fill the lack of study on the efficiency of Islamic banks. To the researcher's best knowledge, this is the first time a stochastic frontier technique is being used to analyze both cost and profit efficiencies of Bangladeshi full-fledged Islamic banks and Islamic windows.

This paper is divided into five parts. Section two reviews briefly the previous studies on bank frontier efficiency followed by the introduction. Section three proceeds with the methodology and data used to carry out the efficiency analysis. Section four examines the empirical finding and section five concludes the paper.

THE GENESIS OF ISLAMIC ONLINE BANKING IN BANGLADESH

At birth, Bangladesh inherited an interest based banking system, which was introduced here earlier when the country was a part of British Colony. Since its inauguration Bangladesh saw a new trend in banking both at home and abroad. Islamic banking was successfully tried in Egypt. During the seventies, Islamic Development Bank (IDB) and a number of Islamic banks at national levels were established in the Islamic world. At home, the Islamic groups were strongly working for adoption of Islam as the complete code of life. They found Islamic banking in ready form of immediate introduction. Two professional bodies "Islamic Economics Research Bureau" (IERB) and "Bangladesh Islamic Bankers Association" (BIBA) were taking practical steps for imparting training on Islamic Economics and Banking to a group of bankers and arranging some national and international seminars/workshops to mobilize local and foreign people and attract investors to come forward to establish Islamic bank in Bangladesh. Due to continuous and dedicated work of the Muslim Businessman Society (MBS) and individuals and active support from the Government, Islamic banking could be established in early

eighties. Islamic Bank Bangladesh Ltd., which was incorporated on 14th March, 1983, went into operation on 30th March, 1983 and introduced a full package of banking services in August 1983. Islamic Bank Bangladesh Limited is considered to be first interest-free bank in South East Asia.

In the beginning out of over 39 banks only five banks (including one foreign Islamic bank) and two Islamic banking branches of a traditional bank, Prime Bank Limited (PBL) have been working on Islamic principles. Today, out of 48 banks in Bangladesh seven are fully-fledged Islamic banks (with an overall network of around 350 outlets across the country) and ten traditional banks have Islamic windows (comprising 21 branches). The industry employs over 14,000 people, which constitutes over a third of the private banking sector and over a tenth of the country's entire banking industry. It is worth noting that the major part of the operational financial resources of Islamic banks in Bangladesh is derived from deposits, mobilized primarily on the principles of al-wadia and mudarabah. Utilization of funds within the Islamic framework has opened multifarious ways for making loans conforming to Shari'ah principles. Since Shari'ah-compliant banks cannot use interest-based lending, they have devised different types of interest free financing modes. The lending instruments applied in Bangladesh include profit-and-loss sharing (PLS) based on mudarabah and musharakah; mark-up principle of murabaha; lease principle of ijara; advance purchase principles of salam and istisna; and output sharing principles of muzara'a and musaqat.

However, the seven full-fledged Islamic banks operating in Bangladesh are: Islamic Bank Bangladesh Limited (IBBL); Al-Arafah Islamic Bank Limited (Al-Arafah); Shahjalal Islamic bank Limited (SIBL); Social Investment Bank Limited (SIBL); ICB Islamic Bank Limited (IIBL); Export Import Bank of Bangladesh Limited (EXIM); First security Islamic Bank Limited (FSIB). Over the two decades, the Islamic bank has grown steadily in size, measures in terms of total deposits, at a fairly uniform average annual growth rate of about 30 per cents. Presently, total deposits at the Islamic windows and stand alone Islamic banks in Bangladesh reached $5.4 billion, equating to 24 per cent of the deposits of all private banks and eleven percent of the deposits of the total banking system. Total investment of Islamic financial institutions in the same period stood at $5.5 billion, equivalent of 27 per cent of all private banks and 19 percent of the whole banking system of the country. In addition, they have been contributing to render financial and social services toward small and rural sector.

METHODOLOGY

In this study the cost and profit efficiency of Islamic banks has been evaluated using a Stochastic Frontier Analysis.

Stochastic Cost Frontier Model

In order to estimate the cost efficiency of Islamic banks, a transcendental logarithmic (Trans-log) stochastic frontier functional form is employed in this study developed by Battese and Coelli (1995). The general form of the cost frontier model is

$$C_{it} = \beta X_{it} + (V_{it} + U_{it}) \quad \text{i=12…..n; t=12…T} \qquad (1)$$

where C_{it} is total cost in logarithm form of bank i in period t; X_{it} is a matrix of outputs, price of inputs, and input quantity independent variables in logarithm form; β is an vector

of unknown parameters; V_{it} are random variables which are assumed to be iid, $N(0,\sigma_v^2)$ and independent of U_{it}. And, U_{it} are non-negative random variables which, are assumed to be identically distributed as normal variates and the value of the error term in the cost function is equal to zero on the average. Thus, inefficiency scores are derived from a normal distribution, $N(0,\sigma_u^2)$ but truncated below zero. The underlying reason for the truncated normal distribution assumption is that inefficiencies cannot be negative. According to Jondrow et al. (1982), the relative efficiency of a bank can be estimated by means of the ratio, $\lambda = \frac{\sigma_u}{\sigma_v}$ if the efficiency factor, which is under the control of management dominates the random factor, which is beyond the control of management, the λ, attains large value.

The transcendental logarithmic functional form of stochastic cost frontier specification is as follows

$$\begin{aligned}
\ln C_{it} &= \beta_0 + \beta_1 \ln(ADV_{it}) + \beta_2 \ln(OEA_{it}) + \beta_3 \ln(OBS_{it}) + \beta_4 \ln(PFA_{it}) + \beta_5 \ln(POL_{it}) \\
&+ \beta_6 \ln(POF_{it}) + \frac{1}{2}[\beta_{11} \ln(ADV^2{}_{it}) + \beta_{22} \ln(OEA^2{}_{it}) + \beta_{33} \ln(OBS^2{}_{it}) + \beta_{44} \ln(PFA^2{}_{it}) \\
&+ \beta_{55} \ln(POL^2{}_{it}) + \beta_{66} \ln(POF^2{}_{it})] + \beta_{12} \ln(ADV_{it}) * \ln(OEA_{it}) + \beta_{13} \ln(ADV_{it}) * \ln(OBS_{it}) \\
&+ \beta_{23} \ln(OEA_{it}) * \ln(OBS_{it}) + \beta_{45} \ln(PFA_{it}) * \ln(POL_{it}) + \beta_{46} \ln(PFA_{it}) * \ln(POF_{it}) \\
&+ \beta_{56} \ln(POL_{it}) * \ln(POF_{it}) + \beta_{14} \ln(ADV_{it}) * \ln(PFA_{it}) + \beta_{15} \ln(ADV_{it}) * \ln(POL_{it}) \\
&+ \beta_{16} \ln(ADV_{it}) * \ln(POF_{it}) + \beta_{24} \ln(OEA_{it}) * \ln(PFA_{it}) + \beta_{25} \ln(OEA_{it}) * \ln(POL_{it}) \\
&+ \beta_{26} \ln(OEA_{it}) * \ln(POF_{it}) + \beta_{34} \ln(OBS_{it}) * \ln(PFA_{it}) + \beta_{35} \ln(OBS_{it}) * \ln(POL_{it}) \\
&+ \beta_{36} \ln(OBS_{it}) * \ln(POF_{it}) + V_{it} + U_{it} \quad (2)
\end{aligned}$$

i=1,2,….,7; t=1,2,……..10

where C_{it} is defined as the total cost; ADV_{it} is the advance of bank i in period t; OEA_{it} is the other earning assets of bank i in period t ; OBS_{it} is the off-balance sheet items of bank i in period t; PFA_{it} is the price of fixed assets of bank i in period t; $POL_{it}$is the price of labor of bank i in period t; POF_{it} is the price of fund of bank i in period t; This model (2) is being estimated by using the technique of maximum likelihood estimation. The unknown parameter β's are to be estimated.

Stochastic Profit Frontier Model

To estimate profit efficiency of Islamic banks, the study uses the transcendental logarithmic stochastic frontier profit function followed by Battese and Coelli (1995). The general form of stochastic profit frontier model is as follows

$$\pi_{it} = \beta X_{it} + (V_{it} - U_{it}) \text{ i=1,2,……,n; t=1,2,……,T} \qquad (3)$$

where π_{it} is total profit in logarithm form of Islamic bank i in period t, X_{it} is matrix of

outputs, price of inputs, input quantity variables in logarithm form; V_{it} are random variables which are assumed to be iid, $N(0,\sigma_v^2)$ and independent of U_{it}. And, U_{it} are non-negative random variables which are assumed to account for technical inefficiency in output production and to be independently distributed as truncations at zero of the $N(\mu,\sigma^2{}_v)$ distribution; β vector of parameters to be estimated.

The specification form of transcendental logarithmic stochastic profit frontier model can be written as follows:

$$\ln(\pi_{it}+\theta)=\beta_0+\beta_1\ln(ADV_{it})+\beta_2\ln(OEA_{it})+\beta_3\ln(OBS_{it})+\beta_4\ln(PFA_{it})+\beta_5\ln(POL_{it})$$
$$+\beta_6\ln(POF_{it})+\frac{1}{2}[\beta_{11}\ln(ADV^2{}_{it})+\beta_{22}\ln(OEA^2{}_{it})+\beta_{33}\ln(OBS^2{}_{it})+\beta_{44}\ln(PFA^2{}_{it})$$
$$+\beta_{55}\ln(POL^2{}_{it})+\beta_{66}\ln(POF^2{}_{it})]+\beta_{12}\ln(ADV_{it})*\ln(OEA_{it})+\beta_{13}\ln(ADV_{it})*\ln(OBS_{it})$$
$$+\beta_{23}\ln(OEA_{it})*\ln(OBS_{it})+\beta_{45}\ln(PFA_{it})*\ln(POL_{it})+\beta_{46}\ln(PFA_{it})*\ln(POF_{it})$$
$$+\beta_{56}\ln(POL_{it})*\ln(POF_{it})+\beta_{14}\ln(ADV_{it})*\ln(PFA_{it})+\beta_{15}\ln(ADV_{it})*\ln(POL_{it})+$$
$$\beta_{16}\ln(ADV_{it})*\ln(POF_{it})+\beta_{24}\ln(OEA_{it})*\ln(PFA_{it})+\beta_{25}\ln(OEA_{it})*\ln(POL_{it})$$
$$+\beta_{26}\ln(OEA_{it})*\ln(POF_{it})+\beta_{34}\ln(OBS_{it})*\ln(PFA_{it})+\beta_{35}\ln(OBS_{it})*\ln(POL_{it})$$
$$+\beta_{36}\ln(OBS_{it})*\ln(POF_{it})+V_{it}-U_{it}\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(4)$$

where π_{it} is defined as profit after tax; θ denotes absolute value of the minimum value of profit (π) over all banks in the sample to avoid negative profit (which is inappropriate for the logarithmic form); ADV_{it} is the advance of bank i in period t; OEA_{it} is the other earning assets of bank i in period t ; OBS_{it} is the off-balance sheet items of bank i in period t; PFA_{it} is the price of fixed assets of bank i in period t; POL_{it} is the price of labor of bank i in period t; POF_{it} is the price of fund of bank i in period t; the unknown parameters β's are to be estimated.

Likelihood Ratio Tests for Stochastic Cost and Profit Models

The likelihood ratio test helps us to determine whether Cobb-Douglas or Transcendental logarithmic production function is better or not. The likelihood ratio is used to test the null hypothesis that there is no technical inefficiency; there is no effect of time on technical efficiency etc. It is measured as follows:

$$\lambda=-2\{\ln[L(H_0)/L(H_1)]\}=-2\{\ln[L(H_0)]-\ln[L(H_1)]\}\qquad(5)$$

Where $L(H_0)$and $L(H_1)$ are the values of the likelihood function under the null and alternative hypothesis (note that this statistic has a mixed chi-square distribution). The null hypothesis is rejected when $\lambda_{LR}>\chi_c^2$.

Data and Variables used in the study

The data used in this study for the period of 2001-2010 from Islamic banks of Bangladesh. The data are collected from the annual reports of the sampled bank of Bangladesh.

Dependent Variables
Total Profit (π): Total profit is deducted of the total cost from total income. It takes after the tax.

Total cost (C): Total cost includes the income paid to depositor, personnel expenses, and other operating expenses.

Output Quantities
Advance (ADV): A payment on account or loan.

Other Earning Assets (OEA): Other Earning Assets which include financing dealing, material (stationary, stamps& printing), capital works in progress (preliminary formation & organization, revolution development) and dealing securities deposit, investment and placement with other banks.

Off-balance Sheet Items (OBS): Off-balance Sheet Items measure as the contingent liabilities, documentary credit and other short term trade and other commitments. The inclusion of the Off-balance Sheet Items as an output is of great importance particularly to Islamic investment banks where restricted investment accounts are not recorded in that balance sheet and considered as off-balance sheet items.

Input Prices
Price of Fixed Assets (PFA): Price of fixed assets is equal to depreciation over fixed capital such as; building, furniture and fixture, computer, vehicle and etc.

Price of Labor (POL): Price of Labor is calculated as total salaries and staff expenses over full time number of staff.

Price of Fund (POF): Price of Fund is measures as interest expenses overtime and saving deposits. Note that in case of Islamic banks interest expenses are replaced with profit distributed to depositor.

RESULTS AND DISCUSSION

Comparison: Maximum Likelihood Estimates of Trans-log Stochastic Cost and Profit Frontier Models

The Trans-log cost and profit frontier models are estimated with three outputs, three input prices and their mixed products and the square of the inputs and outputs. The results of the maximum likelihood estimation are presented in Table-2 for both cost and profit models. The output variables, other earning assets is found negative but significant at 5% level and the input variables, price of labor is observed positive but significant at 10% level for the cost model. This result is not surprising considering that price of labor with the coefficient value of β_5 (1.547) because they are highly associated with cost in terms of personnel expenses such as salary, allowance. Other earning assets with the coefficient value of β_2 (-0.315) is found significant but negative for the cost model, suggesting that material, capital progress, securities and equity investment in allied and non-allied undertakings do not exert much pressure on the Islamic banks cost structure.

Table-1: Summary Statistics of Output, Input Quantity and Input Price Variables from 2001-2010 for Islamic banks in Bangladesh

Variable	Description	Mean	Std. Deviation	Minimum	Maximum
Cost	Total Cost	3306.192	4255.463	143.09	20559.21
Profit	Profit after Tax	751.74	965.851	9.88	4463.47
Output					
ADV	Advance	22527.64	28021.99	768.23	153053.6
OEA	Other Earning Assets	2850.45	5718.667	181.69	37862.45
OBS	Off-balance Sheet items	12434.33	18238.63	379.44	113098.7
Input Price					
PFA	Price of Fixed Assets	788.582	1373.44	33	6743.44
POL	Price of Labour	460.178	734.749	38.23	4289.28
POF	Price of Fund	8.952	1.916	.31	11.37
Input Quantity					
FIA	Fixed Assets	2032.986	2809.03	259	12358
NOF	Total Number Of Fund	36445.03	51309.75	9.24	275196.3
NLA	Number of Labour	1631.1	2394.23	188	10349

On the other hand the input variables, price of fund with the coefficient value of β_6 (-0.421) is significant and negative for profit model at 5% level, suggest that bank can control more personnel expenses than depositor profit expenses. The profit efficiency, it seems plausible to expect a higher profit connected to the price of fund. The outputs, off-balance sheet items is negative for both cost and profit models where price of fixed assets β_5 (-0.005) and price of fund β_6 (-0.428) are negative for cost model only. All mixed products and the square term of input price and output variables are found insignificant for both cost and profit model.

The square of input variables, price of labor β_{55} (-0.827) is negative for cost model where

the square of input variables, off-balance sheet items β_{33} (-0.271) and price of fixed assets β_{44} (-0.413) are recorded negative for profit model. The mixed product off-balance sheet items & price of labor β_{35} (-0.312), price of fixed assets & price of labor β_{45} (-0.11), price of fixed assets & price of fund β_{46} (-0.159) are observed negative for both the banks cost and profit models.

Result of Test of Hypothesis for Stochastic Cost Frontier Model
Table-3 represents the results of various hypothesis tests conducted on the cost model. The all hypothesis tests were obtained using the generalized likelihood-ratio statistic.

The first null hypothesis is $H_0 : \gamma = 0$, which specify that there is no technical efficiency effect in the Cost efficiency model. The hypothesis is accepted so we can conclude that there is a no technical efficiency effect in the model.

The second null hypothesis is $H_0 : \beta_{ij} = 0$ which specifies that Cobb-Douglas stochastic cost frontier model is more preferable than Translog Stochastic Cost Frontier model. From the result it is observed that the null hypothesis is rejected so Translog cost model is more preferable than the Cobb-Douglas.

Results of Test of Hypothesis for Stochastic Profit Frontier Model
Table-4 represents the results of various hypothesis tests conducted on the profit frontier model. The all hypothesis tests were obtained using the generalized likelihood-ratio statistic.

The first null hypothesis is $H_0 : \gamma = 0$, which specify that there is no technical efficiency effect in the profit efficiency model. The hypothesis is accepted so we can conclude that there is a no technical efficiency effect in the profit model.

The second null hypothesis is $H_0 : \beta_{ij} = 0$ which specifies that Cobb-Douglas stochastic profit frontier model is more preferable than Translog stochastic profit frontier model. From the result it is observed that the null hypothesis is rejected so Translog profit model is more preferable than the Cobb-Douglas.

Table-2: Comparison: Maximum Likelihood Estimates of Trans-log Stochastic Frontier Cost and Profit Model

Variable	Parameter	MLE Estimates of	
		Cost Model	Profit Model
Constant	β_0	0.702	0.528
ADV	β_1	0.059@	0.342@
OEA	β_2	-0.315**	0.139@
OBS	β_3	-0.246@	-0.003@
PFA	β_4	-0.005@	0.093@
POL	β_5	1.547***	0.248@
POF	β_6	-0.428@	-0.421**
(ADV)^2	β_{11}	0.082@	0.217@
ADV*OEA	β_{12}	0.056@	0.205@
ADV*OBS	β_{13}	0.142@	-0.027@
ADV*PFA	β_{14}	0.219@	-0.097@
ADV*POL	β_{15}	0.372@	0.205@
ADV*POF	β_{16}	0-132@	0.156@
(OEA)^2	β_{22}	0.031@	0.192@
OEA*OBS	β_{23}	0.117@	-0.039@
OEA*PFA	β_{24}	0.193@	-0.11@
OEA*POL	β_{25}	-0.398@	0.192@
OEA*POF	β_{26}	0.108@	0.144@
(OBS)^2	β_{33}	0.204@	-0.271@
OBS*PFA	β_{34}	0.280@	-0.342@
OBS*POL	β_{35}	-0.312@	-0.039@
OBS*POF	β_{36}	0.193@	-0.088@
(PFA)^2	β_{44}	0.357@	-0.413@
PFA*POL	β_{45}	-0.235@	-0.11@
PFA*POF	β_{46}	0.269@	-0.159@
(POL)^2	β_{55}	-0.827@	0.192@
POL*POF	β_{56}	-0.322@	0.144@
(POF)^2	β_{66}	0.182@	0.095@
Sigma-squared	σ^2	0.122	0.136
Gamma	γ	0.182	0.384

Note: ** at 5% level of significance and *** at 10% level of significance, @ insignificance

Table-3: Likelihood-Ratio Test of Hypothesis for Stochastic Cost Frontier Model

Null Hypothesis	Log-Likelihood Function	Test Statistic λ	Critical Value	Decision
$H_0 : \gamma = 0$	-23.118	3.172	38.301	Accept H_0
$H_0 : \beta_{ij} = 0$	-20.924	26.064	5.138	Reject H_0

Table-4: Likelihood-Ratio Test of Hypothesis for Stochastic Profit Frontier Model

Null Hypothesis	Log-Likelihood Function	Test Statistic λ	Critical Value	Decision
$H_0 : \gamma = 0$	-23.118	12.717	38.301	Accept H_0
$H_0 : \beta_{ij} = 0$	-38.937	24.698	5.138	Reject H_0

Comparison: Year-wise Average Cost Inefficiency and Profit Efficiency using Stochastic Frontier Analysis

The average profit and cost efficiency scores for the sample Islamic banks are illustrated in Table-5 and Figure-1. The average profit efficiency scores of 0.82 is showing that Islamic banks in Bangladesh earn 82% of their potential profits that could be earned by a best-practice bank and 18% are lost to inefficiency. This profit efficiency score 0.82 is quiet better than that of other profit efficiency studies (for example, Al-Jarrah and Molyneux, 2003). The average cost inefficiency scores of 43.9% are evaluated for the period 2001-2010. The profit efficiency of Islamic banks shows an upward trend where cost inefficiency was a downward trend over the study period. The profit efficiency of Islamic banks was recorded 75.7% to 81.2% in year 2001-2004, then it was slight decrease from 76.1% in 2004 and finally, it had been moving upward until 2010. The cost inefficiency is that it was steadily declining from a high of 77.3% in 2002 to reduce to 84% in 2010. Overall Islamic banks have improved their profit and cost efficiency in the study period. The trend result also provides useful information to the policy makers regarding the Islamic bank gradually contributed positive impacts to banking industry in Bangladesh.

Table-5 Comparison: Year-wise Average Cost inefficiency and Profit Efficiency Scores using Stochastic Frontier Analysis

Year	Cost Efficiency	Profit efficiency
2001	1.637	0.757
2002	1.773	0.818
2003	1.616	0.825
2004	1.638	0.812
2005	1.519	0.761
2006	1.439	0.776
2007	1.312	0.791
2008	1.206	0.848
2009	1.129	0.914
2010	1.122	0.916
Mean	1.439	0.822

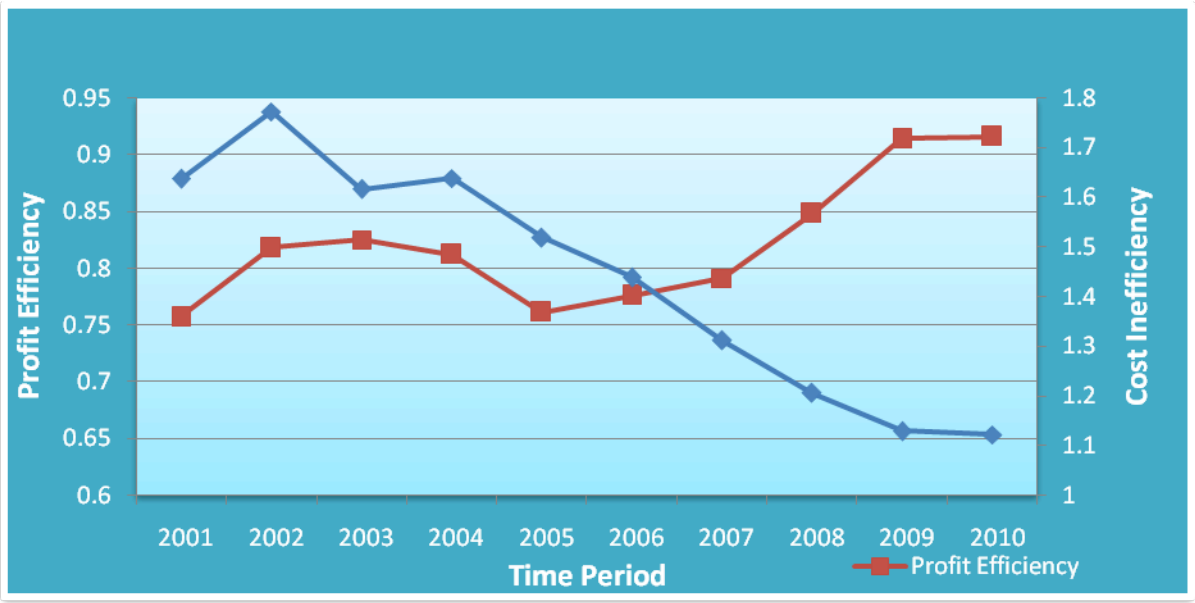

Fig-1: Year-wise Average Cost inefficiency and Profit Efficiency Scores of Islami Banks

Comparison between Bank-wise Average Cost and Profit Efficiency of Islamic Banks using Stochastic Frontier Analysis

The average efficiency scores of Islamic banks from 2001-2010 are reported in Table-6 and Figure-2. This result shows that most of the banks ranking was the same for the profit efficiencies but difference for the cost inefficiencies. The ICB limited bank was the most cost inefficient and profit efficient among the other banks with an average efficiency score of 83.6% and 94.3% respectively. The IBBL was the second cost inefficient (13.6%) and profit efficient (89.2%) banks. FSIB is the less profit efficient (53.7%), where Al- Arafah was the less cost inefficient (9.1%). Most of the bank had the average cost inefficiency scores above 40% which implies that Islamic banks had costs that are 60% of its cost are wasted relative to the best practice banks have producing the same output and facing the same condition. Also the result confirms that over the period of estimation, Islamic banks have become more profit efficient even though less cost efficient. Compare with the findings of other studies for developing countries (i.e. Hussein, 2003), the gap between the best and least performing banks is modest whereby most bank's profit efficiency indexes are not far from the mean.

Table-6: Comparison: Bank- wise Average Cost and Profit Efficiency of Islamic Banks using Stochastic Frontier Analysis

Bank Name	Cost Efficiency	Profit Efficiency
IBBL	1.136	0.892
Al-Arafah	1.091	0.797
Shahjalal	1.711	0.851
Social	1.531	0.847
ICB Limited	1.836	0.943
EXIM	1.219	0.885
FSIB	1.548	0.537
Mean	1.439	0.822

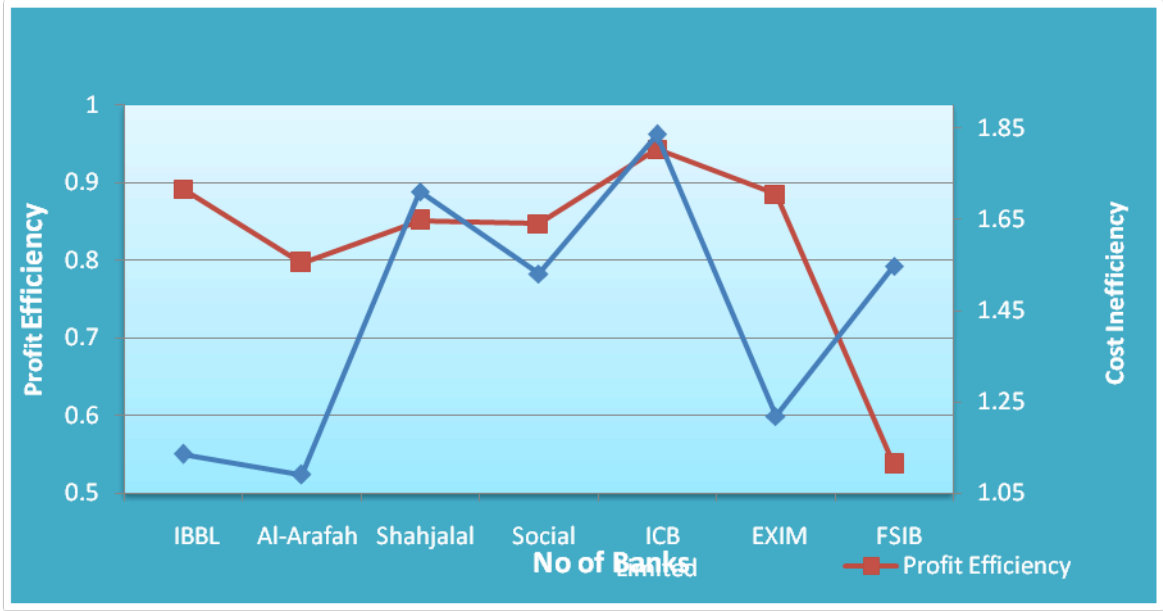

Fig-2: Average Cost and Profit Efficiency of Islamic Banks

Cost Efficiency Estimates of Each Islamic Banks over Time

The results of cost inefficiency scores using cost frontier approach of each Islamic bank during the year 2001-2010 are presented in Table-7 and Figure-3. According to the results, ICB Limited bank was the most cost inefficient bank. At the beginning of the study period the cost inefficiency scores was 29.1% in 2001, then it had been increasing until 2006 and then it was dramatic decrease in 2007 to 2010. Based on this study, the cost inefficiency level of Shahjalal Islamic banks was moving upward and downward over the study period but finally at the end of the study period, it had been moving downward. The cost efficiency of social and FSIB Islamic banks were increasing at the beginning of the study period then it had been decreasing at the end of the study period. Also this results show that, IBBL, Al-Arafah and EXIM banks were more stable in terms of cost efficient than other Islamic banks.

Profit Efficiency Estimates of Each Islamic Banks over Time

The results of profit efficiency scores of each Islamic bank during the year 2001-2010 are presented in Table-8 and Figure-4. The results show that ICB Limited bank which profit efficiency scores was always above 90% under the study period. For IBBL, the profit efficiency scores was above 90% in 2001-2004 then it was drastically fell to 60% in 2005 and then at the end of the study period it had been increasing and in 2010, IBBL was the most profit efficient with the score of 97%. These findings are consistent with the results of Al-Jarrah and Molyneux (2003). This result supports previous study by Astiyah and Husman (2006). At the beginning of the study period in 2001, Al-Arafah was the less profit efficient with the score of 53%.

Also Social Islamic bank was moving upward and downward under the study period. Shahjalal, EXIM and ICB Limited banks were more stable than other Islamic banks. FSIB bank shown less profit efficient but it had been increasing under the study period. On the other hand, Bambang Agus Pramuka (2011) stated that full-fledged Islami banks are more efficient in generating profit as compared to Islamic windows.

Table-7 Cost Efficiency Estimates of Each Islamic Banks over Time

Banks	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
IBBL	1.26	1.481	1.225	1.154	1.041	1.043	1.051	1.032	1.048	1.031
Al-Arafah	1.054	1.213	1.139	1.069	1.045	1.073	1.099	1.080	1.053	1.092
Shahjalal	1.372	1.632	2.084	2.229	2.185	1.539	1.775	1.653	1.202	1.443
Social	2.488	2.383	1.904	1.628	1.115	1.100	1.027	1.432	1.161	1.065
ICB	1.291	1.672	1.997	2.592	2.782	2.881	1.968	1.017	1.111	1.054
EXIM	1.569	1.593	1.319	1.250	1.209	1.082	1.033	1.053	1.045	1.038
FSIB	2.425	2.437	1.645	1.541	1.259	1.359	1.228	1.175	1.283	1.132

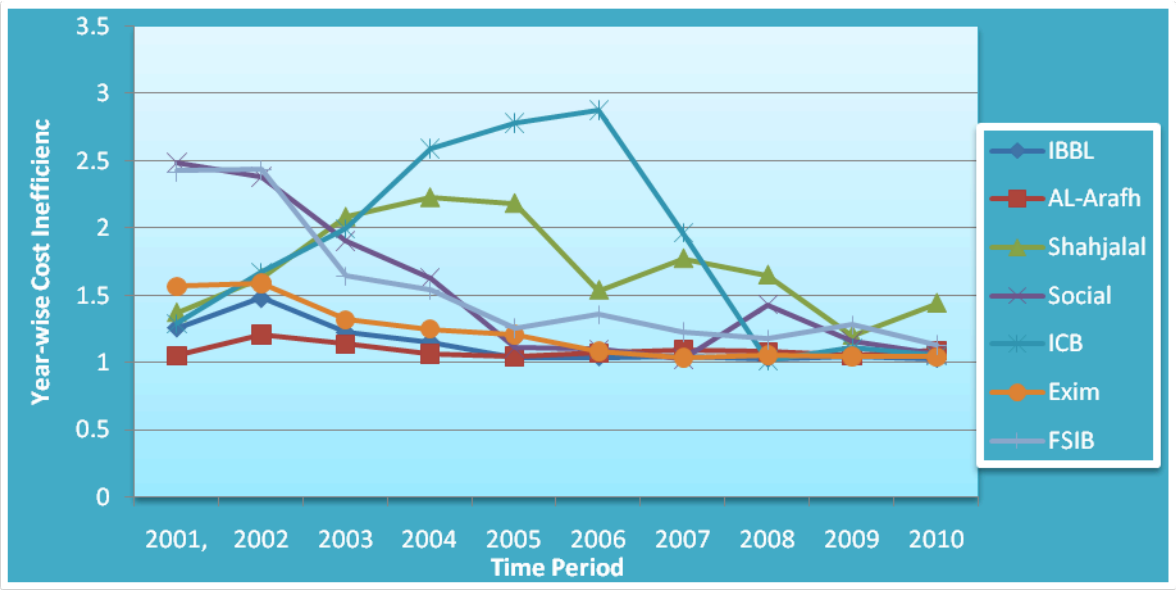

Fig.-3 Cost Inefficiency Estimates of Each Islamic Banks over Time

Table-8: Profit Efficiency Estimates of Each Islamic Banks over Time

Banks	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
IBBL	0.92	0.94	0.95	0.96	0.61	0.67	0.97	0.96	0.96	0.97
Al-Arafah	0.53	0.84	0.83	0.83	0.86	0.87	0.71	0.75	0.84	0.90
Shahjalal	0.64	0.70	0.81	0.92	0.89	0.88	0.86	0.89	0.95	0.96
Social	0.84	0.86	0.87	0.74	0.87	0.82	0.70	0.91	0.93	0.93
ICB	0.96	0.98	0.97	0.91	0.92	0.95	0.95	0.90	0.95	0.93
EXIM	0.83	0.83	0.89	0.88	0.92	0.88	0.86	0.89	0.92	0.93
FSIB	0.54	0.57	0.45	0.46	0.26	0.36	0.48	0.63	0.84	0.77

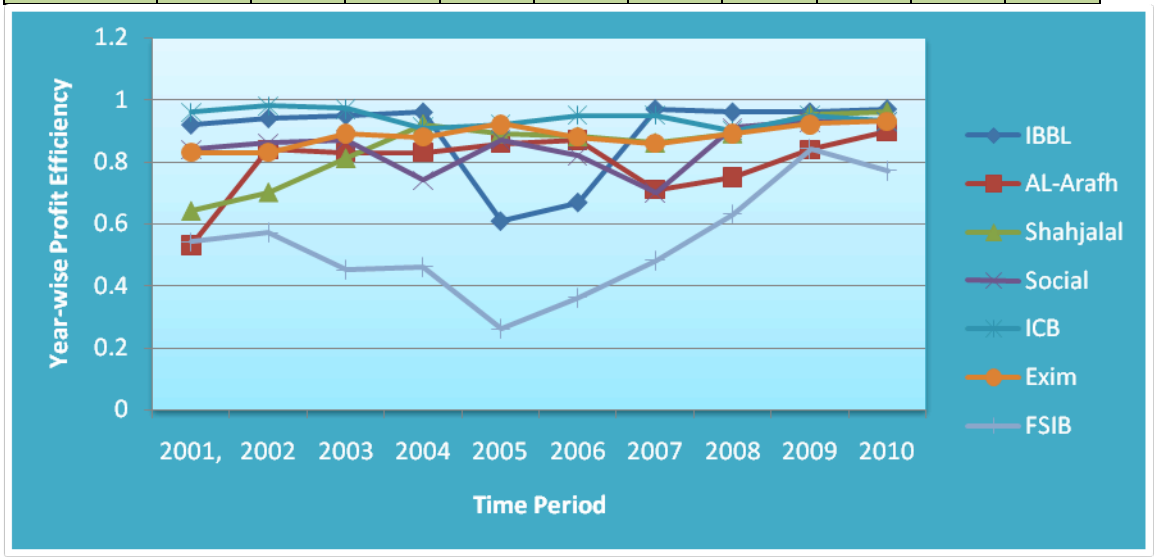

Fig.-4: Profit Efficiency Estimates of Each Islamic Banks over Time

CONCLUSION

There are several studies that were done to measure efficiency of online banks particularly in Bangladesh but study of Islamic banking efficiency is still lacking. The paper investigates relative efficiency of the Islamic banking industry in Bangladesh during 2001-2010. The annual reports of seven full-fledged Islamic banks were used for analysis purposes. Parametric (cost and profit efficiency) models are used to examine efficiency of Islamic banks.

The most important results are summarized below:

First we estimate the maximum likelihood estimates using both translog stochastic cost and profit frontier models and the presence of one-sided error component was justified by the LR test individually, which was recorded significant for these models. We found that the Translog stochastic frontier model is more preferable than Cobb-Douglas stochastic frontier model.

Second the average cost inefficiency (stochastic cost frontier) was 43.9% during the study period where the average profit efficiency (profit efficiency frontier) was 82.2% during the same study period. ICB Limited is the most inefficient (83.6%) in terms of cost (83.6%) and efficient (94.3%) bank in terms of profit. During the study period, cost and profit efficiency of IBBL, Al-Arafah and Exim banks were most stable. The other banks are moving upward and downward under the study period.

The findings of this study have revealed that the cost and profit efficiencies of Islamic banks in Bangladesh could be improved further. In this regard, it requires a concerted effort from the management and policy-makers to optimize the utilization of scarce resources owned by the banking industry in Bangladesh. The findings of this study should help them to set directions for future improvement of Islamic banking operations in Bangladesh. Finally, this study should open up a fruitful avenue for future research in Islamic banking efficiency and competition in other Muslim countries.

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