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Cost and profit efficiency of Islamic banks: international evidence using the stochastic frontier approach

Abstract

The aim of this paper is to examine the cost and profit efficiency of Islamic banks in four regions of the world: Africa, the Far East and Central Asia, Europe and the Middle East during the period of 2003-2008. The study is based on a yearly and regional basis using a parametric frontier technique called stochastic frontier approach (SFA). The results suggest that cost and profit efficiencies have improved over the period and Islamic banks in these four regions are relatively better in controlling costs than generating profits. The results also suggest that Islamic banks in Europe are relatively more cost and profit efficient than the other group of banks. Banks in the Middle East region are significantly less efficient than Islamic banks in Africa but more efficient than banks in the Far East and Central Asia.

Keywords: cost and profit efficiency, Islamic banks, stochastic frontier approach.
JEL Classification: G21, E50, C22, C53.

Introduction

Islamic banking, which began as a theological dream and scholarly discussions among the Muslim economists, has become today a practical reality and accepted worldwide. Islamic banking and finance has transformed from an infant industry in the 1970s to one of the most viable and efficient alternative models of financial intermediation. The Islamic financial services industry has consistently chalked up double-digit growth with a presence in more than 100 countries. It is estimated that total financial assets of the industry now exceed US$1 trillion. World economic powers such as France, Germany, and even Russia are considering amending their financial laws with the purpose of accommodating the establishment of Islamic banks within their financial system.

The integration of Islamic finance into the global economy is marked by the growing awareness of and demand for investing in accordance with *shariah* principles, progress in developing a regulatory framework and enhanced international linkages. However, the success of Islamic banking brings forth new challenges to the industry. These include lack of standard financial contracts and products, illiquidity issues, risks mitigation in the operational aspects and financing portfolios, and co-operation among the players within the industry.

These successes and challenges facing Islamic financial institutions have been widely documented. Nonetheless, there is still an acute dearth of literature which covers concepts and applications of Islamic banking worldwide as well as provides comprehensive illustration of all major aspects of Islamic finance and banking on a more global scale. Having kept a close watch on the developments in Islamic finance and banking over the last two decades, we acknowledge that there are many issues yet to be resolved. Among the major areas that need in-depth study are productivity, efficiency and performance measurement.

The aim of this paper is to assess cost and profit efficiency of Islamic banks in Africa, Far East and Central Asia, Europe and Middle East for the period from 2003 to 2008. The remainder of the paper is organised as follows. Section 1 reviews the literature on performance and efficiency studies in banking. Section 2 describes the data and methodology used in the study. Section 3 discusses the empirical findings and the last Section concludes.

1. Efficiency studies in banking

According to Berger and Humphrey (1997) in their survey of 130 studies on efficiency analyses found that majority of these studies were done in the U.S. banking industry. Despite the fact that efficiency studies are well researched area in the developed countries like USA and Europe, there are still limited studies focusing on the efficiency of Islamic banking.

In the Islamic banking institutions, efficiency studies are still scarce. Several studies in Islamic banking focus on assessing the performance in terms of profitability and determinants of bank performance (Samad and Hassan, 1999; Bashir, 2001; Samad 2004; Haron and Azmi, 2004. Samad and Hassan (1999) apply financial ratio to assess the performance of the oldest Islamic bank in Malaysia, Bank Islam Malaysia Berhad, for the period of 1984-1997. The study found that this bank was found to perform better than conventional banks in terms of liquidity and risk measurement. Bashir (2001) performs regression analysis to determine the determinants of Islamic bank performance in the Middle East. The results indicate that adequate capital ratios and loan portfolios play an important role in explaining the performance of Islamic banks. Further, the results also indicate that the performance is mostly generated from customer and short-term funding, non-interest earning assets and overheads. Samad (2004) used profitability, liquidity risk and credit risks ratios to study the performance of Islamic banks and conventional banks in Bahrain. Nine financial ratios were used and the study found there was no major difference in performance between Islamic banks and conventional banks with respect to profitability and liquidity, but there were significant in the credit performance. A study by Haron and Wan Azmi (2004) used cointegration approach to examine the influence of internal and external factors on selected Islamic banks and found that factors such as liquidity, deposit items, asset structure, inflation and money supply did influence profitability of banks.

However, the use of financial ratios has its limitations. According to Berger, Hunter & Timme (1993), the first problem is that financial ratios are regarded as misleading indicators of efficiency because they do not control for product mix or input prices. Secondly, using the cost-to-asset ratio assumes that all assets are equally costly to produce and all locations have equal costs of doing business. Finally, the use of simple ratios cannot distinguish between X-efficiency gains and scale and scope efficiency gains.

In the study of efficiency in Islamic banking, both the non-parametric approach such as data envelopment analysis (DEA) and the stochastic frontier approach (SFA) have been popularly used. Yudistira (2004), for example, apply DEA to investigate the performance of 18 Islamic banks over the period of 1997-2000 and found that Islamic banks suffer slight inefficiencies and that efficiency differences across the sample appear to be mainly determined by country specific factors. Viverita et al. (2007) examined the efficiency analysis of Islamic banks in Africa, Asia and the Middle East and found that banks outside the Middle East were more efficient.

Mokhtar et al. (2007) examine the technical and cost efficiency of Malaysian Islamic banking and the results indicate that the average efficiency of the overall Islamic banking industry has increased during the period under study, and full-pledged Islamic banks were found to be more efficient than in the Islamic windows but less efficient than the conventional banks. Sufian et al. (2008) report that Islamic banks in MENA (Midle East and North Africa) region were efficient than Islamic banks in the Asian banking sectors.

Kamaruddin et al. (2008) also apply DEA to assess the cost and profit efficiencies of Malaysian Islamic banks and conventional bank Islamic windows for the period from 1998 to 2004. The results suggest that Islamic banks are relatively more efficient in controlling costs than at generating profits.

Studies, using the SFA in Islamic banking, are still considered scarce. Mohamad et al. (2008) examine the cost and profit efficiency of conventional versus Islamic banks in OIC (Organization of Islamic Conference) countries using the SFA. The results suggest that there are no significant differences between the overall efficiency results of the conventional and Islamic banks. On the other hand, Hassan and Hussein use both DEA and SFA to examine the efficiency of the Sudanese banks. The study reports that Islamic banks in OIC countries are relatively efficient in controlling cost than generating profits. The study also reports that the productivity decline in the Sudanse banks are the results of decline in technology and not operating at the right scale.

2. Data and methodology

2.1. Data. The data used in this study is obtained from Bankscope database, a comprehensive, global database containing information on 29.000 public and private banks around the world. For this study, Islamic bank specialization provided unbalanced panel data of 193 banks categorized under four main regions: Africa, Middle East, Europe and the Far East & Central Asia. The period chosen was from 2003 to 2008 because many Islamic banks data were available. All data are selected using US dollars and inflation adjusted so that results are comparable between regions.

The intermediation approach was chosen for this study based on previous literatures. We use the following variables as in Table 1 below. Descriptive statistics for the inputs and outputs variables are shown in the Table 1, Table 2.

Table 1. Variables used in the measurement for cost and profit equations

Dependent variable (s)		
TC	Total cost	Operating + interest + personnel + overheads
π	Profit	Pre tax profits
Independent variables		
Q	Total earning assets	Loans, investment and other earning assets
X_1	Price of capital	Personnel and other overhead expenses divided by the total assets
X_2	Price of deposits	Income paid to depositors divided by total deposits

Table 2. Descriptive statistics for input and output variables, 2003-2008 (in thousand USD)

	Variable	N	Mean	Median	Min.	Max.	Std. dev.
Dependent variable (s)							
TC	Total cost	193	174,301.882	26,175.931	611.242	2,423,647.940	386,501.712
π	Profit	193	30,810.616	6,478.366	-62,380.277	447,165.118	69,429.751
Output							
Q	Total earning assets	193	2,122,977.702	468,882.986	2,416.432	26,944,215.146	4,430,143.475
Input prices							
X_1	Price of capital	193	0.042	0.027	0.007	0.379	0.058
X_2	Price of deposits	193	0.086	0.035	0.001	3.536	0.282

2.2. Methodology. In this study, we use the SFA profit function approach to measure the cost and profit efficiency of Islamic banks in Africa, the Far East and Central Asia, Europe and Middle East. This is discussed below.

2.2.1. The stochastic frontier approach. The SFA, sometimes also referred to as the econometric frontier approach (EFA), was developed by Aigner et al. (1977). In this approach, the SFA specifies a functional form for the cost, profit or the production function, usually a translog form and allows for random error. Cost efficiency measures the performance of banks relative to the best-practice banks that produces the same output under the same exogenous conditions. The stochastic cost frontier (SCF) approach is based on a cost equation that relates a bank's cost to variables that incur those expenses, such as output levels and input prices.

The SCF cost equation contains a composite error structure that distinguishes random cost fluctuations from cost inefficiencies. To put it simply, the cost function describes the relationship between the cost with quantities of output and input variables plus the inefficiency and random error.

The following cost equation:

$$C = f(y, w, z) + u + v, \tag{1}$$

where C measures the total costs of a bank, including both operating and financial costs; y is a vector of outputs; w is a vector of input prices; z represents the quantities of fixed bank parameters; u is the inefficiency term that captures the difference between the efficient level of cost for given output levels and input prices and the actual level of cost; and v is the random error term.

The cost efficiency of the bank can be written in a natural logarithm form as follows:

$$InTC = f(y, w, z) + Inu_t - Inv_t, \tag{2}$$

where f denotes a functional form.

Following the majority of cost-based studies on bank efficiency, the functional form chosen for the cost frontier is a translog function as follows:

$$InTC = \alpha_0 + \sum_i a_i\, InQ_i + \sum_j \beta_j\, InP_i + \frac{1}{2}\left[\sum_i \sum_j \delta_{ij} InQ_i InQ_j + \sum_i \sum_j \gamma_j InP_i InP_j + \sum_i \sum_j \rho_{ij} InQ_j InP_i + \varepsilon\right], \tag{3}$$

where $InTc$ is the natural logarithm of total costs, InQ_i is the natural logarithm of output, InP_i is the natural logarithm of input prices;

$\varepsilon_i = u_{it} - v_{it}$,

$\alpha, \beta, \delta, \gamma, \rho$ are coefficients to be estimated.

We also use the alternative profit function specification, where the dependent variable is the profit (π) of all banks in the sample. The composite error term is now defined as $u_{it} - v_{it}$.

The general procedure for estimating cost inefficiency in equation (3) is to estimate coefficients and the error term $\varepsilon_i = u_{it} - v_{it}$ first, and then calculate the efficiency for each observation in the sample.

These two models are simultaneously estimated using the maximum likelihood parameter estimation (Battese & Coelli, 1995). The computer program, FRONTIER Version 4.1 developed by Coelli (1995) has been used to obtain the maximum likelihood estimates of parameters in estimating the cost and profit efficiency. The program can accommodate cross sectional and panel data; cost and production function; half-normal and truncated normal distributions; time-varying and invariant efficiency; and functional forms which have a dependent variable in logged or original units.

3. Findings

3.1. Cost and profit efficiency based on overall and yearly estimates. The maximum likelihood parameter estimates for cost and profit efficiency are reported in Appendix A and B. Table 3 presents the cost and profit efficiency estimations of the Islamic banks in four regions using the SFA. The average cost and profit efficiency over 2003-2008 are about 44 percent and 41 percent, respectively. This implies that Islamic banks would have needed only 44 percent of the resources they used to produce banking services while only generating on average, about 41 percent of their potential profits. It is apparent that Islamic banks in these four regions are relatively better in controlling cost than generating profits. This is consistent to the findings by Kamaruddin et al. (2008). Hassan and Hussein (2003) also reported similar findings; the scores for cost efficiency and profit efficiency are 54.9 percent and 49.7 percent respectively. On the other hand, study by Mohamad et. al., (2008) find that banks in Islamic banks in OIC countries achieved higher profit efficiency (75.1 percent) than cost efficiency (31.8 percent).

The intertemporal comparison of the scores suggests that the trend for both the cost and profit efficiency of Islamic banking is upward, suggesting that the sample of Islamic banks has improved their efficiencies over the study period. Specifically, cost efficiency of Islamic banks has increased from 23.3 percent in 2003 to 42.8 percent in 2008, while profit efficiency has increased from 32.2 percent in 2003 to 44.8 percent in 2008. Figure 1 exhibits the comparison between cost and profit efficiency by graph.

Table 3. Summary statistics for the stochastic cost and profit efficiency on yearly basis

	Cost efficiency			Profit efficiency		
Year	Mean	Median	Std. dev.	Mean	Median	Std. dev.
2003	0.233	0.628	1.202	0.322	0.247	0.247
2004	0.311	0.669	0.982	0.318	0.253	0.249
2005	0.431	0.705	0.740	0.403	0.324	0.246
2006	0.530	0.682	0.538	0.442	0.364	0.263
2007	0.516	0.698	0.747	0.455	0.378	0.254
2008	0.428	0.661	0.914	0.448	0.366	0.254
All	0.436	0.682	0.827	0.411	0.335	0.255

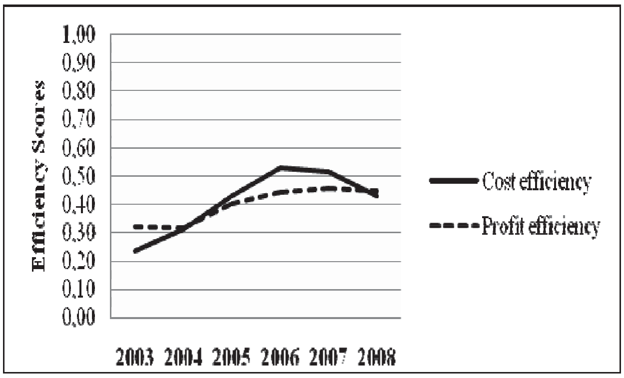

Fig. 1. Cost and profit efficiency of Islamic banks according to year

3.2. Cost and profit efficiency based on regions. The cost and profit efficiency scores on all banks in the four regions: Africa, Europe, Far East & Central Asia and Middle East are summarised in Table 4. As can be seen from the Table, considerable differences in cost and profit efficiency scores in these regions are observed, implying that geographical location does differentiate the cost and profit efficiency between these regions.

However, on average, Islamic banks in Europe were more cost and profit efficient than the other group of banks. These banks scored the highest cost and profit efficiency, implying that Islamic banks in Europe are relatively better in controlling cost and generate profits. Meanwhile, Islamic banks in the Far East and Central Asia scored the lowest mean cost efficiency while banks in Africa scored the lowest profit efficiency. However, the mean scores for cost and profit efficiency for Islamic banks in the Middle East are quite similar, 43.5 percent and 45.4 percent, respectively. Figure 2 reports the graphical representation of the differences between regions.

Table 4. Summary statistics for the stochastic cost and profit efficiency based on regional basis

	Cost efficiency			Profit efficiency		
Region	Mean	Median	Std. dev.	Mean	Median	Std. dev.
Africa	0.643	0.758	0.248	0.277	0.262	0.177
Europe	0.695	0.800	0.172	0.834	0.834	0.006
Far East & Central Asia	0.298	0.516	0.764	0.418	0.345	0.225
Middle East	0.435	0.771	1.028	0.444	0.454	0.276

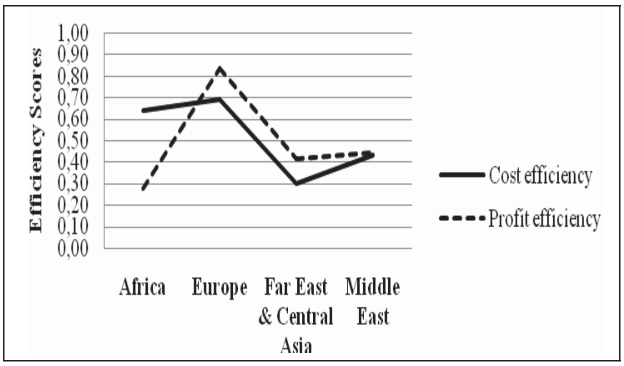

Fig. 2. Cost and profit efficiency of Islamic banks according to regions

Conclusions

The objective of this study is to measure cost and profit efficiency of Islamic banks in Africa, Europe, Far East and Central Asia and Middle East for the period from 2003 to 2008. For analyses purposes, we obtained data from Bankscope database for 193 sample banks for measuring cost efficiency and 163 sample banks for profit efficiency.

The findings showed that the average cost and profit efficiency of the overall Islamic banking increased during the survey period. The average cost and profit efficiency over 2003-2008 are 43.6 percent and 41.1 percent, respectively. This implies that banks in these four regions were relatively better in controlling cost than generating profits. Hence, this result supports the findings by Hassan and Hussein's (2003) and Kamaruddin et al. (2008) that Islamic banks are relatively better in controlling cost than generating profits. This finding, however, contra-dicts to the study found by Mohamad et al. (2008), who reported that Islamic banks are better in generating profits than utilising its resources. The intertemporal comparison of the efficiency scores suggest that the trend for both the cost and profit efficiency of Islamic banking is upward, suggesting that the sample of Islamic banks has improved their efficiencies over the study period.

The findings also show that Islamic banks in Europe are more cost and profit efficient than the other groups of Islamic banks. Overall, banks in the Far East and Central Asia scored the lowest cost efficiency, while African Islamic banks scored the lowest profit efficiency. Islamic banks in the Far East and Central Asia had mean cost and profit efficiency 29.8 percent and 41.8 percent, respectively. On the other hand, the cost and profit efficiency scores for Islamic banks in the Middle East were 43.5 percent and 45.4 percent, respectively.

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Appendix A

Table 1. Cost function maximum likelihood parameter estimates

Dependent variable: *ln(TC)*				
Parameter	Variable	Coefficient	Standard error	T-ratio
β_0	Constant	4.8593	1.037	4.687
β_1	Total earning assets	0.3522	0.142	2.482
β_2	Price of capital	1.2391	0.279	4.440
β_3	Price of deposits	-0.0643	0.173	-0.372
β_4	(T. earning assets)^2	0.0241	0.006	4.007
β_5	T.E. assets X Price of capital	-0.0179	0.020	-0.901
β_6	T.E. assets X Price of deposits	0.0189	0.016	1.173
β_7	(P. of deposits)^2	0.1017	0.031	3.318
β_8	Price of capital X Price of deposits	-0.0898	0.025	-3.556
β_9	(Price of deposits)^2	0.0326	0.008	4.162
Sigma-square	$\sigma^2 = \sigma^2_v + \sigma^2_u$	0.8170	0.287	2.850
Gamma	$\gamma = \sigma^2_u / (\sigma^2_v + \sigma^2_u)$	0.9512	0.021	45.881
Mu		-1.7631	0.814	-2.167
Eta		0.0990	0.019	5.119
Log likelihood function		-18.4881		

Appendix B

Table 2. Profit function maximum likelihood parameter estimates

Dependent variable: *ln(π)*				
Parameter	Variable	Coefficient	Standard error	T-ratio
β_0	Constant	-0.562	3.507	-0.160
β_1	Total earning assets	1.551	0.598	2.594
β_2	Price of capital	2.191	0.892	2.455
β_3	Price of deposits	-0.106	0.908	-0.117
β_4	(T. earning assets)^2	-0.076	0.024	-3.153
β_5	T. E. assets X Price of capital	-0.393	0.060	-6.506
β_6	T. E. assets X Price of deposits	0.065	0.064	1.013
β_7	(P. of deposits)^2	-0.433	0.134	-3.239
β_8	Price of capital X Price of deposits	0.088	0.129	0.684
β_9	(Price of deposits)^2	0.018	0.042	0.436
Sigma-square	$\sigma^2 = \sigma^2_v + \sigma^2_u$	3.004	2.599	1.155
Gamma	$\gamma = \sigma^2_u / (\sigma^2_v + \sigma^2_u)$	0.902	0.085	10.604
Mu		-0.617	2.600	-0.237
Eta		0.039	0.024	1.651
Log likelihood function		-180.571		