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# EFFICIENCY IN ISLAMIC BANKING: AN EMPIRICAL ANALYSIS OF EIGHTEEN BANKS

**DONSYAH YUDISTIRA**[♣]

*Are Islamic banks stable and efficient? This paper addresses this question. Technical, pure technical, and scale efficiency measures are calculated by utilizing non-parametric technique, Data Envelopment Analysis. Several conclusions emerge. First, the overall efficiency results suggest that inefficiency across 18 Islamic banks is small at just over 10 percent, which is quite low compared to many conventional counterparts. Islamic banks in the sample suffered from the global crisis in 1998-1999 but performed very well after the difficult periods. The findings indicate that there are diseconomies of scale for small-to-medium Islamic banks which suggests that mergers should be encouraged.*

## 1. INTRODUCTION

In recent years, financial institutions have experienced a dynamic, fast-paced, and competitive environment at a cross-border scale. One of the fastest growing industries is Islamic banking. There are now more than 160 Islamic financial institutions around the world (Dar 2003). Though most of Islamic Banks are within the Middle-East countries, many universal banks in developed countries have begun to tap the massive demand of Islamic financial products.

The main difference between the Islamic banks and the contemporary banks is that while the latter is based on the conventional interest-based principle, while the former follows the principle of interest-free and profit and loss sharing (PLS) in performing their business as intermediaries (Ariff 1988). Under the term of Islamic PLS, the relationship between borrower, lender and intermediary are rooted on financial trust and partnership. Dar (2003) classifies four types of financing used as alternatives of interest; investment-based, sale-based, rent-based and service-based.

Despite considerable development of Islamic banking sector, there are still limited studies focusing on the efficiency of Islamic banks. Several studies that have been devoted to assess the performance of Islamic banks generally examine the relationship between profitability and banking characteristics. Bashir (1999)

[♣] Department of Economics, Loughborough University, Leicestershire, UK.

and Bashir (2001) perform regression analyses to determine the underlying determinants of Islamic performance by employing bank level data in the Middle East. His results indicate that the performance of banks, in terms of profits, is mostly generated from overhead, customer short term funding, and non-interest earning assets. Furthermore, Bashir (2001) claims that since deposits in Islamic banks are treated as shares, reserves held by banks exert negative impacts such as reducing the amount of funds available for investment.

Samad and Hassan (1999) apply financial ratio analysis to see the performance of a Malaysian Islamic bank over the period 1984-1997 and generally find that bankers' lack of knowledge was the main reason for slow growth of loans under profit sharing. The Islamic bank was found to perform better than conventional banks in terms of liquidity and risk measurement (less risky). Although this study is based only upon one Islamic bank in Malaysia, the result has given some insight on the example from outside the Middle East area. Similarly, utilizing Banking Efficiency Model, Sarker (1999) claims that Islamic banks can survive even within a conventional banking architecture in which PLS modes of financing is less dominated[1]. Using Bangladesh as a case study, Sarker (1999) argues further that Islamic products have different risk characteristics and consequently different prudential regulation should be applied.

The general banking efficiency literature distinguishes two types of efficiency; scale efficiency and X- efficiency. The concept of scale efficiency was first introduced by Farrell (1957), which can be simply defined as the relationship between a bank's per unit average production cost and volume, and thus a bank is said to have economies of scale when the increase in outputs is accompanied by a lower unit cost of production.

Second, the X- efficiency, which was popularized by Leibenstein (1966), refers to deviations from the cost-efficient frontier that depicts the lowest production cost for a given level of output. X-efficiency stems from technical efficiency, which gauges the degree of friction and waste in the production processes, and allocative efficiency, which measures the levels of various inputs. These two are neither scale nor scope dependent and thus X-efficiency is a measure of how well management is aligning technology, human resources management, and other resources to produce a given level of output.

Moreover, the literature distinguishes two main approaches in measuring banking efficiency; a parametric and a non-parametric approach. The specification of a production cost function is required in both approaches. The parametric approach engages in the specification and econometric estimation of a statistical or

[1] Banking Efficiency Model is a tool developed by the author to analyse the performance of a bank based on standard accounting ratios analysis.

parametric function, while the non-parametric method offers a linear boundary by enveloping the experimental data points, known as ”Data Envelopment Analysis” (DEA).

DEA methodology has been extensively used in the banking literature. Most analyses are mainly applied to North American region such as Miller and Noulas (1996) and Berger and Mester (2001). The results from this region are mixed depending on the period of sample studies but generally claim that large and profitable banks are more efficient than their smaller and less profitable competitors. Likewise, DEA was also used to scrutinize the benefit of European Economic Community, especially for the banking sector. Many have doubts that European banks may not perform equally efficient because of different banking structure before the integration. *Ex-ante* analysis suggests that there has been a small improvement in bank efficiency levels but country differences still appear to be very strong (Casu and Molyneux 2000).

Structural change has been particularly the main issue in the UK banking system. Many building societies converted their business into universal banks which has created a more intense competition among banks in the system. Drake (2001) finds that the big four UK banks suffered from decreasing returns to scale over the period 1984-1995. However, X-efficiencies are exhibited by these banks and similar to US banking studies, it suggests that very large banks have tendencies to minimize their costs better than smaller counterparts.

A few studies have been devoted to see the efficiency of Asian banks. Japanese banks are the most researched because of the importance of its financial system to the world economy. By creating a frontier for Japanese credit association (shinkin banks), Fukuyama (1996) finds that the major factor contributing to overall technical inefficiency is pure technical inefficiency, not scale inefficiency. This would suggest that size is not an important factor for Japanese banks to perform efficiently. The more recent study of Japanese banks contrast the earlier research and claim that powerful size-efficiency relationships are exist regarding both technical and scale efficiency, explaining the logic of the large scale mergers in Japanese banking system (Drake and Hall 2003).

Rezvanian and Mehdian (2002) show that small and medium size commercial Singaporean banks have economies of scale. This is in contrast to North American and UK experience since economies of scale is often seen from large banks in these regions. The paper also records the justification of Merger and Acquisitions within small and medium size Singaporean banks that is the significant cost advantages for the Singaporean banks to expand their size and to diversify into several outputs.

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 paper provides evidence on the performance of 18 Islamic banks over the period 1997-2000. Unlike previous studies, this paper is based on efficiency measurement in which the nonparametric approach, Data Envelopment Analysis, is utilized to analyze the technical and scale efficiency of Islamic banking. In specifying input-output variables of Islamic banks, the intermediation approach is selected as it is in line with the principle of Islamic financial system. Overall, the results suggest that Islamic banks suffer slight inefficiencies during the global crisis 1998-9. Efficiency differences across the sample data appear to be mainly determined by country specific factors.

The remainder of the paper is organized as follows. Section 2 reviews the methodology which is employed in the study. Section 3 describes the data sources and model specification. Empirical results are presented in section 4. Finally, section 5 contains concluding remarks.

## 2. METHODOLOGY

### 2.1 Data Envelopment Analysis

DEA is a linear programming technique for examining how a particular decision making unit (DMU, or bank in this study) operates relative to the other banks in the sample. The technique creates a frontier set by efficient banks and compares it with inefficient banks to produce efficiency scores. Furthermore, banks are bordered between zero and one scores, with completely efficient bank having an efficiency score of one. In DEA, the most efficient bank (with score of one) does not necessarily generate the maximum level of output from the given inputs. Rather, this bank generates the best practice level of output among other banks in the sample.

The term DEA was introduced by Charnes, Cooper, and Rhodes (1978), based on the research of Farrell (1957). For *n* DMUs in the banking industry, all of the sample outputs and inputs are characterized by the m and n, respectively. The efficiency of each bank is computed as follows:

$$e_s = \sum_{i=1}^{m} u_i y_{is} / \sum_{j=1}^{n} v_j x_{js}, \text{ for } i = 1, \ldots, m \text{ and } j = 1, \ldots, n, \qquad (1)$$

where $y_{is}$ is the amount of the *i*th output produced by the *s*th bank, $x_{js}$ is the amount of the *j*th input used by the *s*th bank, $u_i$ is the output weight, $v_j$ is the input weight. This efficiency ratio ($e_s$) is then maximized to select optimal weights subject to:

$$\sum_{i=1}^{m} u_i y_{ir} / \sum_{j=1}^{n} v_j x_{jr} \leq 1, \text{ for } r = 1, \ldots, N \text{ and } u_i \text{ and } v_j \geq 0, \tag{2}$$

where the first inequality ensures the efficiency ratios to be at least one and the second inequality guarantees that the weights are positive.

Following Charnes, Cooper, and Rhodes (1978), this fractional linear program can be transformed into an ordinary linear program:

$$\begin{aligned} \text{maximise } e_s &= \sum_{i=1}^{m} u_i y_{is} \\ \text{subject to } & \sum_{i=1}^{m} u_i y_{is} - \sum_{j=1}^{m} v_j x_{ir} \leq 0, r = 1, \ldots N; \\ & \sum_{j=1}^{m} v_j x_{js} = 1 \text{ and } u_i \text{ and } v_j \geq 0. \end{aligned} \tag{3}$$

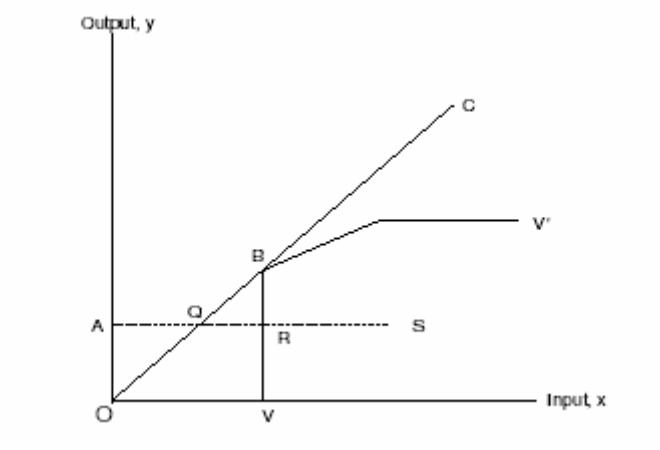
Similarly, the program can be converted into the dual problem:

$$\begin{aligned} &\text{minimise } \xi_s \\ &\text{subject to } \sum_{r=1}^{N} \varphi_r y_{ir} \geq y_{is}, i = 1, \ldots, m; \\ &\qquad \xi_s x_{js} - \sum_{r=1}^{N} \varphi_r x_{ir} \geq 0, j = 1, \ldots, n; \varphi_r \geq 0, \\ &\qquad \text{and } 0 \leq \xi_s \leq 1. \end{aligned} \tag{4}$$

where $\xi_s$ is the overall technical efficiency score of *s*th bank, where a value of 1 indicates the point on the frontier. The linear programming problems (3) and (4) assume constant returns to scale (CRS) in which the solution can be seen as the frontier OC in figure 1, and hence banks on this frontier are theoretically efficient according to Farrell (1957) definition.

Consider sth bank is located to the right of frontier or inefficient bank which is shown as point S in figure 1. The overall technical efficiency ($\xi_s$) is then computed by the ratio of *AQ/AS* and thus *s*th bank must reduce (1 - $\xi_s$) of input in order to arrive as an efficient bank at point *Q*.

**Figure 1**
***Efficiency Measurements Using One Output and One Input***




If the linear programming equations (3) and (4) are solved by adding the restriction of $\varphi_r$s from 1 to N equals one, there are two further efficiency measurements: the variable returns to scale (VRS) which can be shown in figure 1 as *VV*'; and the pure technical efficiency which is given by AR/AS = $\rho_s$ for *s*th bank at point *S*[2] This means that the scale efficiency is calculated by $\sigma_s = \xi_s/\rho_s$. Furthermore, the fraction of output lost due to scale inefficiency can be measured as $(1 - \sigma_s)$.

Scale efficiency equals one if and only if the technology exhibits CRS or point B in figure 1. However, scale inefficiency may exist because of either increasing (IRS) or decreasing returns to scale (DRS). In obtaining these two possible results, the solution of linear programming problems (3) and (4) must be restricted with the sum of the $\varphi_r$ from 1 to N is less than or equal to one in which the pictorial solution can be shown as OBV 0 in figure 1.

The efficiency measure from this technology for *s*th bank at point S is $\theta_s$ = *AQ/AS* which also equals to $\xi_s$. Therefore, DRS is found when $\sigma_s = \theta_s$ and IRS arises when $\sigma_s \neq \theta_s$ .

Above all, efficiency appears when $\sigma_s = \theta_s = \xi_s = 1$.

[2] Note that $\rho_s$ s is larger than the overall efficiency of $\xi_s$ .

## 3. DATA AND MODEL SPECIFICATION

### 3.1 Data

The panel data set is extracted from non-consolidated income statements and balance sheets of 18 Islamic banks during the period of 1997-2000 which are made available by the London-based International Bank Credit Analysis LTD's Bank Scope database[3]. Indeed, the time span was specifically chosen to see the impact of recent financial crisis on efficiency of Islamic banks.

All variables are converted into US dollars using end of year market value, and deflated by the Consumer Price Index of each country in order to take account of macroeconomic differences across countries during the time period of the study. Following Casu and Molyneux (2000), another reason to employ this method is to include environmental differences that obviously arise in the sample data. Both exchange rate and CPI values are drawn from the International Financial Statistics.

**Table-1**
***Islamic Banks Summary Statistics 1997-2000***

Summary statistics are given for 18 Islamic Banks over the period of 1997-2000. The statistics are calculated from yearly data in which all variables are expressed in million US Dollars as monetary values, deflated by the Consumer Price Index of each country where the bank originates from.

| | Mean | Med | Sd | Min | Max |
|---|---|---|---|---|---|
| **1997** | | | | | |
| Assets | 534.81 | 368.41 | 600.10 | 2.72 | 2082.34 |
| Fixed Assets | 6.51 | 4.76 | 5.60 | 0.22 | 18.65 |
| Staff Costs | 5.75 | 3.25 | 5.97 | 0.27 | 17.64 |
| Total Deposits | 440.84 | 308.93 | 549.18 | 1.84 | 2105.81 |
| Other Income | 7.14 | 2.13 | 9.67 | 0.17 | 31.58 |
| Loan | 354.27 | 200.41 | 468.46 | 0.50 | 1570.37 |
| Liquid Assets | 105.83 | 31.09 | 131.92 | 1.05 | 409.82 |
| **1998** | | | | | |
| Assets | 565.45 | 410.46 | 635.58 | 4.00 | 2130.86 |
| Fixed Assets | 8.79 | 7.60 | 10.01 | 0.23 | 40.33 |
| Staff Costs | 6.31 | 3.55 | 6.74 | 0.22 | 19.82 |
| Total Deposits | 444.72 | 345.28 | 525.33 | 3.00 | 1745.84 |
| Other Income | 7.92 | 3.79 | 8.70 | 0.32 | 25.75 |

[3] Due to availability of data, this study only compiles 18 Islamic Banks from the database.

| | Mean | Med | Sd | Min | Max |
|---|---|---|---|---|---|
| Loan | 380.59 | 193.32 | 496.46 | 0.20 | 1600.85 |
| Liquid Assets | 105.05 | 34.61 | 129.30 | 1.01 | 429.05 |
| **1999** | | | | | |
| Assets | 711.27 | 456.83 | 770.95 | 5.27 | 2543.41 |
| Fixed Assets | 10.02 | 7.11 | 12.92 | 0.24 | 51.98 |
| Staff Costs | 6.30 | 3.76 | 6.49 | 0.23 | 20.32 |
| Total Deposits | 505.07 | 387.22 | 520.90 | 4.66 | 1643.90 |
| Other Income | 7.58 | 2.67 | 11.95 | 0.45 | 47.50 |
| Loan | 447.61 | 280.20 | 597.48 | 0.24 | 2198.53 |
| Liquid Assets | 149.90 | 68.42 | 180.14 | 1.21 | 529.32 |
| **2000** | | | | | |
| Assets | 818.10 | 509.04 | 934.36 | 6.56 | 3201.26 |
| Fixed Assets | 12.85 | 7.41 | 16.94 | 0.18 | 58.91 |
| Staff Costs | 7.25 | 4.68 | 7.62 | 0.35 | 26.77 |
| Total Deposits | 669.29 | 419.16 | 778.98 | 5.14 | 2686.86 |
| Other Income | 8.64 | 3.78 | 12.19 | 0.22 | 46.19 |
| Loan | 514.50 | 282.74 | 720.35 | 0.18 | 2809.65 |
| Liquid Assets | 170.01 | 62.00 | 220.58 | 1.58 | 728.48 |

Table 1 presents the summary of Islamic bank balance sheet statistics in the sample study. The dynamics of assets, total deposits, loan and liquid assets show profound variability across banks from the standard deviation values. This is because the sample study consists of Islamic banks from 12 countries within which the sample includes 4 GCC countries: Bahrain, Kuwait, Qatar and United Arab Emirates; 2 East Asian countries: Indonesia and Malaysia; 3 African countries: Algeria, Gambia, and Sudan; and 3 other Middle East countries: Egypt, Jordan, Yemen. To tackle these differences later in DEA estimation, this study groups the sample banks according to the size and the region where each bank originates from.

In contrast, two input variables (fixed assets and staff costs) and one output variable (other income) show similarity across the sample period based on mean and standard deviation values. Even though monetary values have been used across the sample period, the mean values of these variables show small figures relatively for different countries. The main interest in this preliminary analysis is the small figures of other income variable within the sample period. Although this variable increases on yearly basis, it should be noted that earning assets are the main income generating products in most banks, including Islamic banks.

### 3.2 Specification of Inputs and Outputs

Capital structure of an Islamic bank is acknowledged to be equity-based because of the domination of shareholder's equity and investment deposits, which are derived from PLS principle (Muljawan, Dar, and Hall 2002). In other words, the return on capital would be determined *ex post* or would be based on the return of economic activity in which the funds were utilized. Although the mystification of this issue will be abolished by employing the DEA approach, the appropriate specification of an Islamic bank's inputs and outputs has to be viewed properly. Therefore, in modeling bank behavior, this paper follows intermediation approach in which DEA model consists of 3 outputs and 3 inputs, as follows:

| **Output** | **Input** |
|---|---|
| *y1*: Total loans | *x1*: Staff Costs |
| *y2*: Other Income | *x2*: Fixed Assets |
| *y3*: Liquid Assets | *x3*: Total Deposits |

In spite of the definition of inputs and outputs in measuring efficiency remains the contentious issues as discussed extensively in Humprey (1985), the reason for choosing the intermediation approach is because of the main character of Islamic banks, which is often claimed as a joint stock firms which shares are easily tradable (Dar and Presley 2000). The principle of Islamic financial system is the participation in enterprise, employing the funds based on PLS. This by no means implies the importance of intermediary activities that Islamic banks perform.

In specifying inputs, this study reflects the standard intermediation approach in which capital and labor are used to intermediate deposits into loans and other earning assets.

Specifically, the capital input is represented by fixed assets, while the labor input is represented by personnel expenses. In most DEA studies, the number of employees is common to specify input. However, as this study comprises many countries, the general analysis will therefore benefit from the inclusion of personnel expenses in monetary values instead of number of employees.

The inclusion of $y2$ in the analysis is particularly important as Islamic banks have been very creative in avoiding interest rate products which creates the movement from traditional financial intermediation into off-balance sheet alike and fee income-generating businesses (Dar 2003). As a result, concentrating on completely earning assets would be insufficient to capture the overall output of Islamic banking industry. Furthermore, total loans of Islamic banks in the sample consist of mostly Islamic transactions.

### 3.3 Adjustment to Environmental Differences

Although the sample data has been adjusted for country differences by converting into US dollars and deflating the variables, the efficiency scores still recover from the DEA and thus perform two-stage method as suggested by Coelli, Prasada, and Battese (1998). After solving the DEA problem in first-stage analysis, the efficiency scores are regressed upon the environmental variables. The coefficients reflect the direction of influence and the strength of relationship can be assessed by standard hypothesis test. The focus is to measure the overall technical efficiency which is regressed by estimating OLS model:

$$\xi_s = \alpha + \beta_1 KA_{s,t} + \beta_2 NTA_{s,t} + \beta_3 \log(A_{s,t}) + \beta_4 MP_{s,t} + \beta_5 MID_{s,t} + \beta_6 PUB_{s,t} + \varepsilon_{s,t} \quad (5)$$

The subscript *s* refers to the bank and *t* refers to the time period. The dependent variable of (5) is the overall technical efficiency ($\xi_s$ ). The effect of bank size is measured by including the logarithm of total assets (log(A)) and of bank profitability (net income) to total assets (NTA). The ratio of capital to total assets (KA) is employed to analyze the relationship between efficiency and risk taking propensity in which a higher ratio implies a higher risk propensity.

To capture some aspects of market power with the ratio of bank deposits to the total deposits in the country within which the bank operates, the inclusion of Market Power (MP) variable is beneficial as suggested by Miller and Noulas (1996). The geographical location dummy variable (MID) is comprised to detect whether there are efficiency differences between banks operating in Middle East or non-Middle East. Finally, this study includes the dummy variable (PUB) to distinct between the publicly listed and non-publicly listed banks.

## 4. EMPIRICAL RESULTS

### 4.1 Bank Efficiency Measures

From Table 2, it is clear that Islamic banks show considerable overall efficiency (CRS) across sample period, with year 2000 being the most efficient year. However, it is interesting to note that Islamic banking industry experienced slight inefficiencies in 1998 and 1999 (0.870 and 0.897, respectively) compared to 1997 and 2000 (0.902 and 0.909, respectively).

Indeed, 1998 and 1999 were the period of turmoil that hit the global economy. The level of inefficiency in 1998 is more attributable to pure technical inefficiency

rather than scale efficiency. The finding is similar to the recent US and Japanese evidence which typically demonstrates that X-inefficiency (failure to minimize costs for a given output vector) is a more stern setback than scale inefficiency (failure to operate at the minimum efficient scale), especially during the crisis period (Berger and Humprey 1997, Drake and Hall 2003).

**Table 2**
***Efficiency Results Overall Sample of Islamic Banks***

| Sample Bank | Year | Assets | CRS | VRS | Scale | Rtn to scl |
|---|---|---|---|---|---|---|
| Bank 1 | 1997 | 184,175,427.59 | 0.953 | 0.97 | 0.982 | DRS |
| Bank 2 | 1997 | 20,093,541.38 | 0.684 | 0.791 | 0.865 | IRS |
| Bank 3 | 1997 | 22,605,253.98 | 0.93 | 1 | 0.93 | IRS |
| Bank 4 | 1997 | 109,140,185.25 | 1 | 1 | 1 | - |
| Bank 5 | 1997 | 2,723,493.66 | 1 | 1 | 1 | - |
| Bank 6 | 1997 | 1,091,482,953.41 | 0.88 | 1 | 0.88 | DRS |
| Bank 7 | 1997 | 109,489,177.10 | 0.764 | 0.775 | 0.985 | DRS |
| Bank 8 | 1997 | 1,173,804,269.82 | 0.776 | 1 | 0.776 | DRS |
| Bank 9 | 1997 | 2,082,338,538.76 | 0.944 | 1 | 0.944 | DRS |
| Bank 10 | 1997 | 410,320,106.01 | 1 | 1 | 1 | - |
| Bank 11 | 1997 | 1,635,858,618.90 | 1 | 1 | 1 | - |
| Bank 12 | 1997 | 415,959,202.19 | 1 | 1 | 1 | - |
| Bank 13 | 1997 | 420,476,630.23 | 0.866 | 0.876 | 0.988 | DRS |
| Bank 14 | 1997 | 462,352,113.42 | 0.701 | 0.71 | 0.988 | DRS |
| Bank 15 | 1997 | 326,492,755.54 | 1 | 1 | 1 | - |
| Bank 16 | 1997 | 836,427,701.88 | 0.761 | 0.79 | 0.963 | DRS |
| Bank 17 | 1997 | 303,134,316.65 | 1 | 1 | 1 | - |
| Bank 18 | 1997 | 19,792,338.10 | 0.982 | 1 | 0.982 | IRS |
| Mean | | 534,814,812.44 | 0.902 | 0.940 | 0.960 | |
| Bank 1 | 1998 | 195,791,273.92 | 0.966 | 0.983 | 0.983 | DRS |
| Bank 2 | 1998 | 14,249,332.01 | 0.582 | 0.607 | 0.959 | IRS |
| Bank 3 | 1998 | 29,263,193.11 | 0.945 | 1 | 0.945 | IRS |
| Bank 4 | 1998 | 124,959,293.63 | 1 | 1 | 1 | I |
| Bank 5 | 1998 | 4,000,646.41 | 0.84 | 1 | 0.84 | IRS |
| Bank 6 | 1998 | 1,153,967,238.85 | 0.912 | 1 | 0.912 | DRS |
| Bank 7 | 1998 | 32,863,382.17 | 1 | 1 | 1 | - |
| Bank 8 | 1998 | 1,338,459,880.59 | 0.964 | 1 | 0.964 | DRS |
| Bank 9 | 1998 | 2,130,858,588.39 | 0.773 | 1 | 0.773 | DRS |
| Bank 10 | 1998 | 429,257,057.52 | 1 | 1 | 1 | - |
| Bank 11 | 1998 | 1,735,066,576.20 | 1 | 1 | 1 | - |
| Bank 12 | 1998 | 426,855,615.93 | 0.88 | 0.998 | 0.881 | DRS |
| Bank 13 | 1998 | 443,101,765.02 | 0.799 | 0.894 | 0.894 | DRS |
| Bank 14 | 1998 | 482,209,778.29 | 0.651 | 0.785 | 0.828 | DRS |
| Bank 15 | 1998 | 394,065,584.78 | 1 | 1 | 1 | - |
| Bank 16 | 1998 | 927,385,787.44 | 0.773 | 0.972 | 0.795 | DRS |
| Bank 17 | 1998 | 283,956,320.46 | 1 | 1 | 1 | - |
| Bank 18 | 1998 | 31,849,653.92 | 0.568 | 1 | 0.568 | IRS |
| **Mean** | | **565,453,387.14** | **0.870** | **0.958** | **0.908** | |

| Sample Bank | Year | Assets | CRS | VRS | Scale | Rtn to scl |
|---|---|---|---|---|---|---|
| Bank 1 | 1999 | 192,784,738.61 | 1 | 1 | 1 | - |
| Bank 2 | 1999 | 13,357,406.84 | 1 | 1 | 1 | - |
| Bank 3 | 1999 | 45,577,925.84 | 1 | 1 | 1 | - |
| Bank 4 | 1999 | 126,117,997.03 | 1 | 1 | 1 | - |
| Bank 5 | 1999 | 5,271,979.25 | 1 | 1 | 1 | - |
| Bank 6 | 1999 | 1,548,173,515.25 | 1 | 1 | 1 | - |
| Bank 7 | 1999 | 44,705,747.49 | 0.746 | 0.772 | 0.966 | DRS |
| Bank 8 | 1999 | 1,829,232,824.65 | 1 | 1 | 1 | - |
| Bank 9 | 1999 | 2,543,405,987.31 | 1 | 1 | 1 | - |
| Bank 10 | 1999 | 442,129,616.67 | 1 | 1 | 1 | - |
| Bank 11 | 1999 | 1,828,802,218.07 | 1 | 1 | 1 | - |
| Bank 12 | 1999 | 497,855,954.56 | 1 | 1 | 1 | - |
| Bank 13 | 1999 | 471,525,428.69 | 0.688 | 0.694 | 0.991 | IRS |
| Bank 14 | 1999 | 500,340,598.21 | 0.557 | 0.558 | 0.999 | IRS |
| Bank 15 | 1999 | 436,867,059.17 | 1 | 1 | 1 | - |
| Bank 16 | 1999 | 945,769,697.55 | 0.693 | 0.695 | 0.997 | IRS |
| Bank 17 | 1999 | 1,261,192,988.05 | 0.623 | 0.81 | 0.765 | DRS |
| Bank 18 | 1999 | 69,849,382.46 | 0.836 | 1 | 0.836 | IRS |
| **Mean** | | **711,273,614.43** | **0.897** | **0.918** | **0.975** | |
| Bank 1 | 2000 | 221,329,584.25 | 1 | 1 | 1 | - |
| Bank 2 | 2000 | 13,695,621.03 | 1 | 1 | 1 | - |
| Bank 3 | 2000 | 78,782,154.10 | 1 | 1 | 1 | - |
| Bank 4 | 2000 | 147,856,417.09 | 1 | 1 | 1 | - |
| Bank 5 | 2000 | 6,564,402.64 | 1 | 1 | 1 | - |
| Bank 6 | 2000 | 1,915,386,742.44 | 1 | 1 | 1 | - |
| Bank 7 | 2000 | 51,736,794.08 | 1 | 1 | 1 | - |
| Bank 8 | 2000 | 2,281,173,893.02 | 0.908 | 0.967 | 0.939 | IRS |
| Bank 9 | 2000 | 3,201,262,853.30 | 1 | 1 | 1 | - |
| Bank 10 | 2000 | 451,338,806.38 | 1 | 1 | 1 | - |
| Bank 11 | 2000 | 1,917,472,211.65 | 1 | 1 | 1 | - |
| Bank 12 | 2000 | 568,762,338.00 | 1 | 1 | 1 | - |
| Bank 13 | 2000 | 528,197,762.99 | 0.733 | 0.751 | 0.977 | DRS |
| Bank 14 | 2000 | 565,186,522.52 | 0.675 | 0.686 | 0.983 | DRS |
| Bank 15 | 2000 | 489,873,656.08 | 1 | 1 | 1 | DRS |
| Bank 16 | 2000 | 947,826,949.51 | 0.909 | 1 | 0.909 | - |
| Bank 17 | 2000 | 1,321,851,777.47 | 0.584 | 0.694 | 0.843 | DRS |
| Bank 18 | 2000 | 17,495,812.99 | 0.664 | 0.681 | 0.975 | IRS |
| **Mean** | **2000** | **818,099,683.30** | **0.909** | **0.931** | **0.974** | |

The information on efficiency results for Islamic banks grouped by regional area provides significant insights into the analysis. As can be seen from Table 3, Islamic banks in the Middle East region perform better in terms of overall technical efficiency (VRS) until 1998 but subsequently showing a sluggish result compared to their non Middle East counterparts.

The explanation for this fact is, similar to the general results, that Islamic banks outside the Middle East region experienced more difficulties towards the global economic crisis in 1997-1998, especially the contribution from Islamic banks in the East Asia region. However, when most economies have slowly recovered from the crisis (i.e. 1998 onwards), non Middle East Islamic banks become slightly more efficient than Middle East Islamic Banks. Previous studies have already pointed out this fact and argued that the explanation lies on depositors' flight to quality which was found mainly in the East Asia region (Chiuri, Ferri, and Majnoni 2001, Yudistira 2002). Flight to quality supposedly consisted of deposit shifting from small to large banks as the latter was perceived too big to fail or simply more likely to receive public sector support in the case of difficulties.

To analyze the size efficiency relationship, Islamic banks across the sample are grouped by total assets in which banks with more than $600 mln of assets are categorized as large size and banks below this level are categorized as small-to-medium size. Concentrating on scale efficiency (SCALE), it is clear that the largest degrees of scale inefficiencies come from large size Islamic Banks, with the lowest SCALE score is 0.915 in 1998. It is interesting to note that all but one of the large size Islamic banks in 1997-1998 exhibited decreasing returns to scale, whilst in 1999-2000 most large size banks show constant returns to scale. Regarding the minimum efficient scale (MES) in Islamic banking for the end of year 2000, the results would suggest that this is obtained by small-to-medium size Islamic banks with asset levels of around $ 500 mln and by large size Islamic banks with asset levels of around $1.5 bln. Towards these levels, most banks exhibited either decreasing or increasing returns to scale and subsequently drifted to constant returns to scale.

Moreover, as can be seen from Table 3, there is a straightforward relationship between size and VRS in Islamic banking in contrast to the efficiency results of Japanese banking in 1997 (Drake 2001). For example, while large size Islamic banks exhibit a mean VRS score of 0.958 in 1997, the corresponding levels for small-to-medium size is 0.932. This finding would prove why the trend of merger and acquisition (M&A) is not evident in Islamic banking. The finding should, however, be treated as a significant policy implication. M&A should be encouraged if the least efficient of the smaller Islamic banks were to be acquired by their more efficient counterparts, regardless of country border and financial system. Large and efficient Islamic banks may obtain cost reductions from expansion and economies of scale, although these benefits may be offset by increasing levels of X-efficiency. Overall, this argument has been noted by Al-Omar and Iqbal (2000):

**Table-3**
***Efficiency Results Grouped by Regional Area and Bank Size***

| | Year | CRS | VRS | SCALE |
|---|---|---|---|---|
| **Grouped by Regional Area** | | | | |
| Middle east Countries | 1997 | 0.916 | 0.935 | 0.980 |
| Non Middle East Countries | 1997 | 0.886 | 0.946 | 0.936 |
| Middle east Countries | 1998 | 0.891 | 0.963 | 0.922 |
| Non Middle East Countries | 1998 | 0.843 | 0.951 | 0.891 |
| Middle east Countries | 1999 | 0.856 | 0.876 | 0.975 |
| Non Middle East Countries | 1999 | 0.948 | 0.972 | 0.975 |
| Middle east Countries | 2000 | 0.890 | 0.913 | 0.971 |
| Non Middle East Countries | 2000 | 0.932 | 0.953 | 0.978 |
| **Grouped by Bank Size** | | | | |
| Middle east Countries | 1997 | 0.914 | 0.932 | 0.978 |
| Non Middle East Countries | 1997 | 0.872 | 0.958 | 0.913 |
| Middle east Countries | 1998 | 0.864 | 0.944 | 0.915 |
| Non Middle East Countries | 1998 | 0.884 | 0.994 | 0.889 |
| Middle east Countries | 1999 | 0.902 | 0.919 | 0.983 |
| Non Middle East Countries | 1999 | 0.886 | 0.918 | 0.960 |
| Middle east Countries | 2000 | 0.906 | 0.922 | 0.982 |
| Non Middle East Countries | 2000 | 0.916 | 0.949 | 0.959 |

In order to operate in global markets, they [Islamic banks] have to build strategic alliances with other banks. It will also be useful to build bridges between existing Islamic banks and those conventional banks that are interested in doing banking on Islamic principles.

Although bank size clearly appears as a prominent argument on scale efficiency, it is believed that scale efficiency is also mainly induced by factors regarding geographical area, and hence the regulation in the country where bank operates[4]. International standards of Islamic banking accounting principles should also be encouraged in order to be able to compete within the global environment. This is, without doubt, an interesting field of further research in Islamic banking literature.

[4] It should be noted, however, that Islamic banks should be treated differently from other banks. For example, the central bank's reserve normally generates an interest which is prohibited in Islamic banking (Al-Omar and Iqbal 2000). An alternative method should then be required to give a fair treatment for Islamic banks.

### 4.2 Differences in Bank Efficiency

The efficiency results from DEA recover from the environmental factors. As suggested by Coelli, Prasada, and Battese (1998), this study performs second-stage analysis which regresses the efficiency scores from the DEA upon environmental variables. Table 4 reports the regression results. Unlike American and European evidence, KA and NTA are not significant in determining the efficiency of Islamic banks[5]

Banks with more market power, as measured by the share of total country deposits, possess lower efficiency at the 5 percent level. This result is similar to the American experience in the period of 1984 to 1990 (Miller and Noulas 1996). Furthermore, the log(A) is found to be significant at 1 percent level which confirms that the size relationship is evident in the sample data.

**Table-4**
***Second Stage Regressions on Overall Technical Efficiency***

| Variable | | | |
|---|---|---|---|
| Constant | 0.6362* | 0.6921* | 0.7367* |
| | (0.1599) | (0.2091) | (-0.1753) |
| KA | 0.0019 | 0.0025** | 0.0017 |
| | (0.0016) | (0.0018) | (-0.0015) |
| NTA | 0.0066 | 0.0017 | -0.0015 |
| | (0.0031) | (0.0036) | (-0.0030) |
| Log (A) | 0.0158 | 0.0107 | 0.0141** |
| | (0.0085) | (0.0105) | (-0.0089) |
| MP | -1.0426* | | -1.1283* |
| | (0.1874) | | (-0.2089) |
| MID | | 0.0086 | -0.0711* |
| | | (0.0357) | (-0.0597) |
| PUB | | -0.1069 | -0.0597* |
| | | (0.0356) | (-0.0310) |
| R-squared | 0.3434 | 0.1591 | 0.4196 |
| Adjusted R-squared | 0.3042 | 0.0954 | 0.36607 |
| F | 8.760 | 2.497 | 7.832 |

** Significant at 1 percent, * Significant at 5 percent

Both dummy variables are found to be significant. Confirming the efficiency results in previous section, Islamic banks in the Middle East region are

[5] Although the methodologies are different, the results can be compared to the evidence of Islamic banks in the Middle East area by Bashir (2001) which finds that K/A is strongly significant in determining the performance.

significantly less efficient than Islamic banks outside the region, other things constant. Furthermore, negative and statistically significant results on PUB variable shows that publicly listed Islamic banks are less efficient than their non-listed counterparts. The result is different to many evidence of conventional banks, especially in the European area (Casu and Molyneux 2000).

Some caveats should be mentioned in interpreting the results. First, due to the data limitation, the DEA frontier only assesses Islamic banks in the sample. The inclusion of more sample and longer time period would generate better and probably more accurate results. Second, the sample consists of Islamic banks from many countries. The country differences, as proved in the regression analysis, are strongly significant, although various macroeconomic variables have been controlled.

## 5. CONCLUDING REMARKS

In this paper, technical, pure technical, and scale efficiency measures are calculated by utilizing the non-parametric technique, Data Envelopment Analysis. Several conclusions emerge. First, the overall efficiency results suggest that inefficiency across 18 Islamic banks is small at just over 10 percent, which is quite low compared to many conventional counterparts. Similarly, Islamic banks in the sample suffered from the global crisis in 1998-1999 but performed very well after the difficult periods. This would suggest that the interdependence of Islamic banks on other financial system is significant and any regulator, especially in which the bank operates, should consider Islamic banking in the search of global financial stability.

Second, the findings further indicate that there are diseconomies of scale for small-to-medium Islamic banks which suggests that M&A should be encouraged. Supported by the non-parametric technique and regression analysis, Islamic banks within the Middle East region are less efficient than their counterparts outside the region. Additionally, market power, which is common in the Middle East, does not significantly impact on efficiency. The reason is that Islamic banks from outside the Middle East region are relatively new and very much supported by their regulators[6]. Furthermore, publicly listed Islamic banks are less efficient than their non-listed counterparts.

[6] Infant industries that are particularly supported by the governments generally grow at the maximum speed.

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