academicJournals

Vol. 7(23), pp. 2249-2256, 21 June, 2013
DOI: 10.5897/AJBM11.1255
ISSN 1993-8233 © 2013 Academic Journals
http://www.academicjournals.org/AJBM

African Journal of Business Management

Full Length Research Paper

Scale efficiency of Islamic banks of Pakistan

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Accepted 9 May, 2013

This study investigated the scale efficiency scores of Islamic banks of Pakistan for the period 2006 - 2009. Non-parametric technique Data Envelopment Analysis (DEA) was applied on the data collected from the annual reports of banks. Both CRS and VRS specification were applied to calculate scale efficiency under input-orientation. The results suggest the Dawood Islamic bank was the most scale efficient Islamic bank. Also the findings suggest that the Islamic banks had the highest mean scale efficiency scores in 2007. This work is the very first effort to compute the scale efficiency of Pakistani Islamic banking sector.

Key words: Scale efficiency, data envelopment analysis, Islamic banks.

INTRODUCTION

Islamic banking has been in existence since the 1970s. Islamic banking system is different from the conventional banking system in two major ways (Olson and Zoubi, 2008). Firstly, Islamic banking is interest free banking based on Islamic law (sharia) and secondly, Islamic banking follows risk free sharing. So, when financial units or pious Muslims want investment according to sharia principles, they use the services of Islamic banking. Thus when one wants to utilize the Islamic financing services, he must be questioning the efficiency of Islamic banks. Several techniques are available in literature to conduct the performance analysis. Mostly ratio analysis is used to determine the performance of Islamic banks of Pakistan. But there are some shortcomings allied with this technique; for instance, they are useful only when compared to benchmark (Yeh, 1996). We are using a non-parametric approach for assessing scale efficiency of Islamic banks of Pakistan. Only few studies in Pakistan provide scale efficiency comparison of Islamic banks with conventional banks (Mohamad et al., 2007; Farrukh, 2004). No independent study on scale efficiency of Islamic banks of Pakistan has been carried out so far.

Research work on Islamic banking of Pakistan is still in preliminary stage. The purpose of this paper is to compute the scale efficiency of five full-fledge Islamic banks operating in Pakistan and hence to observe the trend in scale efficiency for the period 2006 - 2009.

The main objective of this study is not only to find out the Islamic banks that are scale efficient, that is, operating at optimal scale of operation in each year, but also to calculate the scores of scale efficiency and inefficiency.

Currently, 5 full-fledge banks and 13 commercial banks are providing Islamic banking services in Pakistan. In this study we are taking only five full-fledge Islamic banks in our sample because we aim to do in-depth study of the scale efficiency associated with Islamic banks that are working indecently. Data availability and some other reasons restricted our study to four years analysis.

We applied both constant returns to scale (CRS) and variable returns to scale (VRS) to estimate the scale efficiency of Islamic banks under data envelopment analysis.

LITERATURE REVIEW

Most of the available literature for assessing performance

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of Islamic banking of Pakistan is based on ratio analysis (Samad, 1999; Bashir, 1999; Hassan and Bashir, 2003; Moin, 2008)

Yudistira (2004) worked on computing efficiency of 18 Islamic banks for the period 1997-2000. The technique applied for analysis was DEA to gauge technical and scale efficiency of sample banks. Following the intermediation approach for analysis, Yudistira (2004) confirmed that Islamic banks were somewhat inefficient during the period of global crisis (1998-1999). The primary determinants of efficiency amongst 18 Islamic banks were factors specific to the respective countries.

Valli and Mokhtarul (2004) used non-parametric approach DEA to determine the efficiency of Islamic banking sector and identified the ascriptions of scale and technical efficiency. The banks with full Islamic operations were contrasted with Islamic banks operating under foreign and domestic commercial banks. The results showed a turn down in efficiency of full-fledged Islamic operations due to scale inefficiency. During the period of six years, foreign banks put on full efficiency while domestic banks were relatively inefficient.

Mokhtar et al. (2006) inspected the efficiency of full-fledged Islamic banks, Islamic windows and conventional banks working in Malaysia over the period 1997-2003. The analysis illustrated that in term of deposits, assets and financing base, Islamic banks grew rapidly. Through Stochastic Frontier Approach, Mokhtar et al. (2006) and Mohamad et al. (2007) found that overall efficiency of Islamic banking industry has augmented during the period. Also Islamic windows were found less efficient than full-fledged Islamic banks.

Hassan (2006) applied parametric and non-parametric approach to investigate the relative efficiency of Islamic banking sector in the world. The study enclosed the period of 1995-2001. The efficiency measures, that is, cost, allocative, technical, pure technical and scale efficiency were first estimated and than compared with measures obtained through conventional accounting. Islamic banks were found a bit inefficient as compared to conventional banks. The study also suggested that for measuring the performance of Islamic banking sector, conventional ratios could be used along with the efficiency measures.

Sufian (2006) measured the performance of Malaysian Islamic banking sector for the period 2001-2005. Using DEA, the impact of change inputs and outputs was studied applying different approaches; also to look at the effect of risk factor on efficiency of Islamic banks a non-discretionary variable, that is, problem loan was used as input in the study. Scale inefficiency was leading over the pure technical inefficiency of Islamic banks; also domestic banks were more technically inefficient than foreign banks.

Kamaruddin et al. (2008) measured cost and profit efficiencies of fully Islamic banks and Islamic windows operating in Malaysia using non-parametric approach DEA and the study covered both domestic and foreign banks. Through analysis, Islamic banks were found efficient in managing cost and hence bringing about profits. This cost efficiency was found to be attained all the way through economies of scale and better management of resources.

Onour and Abdalla (2010) worked on estimating efficiency measures and productivity changes of Islamic banks in Sudan. Analysis was made using data envelopment analysis conducted on the sample of 12 Islamic banks. The results found only two largest Islamic banks overall technically efficient; on the other hand only one Islamic bank (smallest Islamic banks of Sudan) secured pure technical efficiency but the same bank was scale inefficient. Thus the size of banks was found as key factor for scale efficiency rather than ownership.

Bilal et al. (2011) used data envelopment analysis to probe the efficiency of Islamic banks and contrasted it with small commercial banks of Pakistan. They concluded that in overall inefficiency of Islamic banks, scale inefficiency was overriding by pure technical inefficiency effects. Islamic banks were found more efficient than small commercial banks of Pakistan in the study.

Ahmad et al. (2010) calculated efficiency measures of individual Islamic banks of Asian countries over the period 2001-2006. The calculations based on DEA revealed that in 2004, the Islamic banks showed highest mean technical efficiency of 86.5%. The pure technical inefficiency of Asian Islamic banks was more than scale inefficiency.

Sarker (1999) threw light on the troubles, projections and performance of Islamic banking industry in Bangladesh. He said that presence of apt banking laws and policies will add to the efficiencyof Islamic banks. In order to make use of maximum potential of Islamic banking they would be provided a self-governing system. The conventional banking framework moving parallel to Islamic banking put obstacles to the efficient operation of Islamic banking. However, he found conventional banking not a big danger for Islamic banking.

DATA AND METHODOLOGY

Efficiency has always been critical to the enhancement of the output of an organization. The study is designed to determine the scale efficiency of five Islamic banks currently operating in Pakistan for the period 2006-2009. Data for each year were taken from the annual reports of banks published on each bank's website. In order to know the trends of scale efficiency of Islamic banks DEA, BCC and CCR model is used with input-orientation.

Data envelopment analysis

Data envelopment analysis is a non-parametric efficiency measuring technique. It measures the relative efficiency of decision making units (DMUs). The DMUs considered may be branches of an organization or an independent organization.

The notion of activity analysis was first opened by Farrell (1957) and thirty years after his work, Charnes et al. (1978) made addition to his concept and brought forward a powerful idea that was later on

named as data envelopment analysis. DEA involves the estimation of efficient frontier using linear programming (Collie et al., 1998). This frontier determines the relative performance of DMU and compares it with best practice DMU in the sample without requiring any prior assumption (Al-Faraj et al., 1993).

Orientations of data envelopment analysis (DEA)

Data envelopment analysis entails two orientations; input-orientation and output-orientation. Input-orientation involves minimizing inputs and producing observed level of outputs. However, output-orientation focuses on output maximization by consuming observed level of inputs. Our study is based on input –orientation of DEA.

CCR model

CCR model of DEA was introduced by Charnes et al. (1978). This is obtained by ratio of weighted output to weighted inputs. This implies that the more the outputs produced from given inputs, the more efficient is the production. Determination of weights for the ratio follows a restriction that similar ratios for every DMUs have to be less than or equal to, unity. The definition of efficiency measurement permits multiple outputs and inputs without necessitating pre-assigned weights. CRS model of DEA measures the overall technical efficiency of DMUs. The model presumes no major relationship between scale of operations and efficiency by considering constant returns to scale.

The constant return to scale model presumes that optimal mix of inputs and outputs in a given production process is independent of the scale of operation. The CRS model measures the overall technical efficiency of the DMU. The objective function is to maximize h^0.

Max $h^0=\sum_{j=1}^{J} u_j^0 y_j^0$
Subject to
$\sum_{i=1}^{I} v_i^0 x_i^0 = 1, \sum_{j=1}^{j} u_j^0 y_j^n - \sum_{i=1}^{I} v_i^0 x_i^n \leq 0;$
n=1,… N, $v_i^0 \geq \varepsilon, u_j^0 \geq \varepsilon$, i=1
j=1, …. , j

The variable defined in both the problems, that is, 4 and 5 are same. The arbitrary sign introduced in the problem 5 is small positive number that is to make sure that all the inputs and outputs are having positive weights. The condition h makes certain that the base decision making unit (DMU^0) is efficient; or else it is DEA inefficient as compared to all other decision making units in the sample.

BCC model

Banker et al. (1948) extended the CCR model by adding variable assumption and put forward BCC model that was used to access DMUs characterized variable return to scale (VRS). The BCC model provides the measurement of pure technical efficiency, which is the technical efficiency devoid of scale efficiency.

By the sign of the variable $z_{j0,}$ we can determine whether the DMU'S production indicates the increasing return to scale, decreasing return to scale or constant return to scale. If $z_{jo}> 0$ then increasing return to scale exists, decreasing return to scale if $z$jo< 0 and constant return to scale if value of z_{jo} = 0. The BCC model is given as follows:

Max $h_0 = \sum_{r=1}^{s} u_r y_{rjo} + z_{j0}$

Subject to

$\sum_{i=1}^{m} v_i x_{ijo} + z_{jo} = 1$
$\sum_{r=1}^{s} u_r y_{rj} - \sum_{i=1}^{m} v_i x_{ij} + z_{jo} \leq 0$ j= 1, …. , n Ur, $v_i \geq 0$

Though pretty similar to the CRS, the VRS model measures the pure technical efficiency and returns to scale for each DMU. It is called BCC model. Scale efficiency can be calculated with CCR and BCC model.
So,

$SE = TE_{CRS} / TE_{VRS}$

If the technical efficiency scores measured by CRS and VRS are dissimilar then the scale inefficiency is said to be present.

Selection of variables

For selection of variable two approaches are available in literature; production approach and intermediation approach. Production approach was given by Benston (1965). In production approach, bank is considered as producer of services to the customer. Production approach considers production approach as inputs, example, material and labor. Intermediation approach, on the other hand, was developed by Sealey and Lindley (1977). According to this approach, financial institutions are regarded as intermediaries that transform and transfer financial assets from servers to borrowers.

Since Islamic banks provide intermediary services to the customers collecting deposits and other liabilities, we have used intermediation approach for defining inputs and outputs. Islamic banks are modeled multi-product firms utilizing two inputs to produce two outputs (Table 1).

EMPIRICAL RESULTS

The results for CRS and VRS models of Data Envelopment Analysis using input-orientation for year 2006, 2007, 2008 and 2009 were calculated. The scores of both models were used to determine the scale efficiency of respective year.

As shown in Table 2, in 2006 Bank Islami and Meezan Islamic Bank were 100% scale efficient. However, Albaraka Islamic Bank and Dubai Islamic Bank showed scale efficiency of 0.845 and 0.806 respectively. Thus both of these banks were not operating at optimal scale. Overall the scale inefficiency of all Islamic banks in 2006 was 8.7%.

In 2007 three Islamic banks, Bank Islami, Dawood Islamic Bank and Meezan Bank were operating at optimal scale with scale efficiency scores of 100% (Table 3). Albaraka Bank was 3.8% scale inefficient while scale inefficiency of Dubai Islamic Bank was 1.2%. Thus 3 Islamic banks were operating at optimal scale in 2008. As compared to the previous year, the scale inefficiency of Islamic banks was reduced in 2007 by 1% only; that is, Islamic banks were 1% inefficient in using factors of production.

Table 4 presents scale efficiency scores of Islamic banks in 2008. During this year three Islamic banks;

Table 1. Variables used for analysis.

Inputs	Outputs
Deposits (D)	Investments (I)
Total assets (A)	Net spread earned (S)

Table 2. Scale efficiency scores of Islamic banks for the year 2006.

Bank name	SE
Albaraka Islamic Bank	0.845
Bank Islami	1.00
Dubai Islamic Bank	0.806
Meezan Bank	1.00
Mean	0.913

Table 3. Scale efficiency scores of Islamic banks for the year 2007.

Bank name	SE
Albaraka Islamic Bank	0.962
Bank Islami	1.00
Dawood Islamic Bank	1.00
Dubai Islamic Bank	0.988
Meezan Bank	1.00
Mean	0.99

Note: SE=scale efficiency. Dawood Islamic Bank officially commenced its operations on April, 2007.

Table 4. Scale efficiency scores of Islamic banks for the year 2008.

Bank name	SE
Albaraka Islamic Bank	0.954
Bank Islami	1.00
Dawood Islamic Bank	1.00
Dubai Islamic Bank	0.939
Meezan Bank	0.922
Mean	0.963

Table 5. Scale efficiency scores of Islamic banks for the year 2009.

Bank name	SE
Albaraka Islamic Bank	0.839
Bank Islami	0.907
Dawood Islamic Bank	1.00
Dubai Islamic Bank	1.00
Meezan Bank	1.00
Mean	0.949

Albaraka Islamic Bank, Dubai Islamic Bank and Meezan Islamic Bank were operating at wrong scale of operation with scale inefficiency scores of 4.6, 6.1 and 7.8% respectively. Bank Islamic and Dawood Islamic Bank were scale efficient with 100% scale efficiency scores. Mean value gives the average scale efficiency of five Islamic banks (96.3%).

Table 5 gives the scale efficiency scores of Islamic banks of Pakistan in 2009. Dawood Islamic Bank, Dubai Islamic Bank and Meezan Islamic Bank were fully utilizing the factors of production and showed 100% scale efficiency, that is, production was at optimal level. Albaraka Bank and Bank Islami showed scale inefficient with 0.839 and 0.907 respectively. However, overall Islamic banks were 5.1% scale inefficient in 2009.

Table 6 and Annexure 6 presents the mean value of each Islamic bank's scale efficiency scores for year 2006 - 2009. Only Dawood Islamic Bank was 100% scale efficient for 4 years under consideration, that is, the bank was operating at optimal size of the bank (Annexure: Figure 3). Albaraka Islamic Bank was found with the least scale efficient during 2006 – 2009 with mean scale efficiency scores of 0.9 (Annexure: Figure 1). However, the mean scale efficiency scores of Albaraka Islamic Bank, Bank Islami and Meezan Bank was 0.9, 0.98 and 0.98 respectively (Annexure: Figures 1, 2 and 5). Albaraka Islamic Bank, Bank islami, Dubai Islamic Bank and Meezan Bank were scale efficient on average for the four years, that is, operating at wrong scale of production (Annexure: Figures 1, 2, 4 and 5).

Conclusion

This study attempted to pragmatically estimate the scale efficiency of five Islamic banks of Pakistan over the period 2006-2009. The study used non-parametric DEA approach that allowed the calculation of SE through TE_{CRS} and TE_{VRS} under input-oriented approach. The results suggest that in 2007 Islamic banks of Pakistan showed highest scale efficiency scores of 0.99. On the other hand, in 2006 Islamic banks were least scale efficient with efficiency scores of 0.913

The individual assessment of Islamic banks for the four years showed that Dawood Islamic Bank was on correct scale of production and operated at optimal level with mean efficiency score of 1.The scope of this study was limited and further elaborations could be made. The data could be extended to five years to make the scale efficiency estimation for previous year which will provide the insight of current situation. So, it would be another extension of the study. In our study we used input-orientation of DEA so output-orientation can be another

Table 6. Summary of scale efficiency scores of Islamic banks.

Banks	2006	2007	2008	2009	Mean
Albaraka Islamic bank	0.845	0.962	0.954	0.839	0.9
Bank Islami	1.00	1.00	1.00	0.907	0.98
Dawood Islamic bank	-	1.00	1.00	1.00	1.00
Dubai Islamic bank	0.806	0.988	0.939	1.00	0.93
Meezan bank	1.00	1.00	0.922	1.00	0.98

important extension of the study.

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Appendix

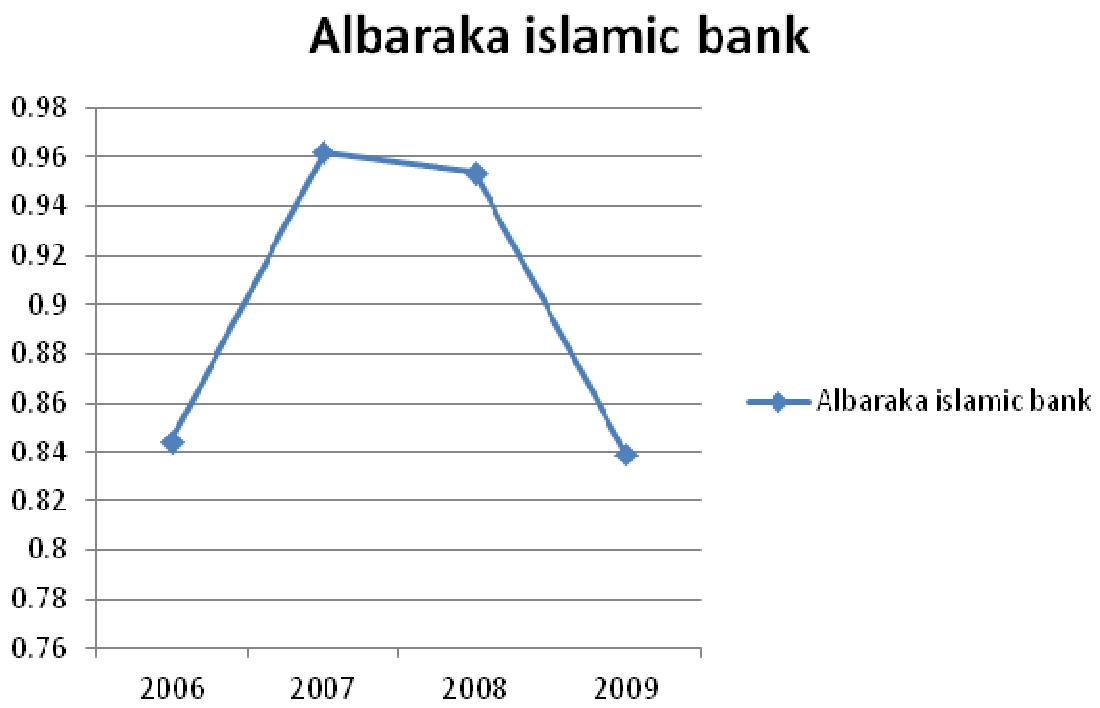

Figure 1. Scale efficiency of Albaraka Islamic Bank.

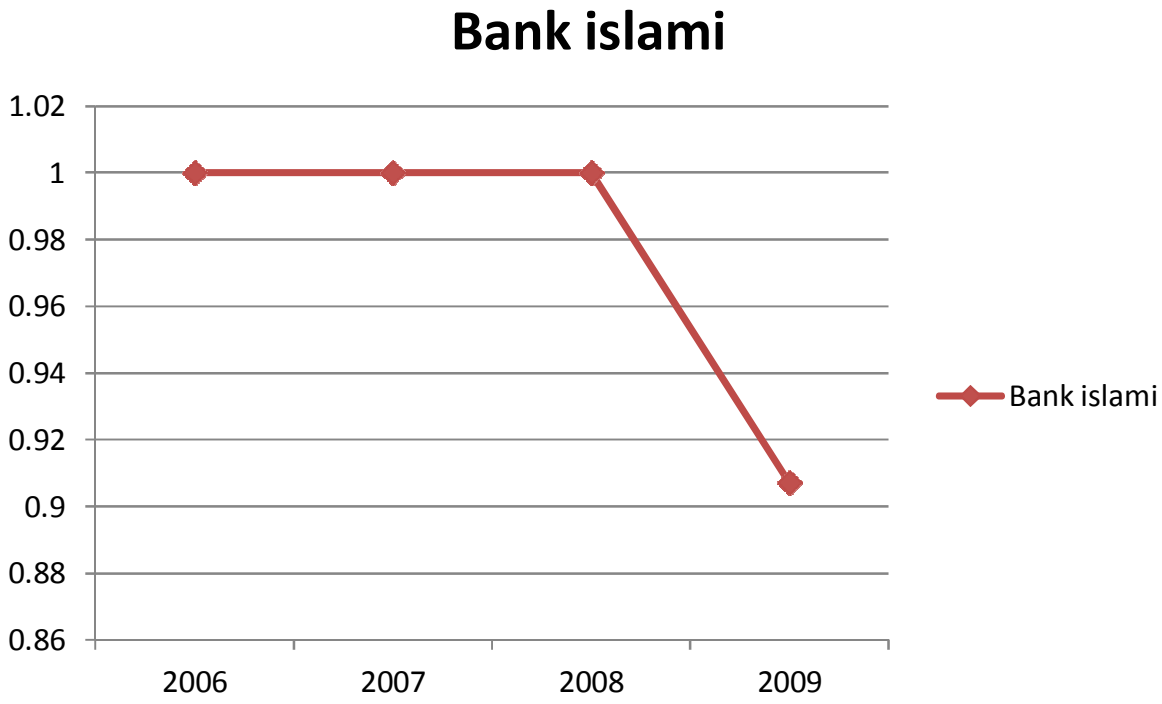

Figure 2. Scale efficiency of Bank Islami.

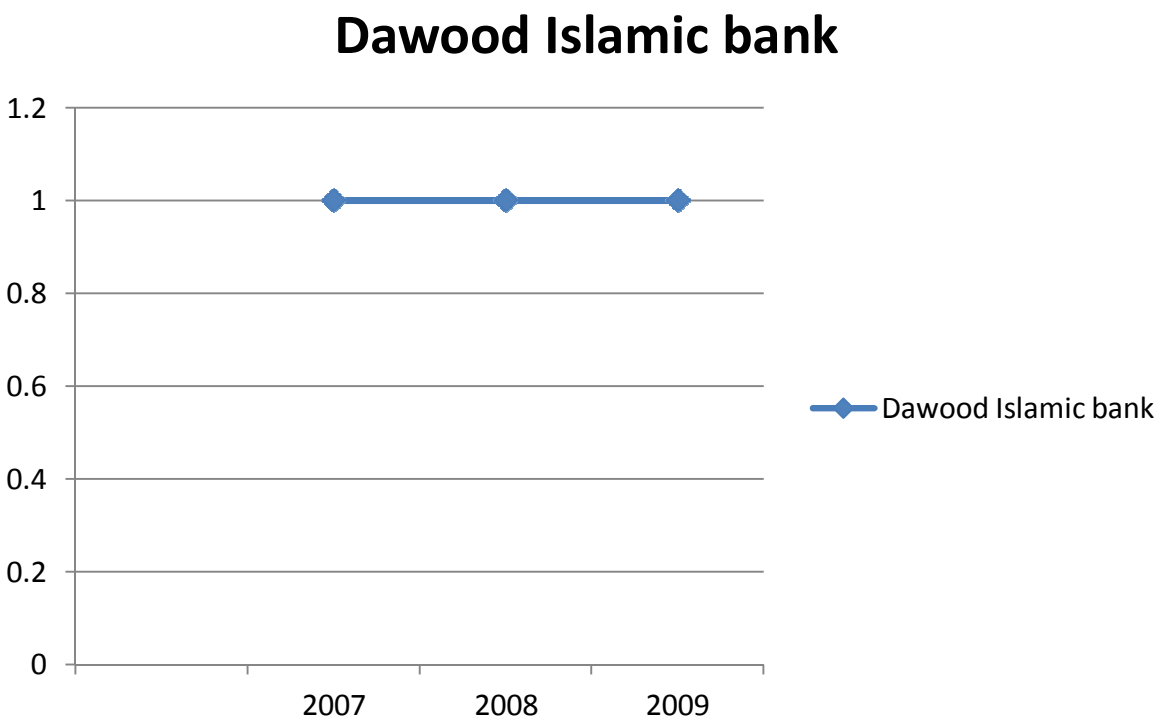

Figure 3. Scale efficiency scores of Dawood Islamic Bank.

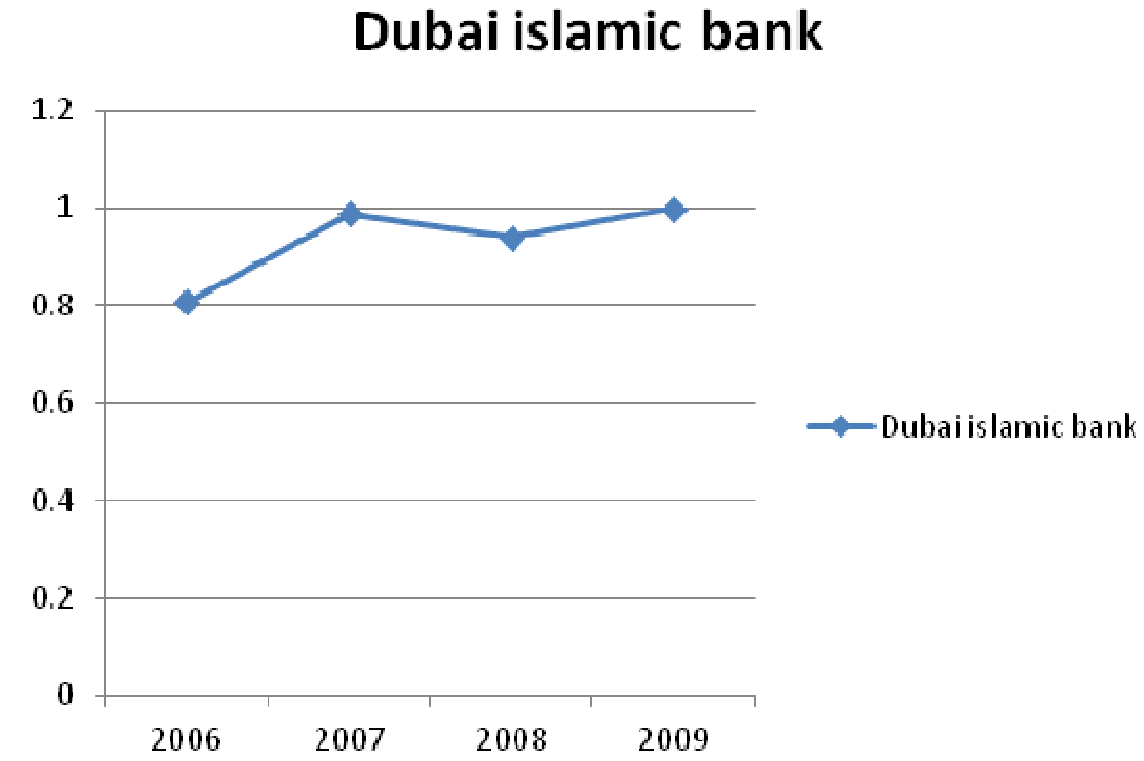

Figure 4. Scale efficiency scores of Dubai Islamic Bank.

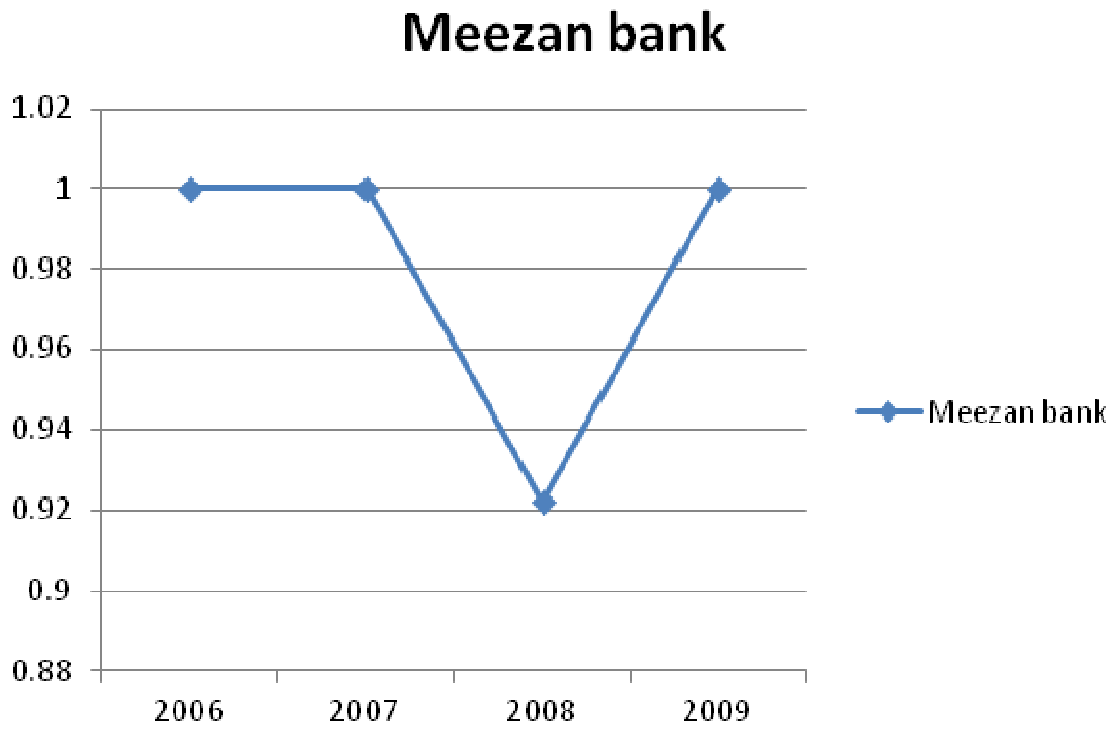

Figure 5. Scale efficiency scores of Meezan Bank.

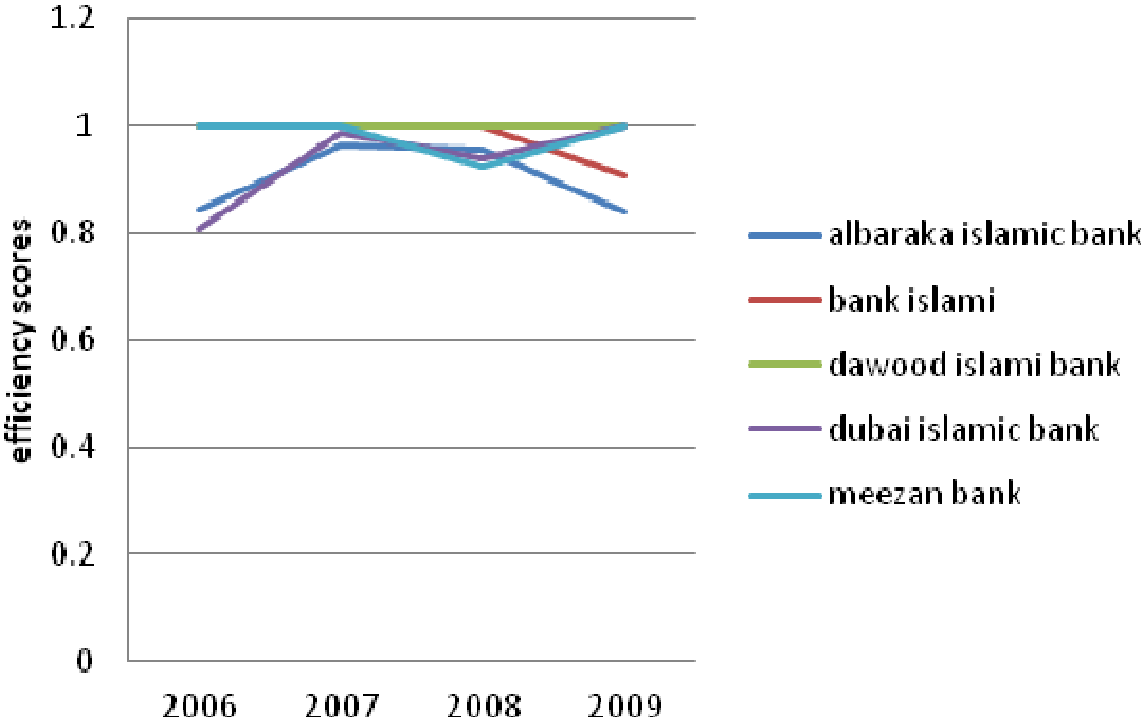

Figure 6. Summary of scale efficiency scores of Islamic banks 2006-2009.