The International Journal of Business and Finance Research
Vol. 10, No. 2, 2016, pp. 31-40
ISSN: 1931-0269 (print)
ISSN: 2157-0698 (online)

IBFR
www.theIBFR.com

TECHNICAL EFFICIENCY OF ISLAMIC BANKS VERSUS DOMESTIC BANKS: EVIDENCE FROM BANGLADESH

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ABSTRACT

This paper empirically estimates the technical efficiencies (TE) of Islamic banks compared to conventional banks in deposit mobilizations and loans production for 2010. This analysis uses the stochastic frontier production function. Estimates of the mean TE of Islamic banks and conventional banks for loans are 59.6 percent and 62.8 percent respectively, and for deposits are 0.61 and 0.60 respectively. Parametric tests, test, Satterthwaite-Welch t-test, Anova F-test, and Walch F-test, indicate no statistical evidence of significant differences between the TE of Islamic and conventional banks. The competitive market structure for loans and deposits markets, evidenced by the Herfindahl-Hirschman Index of less than 400, provides an explanation for the equality of mean TE between Islamic and conventional banks.

JEL: G20, G21, C33

KEYWORDS: Efficiency, Foreign Bank, Domestic Bank, Stochastic Frontier

INTRODUCTION

Since the liberation in Bangladesh in 1971, there has been a rapid development of banking as well as of deposit mobilizations and financing bank loans. At the time of liberation, Bangladesh had only five domestic banks (Sonali Bank, Rupali Bank, Janata Bank, Agrani Bank, and Pubali Bank). All were nationalized by the then-government. When the privatization policy was introduced in 1982, one of the five banks, Pubali Bank, was sold to the private sector.

Currently, there are forty-seven banks operating in Bangladesh with a total of 8,375 branches. Of these forty-seven banks, forty are conventional (i.e., interest-based banks), and seven are Islamic banks. Among the forty conventional banks, eight are foreign banks. All banks operate side by side and compete for deposit and loan markets. During the period 2012-2013, total deposit mobilizations of banks were TK 5388.39 billion and loan financings totaled TK 5547.99 billion. These numbers were significant improvements over the past.

The operation of Islamic banks is a new phenomenon compared to that of conventional banks. Conventional banks are centuries old and therefore have significant experience in portfolio management, deposit mobilization, and loan financing compared to Islamic banks. Even though Islamic banks are new, however; they compete with conventional banks and operating side by side with them. So, the study of comparative technical efficiency (TE) between conventional banks and Islamic banks in deposit mobilizations and financing loans is important. The comparative study of TE has not been explored in Bangladesh. The study of comparative efficiency in Bangladesh is important to several agents, including bank customers, depositors, and lenders. Bank customers may decide whether they should approach conventional banks or Islamic banks and which may be the better choice for them.

The study of TE is also helpful for bank management, who can improve their efficiency level if they determine their comparative efficiency level in the banking market. Bank management must know whether they are performing below the average or above the average level of efficiency of their rival banks (foreign banks) before making any reallocation of resources for output optimization or cost minimization. Thus, bank management can improve and maintain their competitive skill and efficiency in a competitive market for their survival only when they know current level of efficiency.

As Islamic banks enter into the banking sector, competition in the banking market is increasing and demanding the determination of efficiency for determining comparative efficiencies. A current literature survey shows no record of comparative efficiency studies between conventional banks and Islamic banks. The absence of comparative efficiency studies between Islamic banks and conventional banks in Bangladesh in particular provides a key motivating factor for this study. This study thus makes an important contribution to the banking literature by providing the comparative status of efficiency. It is not only important for bank management and bank regulators but also for bank customers. Relative efficiency information might also provide valuable information to bank customers their decision to choose banks.

The study is organized as a brief survey of literature, discussion of data, methodology and the description of model, and a final section that provides empirical results and conclusions.

LITERATURE REVIEW

The literature on bank efficiency studies is plentiful. However, the number of bank efficiency studies covering less developed countries is limited. For the banking systems of Southeast Asian countries, including Bangladesh, such studies are almost non-existent. El-gamal and Inanoglu (2004) estimated the comparative cost efficiency of Turkish banks for the period 1990-2000 using the data envelopment analysis (DEA) method. They found that Islamic banks were more efficient due to their asset-based financing.

Samad (2004) compared the performance of Islamic banks and conventional commercial banks of Bahrain with respect to (a) profitability, (b) liquidity, and (c) capital management. A comparison of eleven financial ratios for the period 1991-2001 found no difference in profitability and liquidity performance between Islamic and conventional banks for that period.

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

There has been some analysis of bank efficiency in India. For the most part, these analyses have used financial indicators for measuring bank efficiency as in the articles by Rammohan and Roy (2004) and Sarkar et al. (1998). Rammohan and Roy found that public sector banks are more efficient than private sector banks in India. In another study, Kumbhakar and Sarkar (2003) used a cost efficiency approach for measuring bank efficiency and also concluded that private sector banks had higher levels of efficiency in contrast to public sector banks in that country.

Another group of Indian scholars used the DEA approach in measuring bank efficiency, including Saha and Ravishankar (2000), Bhattacharyya et al. (1997) and Sanjeev (2006). Bhattacharyya et al. (1997) determined that public sector banks were the best performing banks in India during the late 1980s and early 1990s. Shanmugam and Das (2004) used a stochastic frontier analysis (SFA) process for measuring technical efficiencies of Indian commercial banks and found that a group of state banks were more efficient than a comparable group of foreign banks during a period from 1992-1999.

Andries and Cocris (2010) analyzed the comparative efficiency of banks in several southern European countries during the period of 2000-2006 using both DEA and SFA analytic processes. They found that banks in Romania, the Czech Republic, and Hungary all operated at relatively low levels of technical efficiency.

Samad has done several evaluations of the Bangladesh banking system. Samad's (2009) review of technical efficiency using data for 2000 found the average efficiency of those banks was 69.6. Samad (2007) also examined the comparative performance of foreign banks verses domestic banks in Bangladesh using various financial ratios of bank performance and found no difference in profit performance between domestic banks and foreign banks in the period 2000-2001. In yet another analysis, Samad (2010) estimated the technical efficiency of Grameen bank micro-financing activities in Bangladesh as developed by Nobel Laureate, Dr. Muhammad Yunus.

Samad (2009) has also previously examined the TE of Bangladesh banking industry, but the current analysis is different from the previous studies in several ways. First, there was no comparison in the previous study. Second, unlike the 2009 study, this study estimates loan and deposit for technical efficiencies instead of profits of the previous study. 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.

DATA AND METHODOLOGY

Data

Forty three banks were examined. Data for labor, deposits, loans and investments were obtained from the Bank and Financial Institutions' Activities, Division of Finance, Ministry of Finance, the Peoples' Republic of Bangladesh for2010. Data for fixed capital were obtained from the Website of the respective banks. Data are annual. The descriptive statistics of variables are provided in Table 1.

Table1: Descriptive Statistics of Variables

	LABOR	CAPITAL	LOANSINVT	DEPOSIT
Mean	2,812.35	2,575.93	83,302.51	83,578.84
Median	1,511.00	1,615.53	68,434.00	65,126.00
Maximum	20,840.00	26,888.23	390,837.0	464,886.0
Minimum	49.00	0.00	2,804.000	1,851.000
Std. Dev.	4,088.80	4,360.86	77,609.86	85,924.20
Observations	43	43	43	43

Labor refers to the number of fulltime and part-time workers working for the bank. Capital describes the fixed capital of banks such as bank premises, computers, etc., and is expressed in Taka, the local currency of Bangladesh. Deposits, Loans and investments are considered the banks' output.

Methodology-Stochastic Frontier

Each bank's efficiency was analyzed using the time invariant stochastic frontier method developed by Aigner, Lovell, and Schmidt (1977) and later refined by Pitt and Lee (1981) and Batties and Colie (1992). As this experience has developed, stochastic frontier modeling has become popular using distinct

parameterizations of an inefficiency term in stochastic production or cost frontier models. The frontier production assumes that a producer has a production function:

$$Q_i = f(X_i, \beta) \quad (1)$$

where X_{it} is a (1x k) vector of inputs and other explanatory variables used for the quantity of output of ith firm and β is a (k x 1) vector of unknown parameters to be estimated.

Stochastic frontier analysis assumes that each firm potentially produces less than it might produce due to a degree of inefficiency. Specifically,

$$Q_i = f(X_i, \beta)\xi_i \quad (2)$$

where ξ_i is the level of efficiency for ith firm; $0 \leq \xi_i \leq 1$. That is, efficiency (ξ_i) lies in the interval between zero and one. If $\xi_i = 1$, the firm achieves the optimum output with the technology provided by the production function $Q_i = f(X_i, \beta)$. When $\xi_i < 1$, the firm is not making the most of the inputs X_i given the technology embodied in the production function (2). Since output is assumed to be strictly positive (Q>0), the degree of technical efficiency (ξ_i) is assumed to be strictly positive, i.e. $\xi_i > 0$.

The production of output assumes that it can be subject to random shock, implying that

$$Q_i = f(X_i, \beta)\xi_i \exp(\vartheta_i) \quad (3)$$

Taking natural log of both sides yields

$$\ln Q_i = \ln\{f(X_i, \beta)\} + \ln(\xi_i) + \vartheta_i \quad (4)$$

Assuming the production function is linear in log and defining $\upsilon_i = -\ln(\xi_i)$ yields

$$\ln Q_i = \beta_0 + \Sigma\beta_j \ln(X_i) + \vartheta_I - \upsilon_i \quad (5)$$

Restricting $u_i \geq 0$, implies $0 < \xi_i < 1$ as specified in (6). ϑ_I is a random error and is assumed to be iid (independent and identically distributed) as $N(0,\sigma_v 2)$ and independent of u_i which represents technical efficiency/inefficiency.

The most commonly used production is the Cobb-Douglas function as:

$$Q = L^{\alpha}K^{\beta} \quad (6)$$

where L and K are labor and capital; α and β are elasticity of output with respect to labor and capital respectively.

This paper estimates the following Cobb-Douglas production function using the frontier stochastic method:

$$\ln(Q_{it}) = \beta_0 + \beta_1 \ln(K_{it}) + \beta_2 \ln(L_{it}) + V_{it} - U_{it} \quad (7)$$

where Q is the total output, K is capital, and L is labor. All variables are expressed in natural log, ln.

Unlike other businesses such as coal mines, agriculture, electricity utilities, etc., where inputs and outputs are more visible and measurable, a banking firm's input and output is less clearly defined. Since a bank

produces such a wide variety of services, including such functions as account services, loan services, deposit services, and safekeeping services for its customers, it becomes difficult to clearly identify inputs with appropriate outputs (Humphrey, 1991; Benson and Smith, 1976; Sealy and Lindley, 1977). In this paper, I have followed an intermediary approach where banks use their employees and fixed capital as inputs and produce loans and deposits as outputs. The TE for banks' deposits mobilizations and financing loans are estimated.

Methodology-Parametric and Non-Parametric Tests

Once the TE for deposit mobilizations and loan financings is obtained for each bank, parametric tests (T-test, ANOVA, and Welch F-test) and non-parametric tests (Wilcoxon/Mann-Whiteney and Kruskal-Walis) are performed to determine whether there are significant differences in the TE between the Islamic banks and conventional banks.

The Jarque–Bera statistic is used to verify the normality test of the series. The null hypothesis, H_0, is that the series is normally distributed. The alternative hypothesis, H_a, is that the series is not normally distributed. If the Jarque-Bera statistic is insignificant for both series, the series are normally distributed and the null hypothesis cannot be rejected. Parametric tests such as a t-test, Welch F test, and ANOVA are applied when the data series are normally distributed. If the null hypothesis of a normal distribution is rejected for both series, then it is necessary to apply a non-parametric test such as Mann-Whiteney/Kruskal-Wallis K test.

For the parametric test, the null hypothesis, $H_{0:}\ \mu_{conbk} = \mu_{isbk}$. is tested against the alternative hypothesis, $H_a : \mu_{conbk} \neq \mu_{isbk.}$ where μ_{conbk}= the mean of conventional banks and μ_{isbk} = the mean of Islamic banks.

For the non-parametric test, the null hypothesis is $H_{0:}\ Med_{conbk} = Med_{isbk}$: There is no difference in median efficiency between conventional banks and Islamic banks, where Med_{conbk} and Med_{isbk} are the medians of conventional banks and Islamic banks, respectively. The alternative hypothesis is Ha : medconbk ≠ Medisbk: There is a difference in median efficiency between conventional banks and Islamic banks.

EMPIRICAL RESULTS

Table 2 and Table 3 show the regression estimates of equation (7) for loans and investment and deposits.

Table 2: Stochastic Frontier Estimates of Loans and Investments Efficiency

Number of obs = 42
Wald chi2(2) = 107
Prob > chi2 = 0.0000
Log likelihood = -21.39

Variables	Coefficient	Z-statistics
Log labor	0.60	6.94*
Log capital	0.11	2.11**
Constant	6.20	10.33*
Sigma v	0.13	
	(0.17)	
Sigma u**	0.69	
	(0.19)	
Sigma2	0.49	
	(0.23)	
Lambda	5.20	
	(0.36)	

*Parenthesis ( ) shows standard deviation. * Significant at 1 percent, ** Significant at 5 percent level. **Likelihood-ratio test of sigma_u=0: chibar2(01) = 7.19 Prob>=chibar2 = 0.004*

Table 2 shows that coefficients of labor and capital are significant factors for the production of loans and investments. Labor is the most significant factor in determining bank efficiency. Employee elasticity of output (deposits) is 60 percent compared to 11 percent of fixed assets. The sum of coefficients, 0.71 (0.60 + 0.11), shows a decreasing return to scale for the production of loans and investments. The null hypothesis, H_0: $\beta_1=\beta_2=0$ (i.e. the joint coefficient of labor and capital=0), is tested by the LR test. The probability of Wald $\chi^2>$ is 0.0000 rejects the null hypothesis of joint coefficients, $\beta_1=\beta_2=0$. The standard deviation of two error components, σ_u, and $\sigma\vartheta$, which are labeled sigma_u and sigma_v, is 0.17 and 0.23, respectively. The null hypothesis, H_0: $\sigma_u= 0$ (that there is no technical inefficiency), is tested by the Likelihood-ratio test. The low P-value, 0.004, for χ^2 rejects the null hypothesis that there is no technical inefficiency, i.e. $\sigma_u= 0$.

Table 3: Stochastic Frontier Estimates of Deposit Efficiency

Number of obs = 42		
Wald chi2(2) = 43900000.0		
Prob > chi2 = 0.0000		
Log likelihood = -17.394662		
Variables	**Coefficient**	**Z-statistics**
Log labor	0.58	130.0 *
Log capital	0.16	50.0*
Constant	6.12	202.0*
Sigma v	0.0000002	
	(0.0002)	
Sigma u**	0.72	
	(0.073)	
Sigma2	0.53	
	(0.00002)	
Lambda	328,000	
	(0.079)	

*Parenthesis ( ) shows standard deviation. * Significant at 1 percent. **Likelihood-ratio test of sigma_u=0: chibar2(01) = 7.19 Prob>=chibar2 = 0.004*

Table 3 shows that both bank employees and bank fixed assets are significant factors for deposit efficiency. However, labor is the most significant factor. Employee elasticity of output (deposit) is 58 percent compared to 16 percent of fixed assets. The sum of coefficients, 0.74 (=0.58+0.16), shows a decreasing return to scale for the production of deposits.

The LR value has an approximately χ^2 distribution with the parameters shown in Table 1. LR = -17.39 and it is significant. The significance provided by the probability of Wald $\chi^2>$ is 0.0000. The significance means the null hypothesis of joint coefficients, $\beta_1=\beta_2=0$, is rejected. The standard deviation of two error components, σ_u, and $\sigma\vartheta$, which are labeled sigma_u and sigma_v, is 0.7322504 and 2.23e-08, respectively.

The null hypothesis, H_0: $\sigma_u= 0$ (that there is no technical inefficiency) is tested by the Likelihood-ratio test. The low P-value, 0.004, for χ^2 rejects the null hypothesis that there is no technical inefficiency, i.e. $\sigma_u= 0$. Comparative descriptive statistics of deposits and loans TE for domestic banks and foreign banks obtained from the frontier estimates are provided in Table 4.

Table 4: Comparison of the Descriptive Statistics of Efficiencies between Islamic Banks and Conventional Banks

	Islamic Banks		**Private Domestic Banks**	
	Loan Efficiency	**Deposit Efficiency**	**Loan Efficiency**	**Deposit Efficiency**
Mean	0.596	0.612	0.628	0.606
Std.dev	0.20	0.23	0.18	0.18
Minimum	0.23	0.20	0.23	0.32
Maximum	0.90	0.99	0.90	0.99
Jerque-Bera	0.15	0.01	1.42	1.13
Probability	0.92	0.99	0.49	0.56

This table shows descriptive statistics of the sample for domestic and private banks.

Table 4 shows mean efficiencies of private domestic banks for loans and deposits are 62.8 percent and 60.6 percent respectively, compared to 59.6 and 61.2 percent for Islamic banks. The minimum efficiencies of private domestic banks for loans and deposits are 23 percent and 32 percent respectively, compared to 23 percent and 20 percent for Islamic banks. The standard deviations of loans and deposits for domestic banks are smaller (18 percent and 18 percent) compared to those of Islamic banks' 20 percent and 23 percent.

The insignificance of Jarque-Bera is supported by high probability for both series' (loan efficiency and deposits efficiency) failure to reject the null hypothesis of a normal distribution. The failure to reject the null hypothesis of normal distribution suggests the appropriateness of the application of the parametric test and the redundancy of the non-parametric test. Table 5 provides the result of the parametric test.

Table 5: Mean Difference Analysis of Technical Efficiencies for Islamic banks and Conventional Banks

Variable	Mean of Conventional Banks	Mean of Islamic Banks	Test of Mean Difference
Deposits	0.60	0.61	-0.006
Loan	0.62	0.59	0.02

This table shows mean financing efficiencies.

Table 5 shows that the mean of loan financing efficiencies of the domestic conventional banks and the Islamic banks is 62.8 percent and 59.6 percent respectively. The test of mean difference shows that the difference of TE between Islamic and conventional banks is not statistically significant. This suggests that there is no difference in the TE between them.

With regard to loan efficiency, Table 5 shows that the TE of the conventional banks and the Islamic banks are 60 percent and 61 percent respectively. That is, the inefficiencies of conventional banks and Islamic banks are 40 percent and 39 percent respectively. The test of mean difference for loans shows that the difference of TE between the Islamic banks and the conventional banks is not statistically significant. This suggests that there is no difference in the TE between them.

One possible explanation for the equality of efficiency between the conventional banks and the Islamic banks is the competitiveness of the market structure of the Bangladesh banking industry. When the market is competitive, Islamic banks must successfully compete with the conventional banks for their survival. They cannot be less efficient than the conventional banks.

An analysis of the Bangladesh banking market concentration was conducted. Results are reported in Table 6. The result of market concentration study suggests that the Bangladeshi banking market is unconcentrated and highly competitive. This is substantiated by the Herfindahl-Hirschman Index.

Based on the US Department of Justice Merger Guidelines of 1982, an "unconcentrated" market is defined when the HHI Index is less than 1,000. Table 6 shows that the concentration in both deposits and loans markets is less than 500, suggesting that both the deposits and loans markets of Bangladesh are highly competitive. These data demonstrate why there is such limited difference in deposit and loan efficiencies between the domestic banks and the foreign banks in Bangladesh.

Because of competitiveness it is plausible that there are no differences in deposit mobilizations and loan financing efficiencies between the Islamic banks and the conventional banks.

Table 6: HHI Estimate for Deposit and Loan & Investment Market

HHI for Market	HHI_4	HHI_8	HHI_{12}
HHI loan & investment	274.18	317.76	351.55
HHI Deposit	329.86	368.91	400.55

This table shows estimates for the deposit and loan market. HHI denotes the Herfindahl-Hirschman Index.

CONCLUSIONS

This paper estimates the TE of domestic commercial banks and foreign banks operating in Bangladesh using the stochastic frontier function during 2010. Annual data was used to estimate the TE of banks using the parametric stochastic frontier method. Jarque- Bera statistics was used for a normality test in determining whether to use the parametric test or non-parametric test for the comparison of efficiency between Islamic banks and conventional banks. The paper finds: (1) The Likelihood-ratio test rejects the null hypothesis, H_0: $\sigma_u = 0$, that there is no technical inefficiency. The rejection of the null-hypothesis suggests that there are technical inefficiencies. Both labor and capital are found to be significant factors for loans and deposits efficiencies. (2) The results of JarqueBera statistics suggest the application of both parametric and non-parametric tests. The estimates found that the mean technical efficiencies of loans and deposits of domestic banks are 62.8 percent and 60.5 percent respectively, compared to 58.7 percent and 58.6 percent of foreign banks.

All parametric tests, t-test, Satterthwaite-Welch t-test, Anova F-test, and Walch F-test, show no statistical evidence of significant differences in technical efficiencies between the Islamic banks and the conventional banks. All parametric test statistics fail to reject the null hypothesis of the equality of mean technical efficiencies. The findings of this paper confirm the previous findings of Samad (2007).

One possible explanation for the equality of efficiencies of the Islamic banks and the conventional banks is the competitiveness of the loans and deposit market structure of the Bangladesh banking industry. The estimates of Herfindahl-Hirschman Index support the hypothesis.

There are a few limitations of this study. (i) The paper provides the estimated technical efficiency of one year (2010). A study of an extended period of five or more years could be undertaken for robust results of bank efficiencies. (ii) Since banks use many inputs such as labor, capital, interest expenses, and deposits and produce many outputs such as securities, loans, income, and other financing, it is worth conducting a future study to incorporate these inputs and outputs for finding the detailed technical efficiencies, including scale efficiencies.

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ACKNOWLEDGEMENTS

I would like to thank journal editors, Terrance Jalbert and Mercedes Jalbert, and the anonymous referees for their valuable comments.

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