An Analysis on the Efficiency of the Malaysian Islamic Banking Industry: Domestic *vs.* Foreign

Fatimah Salwa Abd. Hadi and Norma Md. Saad

Abstract: This paper examines productivity change of Islamic banks in Malaysia during the period 2006 to 2008. The data includes a panel of 12 Islamic banks and the productivity of each bank is analysed using the non-parametric Data Envelopment Analysis (*DEA*) method or the intermediation approach. In the DEA technique, efficiency is measured by the Malmquist index. We model Islamic banks in Malaysia as multi-product firms producing two outputs (total loan and income) by employing three inputs (total deposit, labour, fixed asset). Overall results suggest that scale efficiency dominates the pure technical efficiency effects in determining Malaysian Islamic banks' overall or technical efficiency. Another important finding derived from the study is that Malaysian-owned Islamic banks' performance is better compared to their foreign-owned counterparts. The findings of the study are important for Islamic banks in Malaysia to improve or maintain the ability to become more competitive and provide a viable and better alternative to the conventional banking system.

JEL Classification: G11, G21, Z12.

I. Introduction

The banking industry has become increasingly integrated in recent years. Liberalization and deregulation of the financial sector, coupled with rapid technological advancement and improved communication systems, have contributed to the integration process. As a result, banks are now faced with

Fatimah Salwa Abd. Hadi, Department of Economics, Kulliyyah of Economics and Management Sciences, International Islamic University Malaysia, Kuala Lumpur, Malaysia.
Norma Md. Saad, Department of Economics, Kulliyyah of Economics and Management Sciences, International Islamic University Malaysia, Kuala Lumpur, Malaysia.

© 2010, international association for islamic economics
Review of Islamic Economics, Vol. 14, No. 1, 2010, pp. 27–47.

very high and intense competition. The Islamic banking industry has not been spared the effects of the recent technological developments and the resulting competitive pressure.

The existence of Islamic banking operations can be traced back to 1963 when Tabung Haji or the Pilgrims Management and Fund Board was established by the government, concerned at the time to cater for the religious consciousness of the Muslim community in Malaysia. Tabung Haji, known as a specialized financial institution provides in fact a very systematic mobilization of funds from Muslim savers both to enable pilgrimage and encourage indirect participation in investment opportunities. Tabung Haji is considered to be the first of its kind in the world (Mohammed Seidu, 2002).

The Ninth Malaysia Plan, covering 2006-10, seeks to position Malaysia as a global hub of Islamic finance. In order to promote this goal, Bank Negara, Malaysia's Central Bank, has issued a number of licenses to allow commercial banks to practice Islamic banking and thus offer Islamic banking products and services to both Muslim and non-Muslim customers. Currently, there are 13 Islamic banks operating in the country, of which three are foreign-owned and the rest locally-owned. This paper focuses on two aspects of Islamic banking in Malaysia. Firstly, it aims to investigate the efficiency of all Islamic banks incorporated in Malaysia. Secondly, it tries to compare the performance of the domestically-owned and the foreign-owned Islamic banks operating in the country.

This study should add to our knowledge and understanding of performance of Islamic banks in Malaysia and provide insights useful both to specific bank management and to state policy makers with regard to optimal utilization of capacities, improvements in managerial expertise, efficient allocation of scarce resources and most productive scale of operation.

Following the literature review in section 2, section 3 of this paper discusses the methodology of the study. Section 4 then presents the empirical results and analysis, followed by concluding remarks in section 5.

II. Literature Review

Studying the efficiency of Malaysian Islamic banking has significant public policy implications, especially as efficiencies have been found to account for around 20% or more of costs in banking (Berger *et al.*, 1993). Many studies of bank efficiency in the developed countries — like United States (Wheelock and Wilson, 1999; Alam, 2001), Australia (Avkiram, 2000; Worthington, 2000) and Europe (Berger and Humphrey, 1997; Fernandez *et al.*, 2002) —

have helped to develop and operate the banking system in those countries in better ways.

Mester (1993) used the stochastic econometric cost frontier approach to examine efficiency of banks operating in the Third Federal Reserve District in the US using specific data starting from 1991-1992. The finding of the study suggested that there is less to be gained, in terms of cost saving, from changing output size than using different inputs, which is clearly more cost-efficient. In the same year, a study by Cebenoyan *et al.* (1993) concentrated on the risk of failure of inefficient banks: it found that savings and loans banks in the US with low efficiency estimates face failure at higher rates than those with high efficiency estimates. A study conducted in Turkey by Zaim (1995) found that the financial reform introduced there in the mid 1980s had succeeded in prodding commercial banks into taking positive measures to enhance technical as well as allocative efficiencies. He also observed that banks in Turkey recorded some improvement in efficiency during the 1980-1990.

Lovell and Grifell-Tatje (1997) used Spanish banking data over 1986–93 to show that savings banks reacted to banking deregulation by engaging in efficiency-enhancing merger activities. A study by Chang (1998) based on banking data from 1984-1989 using translog stochastic cost frontier method to estimate the cost inefficiency scores, found that foreign-owned multinational banks operating in the US were significantly less efficient than their local counterparts.

With regard to studies on the efficiency of Islamic banks, Metwally (1997) compared the performance of 15 conventional and 15 interest-free banks from all over the world. The study tested for structural difference between the two groups of banks from the following perspectives: liquidity, leverage, credit risk, profit, and efficiency. The study concluded that interest-free banks face higher or more difficulties in attracting depositors to deposit their money as compared to conventional banks. Another finding was that interest-free banks tend to be more traditional in utilizing funds for lending and, therefore, face many disadvantages in terms of investment opportunities. The Islamic banks also have a higher cash-to-deposits ratio as compared to conventional ones. However, statistical results suggest that profitability and efficiency differences are not statistically significant between these two kinds of different banks.

Sarker (1999) did a research on all Islamic banks in Pakistan measuring efficiencies in productivity, operation, allocation, distribution, and stability computed in financial ratios. The conclusion derived from this research is that, Islamic banks could not achieve maximum efficiency under the conventional banking framework due to the constraints that they face. In the same year, Samad and Hassan (1999) undertook a study using financial ratios to measure the profitability performance of Bank Islam Malaysia Berhad (BIMB) as compared to 8 conventional banks. The crucial output derived from this study is that the average profit of BIMB was significantly lower than that of the conventional banks.

Recently, Batchelor and Wadud (2003) published a study of the relative efficiency of the operation of Islamic banking under a dual banking system, as pioneered in Malaysia. The study used the Data Envelopment Analysis (*DEA*) or intermediation approach to compute changes in Islamic banking system efficiency over the period 2000–2001. The result indicates that full-pledged Islamic banks tend to have lower technical efficiency than commercial banks that offer Islamic banking products due to decreasing return to scale. This study, however, was confined to the two-year period mentioned and did not cover allocative efficiency.

Majid *et al.* (2003) measured the cost efficiency of 34 commercial banks in Malaysia paneling the data for the period 1993-2000 with a view to comparing the relative performance of two bank sets – Islamic and conventional. Based on their results, the authors maintain that the efficiency of the Islamic banks is not statistically different from that of the conventional banks. Also, they found no evidence to suggest that bank efficiency is a function of ownership status *i.e.* public or private, foreign or local.

Saaid *et al.* (2003) conducted a study on Islamic banks in Sudan and found that the Islamic banks have low efficiency – both technical and allocative: they were not optimizing their input usage. Furthermore, the authors claim, the inefficiency is more in resource allocation than in their technical use. Based on these broad findings, the study ventures a few policy prescriptions for improving the performance of Islamic banks in Sudan.

III. Research Methodology

In exploring the contributions of technical and efficiency change to the growth of productivity of the Malaysian Islamic banks, the generalized output-oriented Malmquist index, developed by Fare *et al.* (1989) is adopted here. The Malmquist indexes are constructed using the *DEA* approach and estimated using Coelli's (1996) *DEAP* version 2.1. This was first demonstrated by Fare *et al.* (1989) using the geometric mean formulation of the

Malmquist index. Following this, Forsund (1991) derived the decompostiton of the simple version of the Malmquist productivity index into technical change and efficiency change.

The function of *DEA* concentrates primarily on the technological aspects of production correspondences. It can be used to estimate technical and scale efficiency without requiring estimates of input and output prices; hence, it leads to simple efficiency comparisons and the Malmquist index. The *Malmquist productivity indexes* and *DEA* have been used extensively in a variety of studies, which include the regulated sector (*e.g.*, Banker *et al.,* 1986) and the non-profit sector (*e.g.*, Lewin *et al.,* 1982), aggregate comparisons of productivity between countries (Fare *et al.,* 1994a) as well as various economic sectors such as agriculture by Tauer (1998) and Mao and Koo (1996).

Following Fare *et al.* (1989), the Malmquist index of total factor productivity growth is written as follows:

$$M_0(x^t, y^t, x^{t+1}, y^{t+1}) = \frac{D^{t+1}(x^{t+1}, y^{t+1})}{D^t_0(x^t, y^t)} \times \left\{ \left[\frac{D^t_0(x^{t+1}, y^{t+1})}{D^{t+1}(x^{t+1}, y^{t+1})} \right] \left[\frac{D^t_0(x^t, y^t)}{D^{t+1}(x^t, y^t)} \right] \right\}^{1/2} \quad (1)$$

where the notations $D^t(x^{t+1}, y^{t+1})$, represents the distance from the period *t+1* observation to the period *t* technology. The first ratio on the right hand side of the equation (1) measures the change in relative efficiency (*i.e.* the change in how far away observed production is from maximum potential production) between years *t* and *t+1.* In addition, both of the numerator and denominator of this ratio must be more than or equal to 1 and the values that are closer to 1 represent higher efficiency. Thus, if technical efficiency is higher in period *t+1* than in period *t*, the value of this ratio will be more than 1; while if efficiency declines between the two periods, the value of the ratio will automatically be less than 1.

The second term in equation (1), in brackets (geometric mean of the two ratios), captures the shift in technology (*i.e.* movements of the frontier function itself) between the two periods evaluated at x^t and x^{t+1}. Essentially, the change in relative efficiency measures how well the production process converts inputs into outputs (catching up to the frontier) and the latter reflects improvement in technology. According to Fare *et al.* (1994a), improvements in productivity yield *Malmquist index* values greater than unity while a *Malmquist index* of less than unity is associated with deterioration in performance. The same interpretation goes for the values taken by the components of the overall *TFP* index. Improvements in the efficiency component yielded index values greater than one, which is evidence of the catching up (to the frontier). Values of the technical change component greater than one are considered evidence of technological progress.

In empirical applications, the four distance measurements that appear in (1) above are calculated for each operator in each pair of adjacent time periods using the mathematical programming technique. Suppose that there are $k = 1, \dots, K$ firms that produce $m = 1, \dots, M$ outputs $y^t_{k,m}$ using $n = 1, \dots, N$ inputs $x^t_{k,n}$ at each time period $t = 1, \dots, T$. Under *DEA*, the reference technology (G^t) with constant returns to scale at each time period t from the data can be defined as:

$$G^t = [\ (x^t, y^t) : y^t_m \leq z^t_k\, y^t_{k,m}\ ] \qquad m = 1, \dots, M$$

$$\sum_{K=1}^{k} z^t_k\, x^t_{k,n} \leq x^t_n \sum_{K=1}^{k} \qquad n = 1, \dots, N \qquad (2)$$

$$z^t_k \geq 0 \qquad k = 1, \dots, K$$

where z^t_k refers to the weight on each specific cross-sectional observation. Following Afriat (1972), the assumption of *CRS* may be relaxed to allow variable returns to scales (*VRS*) by adding the following restriction:

$$\sum_{K=1}^{k} z^t_k = 1\ (VRS) \qquad (3)$$

Following Fare *et al.* (1994), this study applies an enhanced decomposition of the Malmquist index by decomposing the efficiency change component calculated relative to the *CRS* technology into a pure efficiency component (calculated relative to the *VRS* technology) and a scale efficiency change component, which captures changes in the deviation between the *VRS* and *CRS* technology. The subset of pure efficiency change measures the relative ability of operators to convert inputs into outputs, while scale efficiency measures to what extent the operators can take advantage of returns to scale by altering its size towards optimal scale.

To construct the Malmquist productivity index of firm k' between periods t and $t+1$, the following four distance functions are calculated using the *DEA* approach: $D^t_o(x^t, y^t)$, $D^{t+1}(x^t, y^t)$, $D^t_o(x^{t+1}, y^{t+1})$, $D^{t+1}(x^{t+1}, y^{t+1})$. These distance functions are the reciprocals of the output-based Farrell's measure of technical efficiency. The non-parametric programming model used to calculate the output-based Farrell measure of technical efficiency for each firm $k' = 1, \ldots, K$, is expressed as:

$$[D^t_o\,(x^t_k\,,\,y^t_k)]^{-1} = max\,\lambda^{'k'} \qquad (4)$$

subject to

$$\begin{aligned}
&\lambda^{k'}\,y^t_{k,m} \leq \sum_{K=1}^{k} z^t_k\,y^t_{k,m} && m = 1, \ldots, M \\
&\sum_{K=1}^{k} z^t_k\,x^t_{k,n} \leq x^t_{k',n} && n = 1, \ldots, N \qquad (5)\\
&\sum_{K=1}^{k} z^t_k = 1 && \text{(VRS)} \\
&z^t_k \geq 0 && k = 1, \ldots, K
\end{aligned}$$

The computation of $D^{t+1}\,(x^{t+1}, y^{t+1})$ is similar to (5), where $t+1$ is substituted for t.

Construction of the Malmquist index also requires calculation of two mixed-distance functions, which is computed by comparing observations in one time period with the best practice frontier of another time period. The inverse of the mixed-distance function for observation k' can be obtained from

$$[D^t_o\,(x^{t+1}\,,\,y^{t+1})]^{-1} = \max\,\lambda^{'k'} \qquad (6)$$

subject to

$$\begin{aligned}
&\lambda^{k'}\,y^{t+1} \leq \sum_{K=1}^{k} z^t_k\,y^t_{k,m} && m = 1, \ldots, M \\
&\sum_{K=1}^{k} z^t_k\,x^t_{k,n} \leq x^{t+1} && n = 1, \ldots, N \qquad (7)\\
&\sum_{K=1}^{k} z^t_k = 1 && \text{(VRS)} \\
&z^t_k \geq 0 && k = 1, \ldots, K
\end{aligned}$$

To measure changes in scale efficiency, the inverse output distance functions under the *VRS* technology are also calculated by adding (3) into the constraints in (5) and (7). Technical change is calculated relative to the *CRS* technology. Scale efficiency change in each time period is constructed as the ratio of the distance function satisfying *CRS* to the distance function under *VRS*, while the pure efficiency change is defined as the ratio of the own-period distance functions in each period under *VRS*. With these two distance functions with respect to the *VRS* technology, the decomposition of (1) becomes:

$$M_0(x^t, y^t, x^{t+1}, y^{t+1}) = \underbrace{\left\{\left[\frac{D^{t+1}(x^t, y^t)}{D_0^t(x^t, y^t)}\right]\left[\frac{D^{t+1}(x^{x+1}, y^{t+1})}{D^t(x^{t+1}, y^{t+1})}\right]\right\}^{1/2}}_{a} \text{X} \underbrace{\left[\frac{D_0^t(x^t, y^t}{D^{t+1}(x^{t+1}, y^{t+1})}\right]}_{b}$$

$$\text{X} \underbrace{\left[\frac{D^{t+1}(x^t, y^t)}{D^{t+1}(x^t, y^t)} \frac{D^{t+1}(x^{x+1}, y^{t+1})}{D^{t+1}(x^t, y^t)} \frac{D_{0c}^t(x^t, y^t)}{D_0(x^t, y^t)} \frac{D^t(x^{x+1}, y^{t+1})}{D_{0c}^t(x^{x+1}, y^{t+1})}\right]^{1/2}}_{c} \qquad (8)$$

where *a*=technical change, *b*=pure efficiency change and *c*=scale efficiency change.

Note that the scale change factor equals to one when the technology exhibits *CRS*, and this is the same decomposition as equation (1).

IV. Empirical Results and Analysis

4.1. Input and output specifications

The definition and measurement of inputs and outputs in the banking function remains a sensitive issue among researchers. To determine what constitutes inputs and outputs of banks, one should first decide on the nature of banking technology. In banking theory literature, there are in the main two competing approaches: the production and intermediation approaches (Sealey and Lindley, 1977).

Under the production approach, a financial institution is defined as a producer of services for account holders, that is, they perform transactions on deposit accounts and process documents such as loans. Hence, according to this approach, the number of accounts or their related transactions are the best measures for output, while the number of employees and physical capital are considered as inputs. Previous studies that adopted this approach are, among others, by Sherman and Gold (1985), Ferrier and Lovell (1990) and Fried *et al.* (1993).

The intermediation approach, on the other hand, assumes that financial firms act as an intermediary between savers and borrowers and posits total loans and securities as outputs, whereas deposits (along with labour and physical capital) are defined as inputs. Previous banking efficiency studies research that adopted this approach among others are Charnes *et al.* (1990), Bhattacharyya *et al.*(1997) and Sathye (2001).

For the purpose of this study, a variation of the intermediation approach or asset approach originally developed by Sealey and Lindley

(1977) is adopted in the definition of inputs and outputs used. According to Berger and Humphrey (1997), the production approach might be more suitable for branch efficiency studies, as at most times bank branches basically process customer documents and bank funding, while investment decisions are mostly not under the control of branches.

In this study, three inputs and two outputs were used to investigate the efficiency of 12 Islamic banks in Malaysia from the fourth quarter of 2006 until the second quarter of 2008. The inputs are total deposits, labour and fixed assets, while outputs are total loans and income. Table 1 lists the Islamic banks included in the study.

Table 1: Islamic Banks in Malaysia

No.	Name	Ownership
1	Kuwait Finance House (Malaysia) Berhad	Foreign
2	Al Rajhi Banking & Investment Corporation (Malaysia) Berhad	Foreign
3	Asian Finance Bank Berhad	Foreign
4	RHB Islamic Bank Berha	Local
5	CIMB Islamic Bank Berhad	Local
6	Hong Leong Islamic Bank Berhad	Local
7	EONCAP Islamic Bank Berhad	Local
8	Affin Islamic Bank Berhad	Local
9	AmIslamic Bank Berhad	Local
10	Alliance Islamic Bank Berhad	Local
11	Bank Islam Malaysia Berhad	Local
12	Bank Muamalat Malaysia Berhad	Local

4.2. Productivity performance of individual bank

Tables 2 to 3 present the performance of the banks during six periods of study in term of *TFP* change and its two subcomponents, namely technical change and efficiency change. The value of Malmquist *TFP* productivity index and its components of less than unity mean a decrease or deterioration in productivity. By contrast, the values greater than unity show improvements of productivity in the relevant aspect. (Robert, 2000)

According to Robert (2000), in order to get an average increase or decrease and relevant performance measure per period of study, we have to subtract 1 from the number reported in the table. Table 2 shows calculated changes in the *Malmquist-based total factor productivity index.* As evidenced in the result, CIMB Islamic Bank Berhad has positive productivity changes for the first (Q4, 2006 – Q1, 2007) and sixth (Q1, 2008 – Q2, 2008) period.

In contrast, Kuwait Finance House (Malaysia) Berhad, Asian Finance Bank Berhad, Hong Leong Islamic Bank Berhad, Alliance Islamic Bank Berhad recorded deterioration in *TFP* over six periods of study. However, there were some improvements of *TFP* change for AmIslamic Bank Berhad and Bank Islam Malaysia Berhad. In addition, Asian Finance Bank Berhad had the highest average *TFP* at average rate quarterly of 14.7%. Affin Islamic Bank Berhad come next with a rate at 12.8%, and followed by Hong Leong Islamic Bank Berhad at 1.2%. Overall, all banks did not increase their *TFP* on average over the six periods. The *TFP* change, on average, only showed some growth in period 1 (Q4, 2006–Q1, 2007) and period 4 (Q3, 2007–Q4, 2007): 2.3% and 11.9% respectively. However, it deteriorated in the period 2 (Q1, 2007 –Q2, 2007): 3.4%, period 3 (Q2, 2007–Q3, 2007): 0.6%, period 5 (Q4, 2007–Q1, 2008): 2.3%, and period 6 (Q1, 2008–Q2, 2008): 8%.

The *Malmquist TFP* index is further decomposed into its two components, called technical change and efficiency change. The results for technical and efficiency change are reported in Tables 3 and 4. Table 3 presents the index values of technical progress/regress as measured by average shifts in the best-practice frontier from period t to t+1. Over the period of analysis; Asian Finance Bank Berhad recorded the highest change in technical progress (60.7%) in the first period, followed by EONCAP Islamic Bank Berhad in the second period, Kuwait Finance House (Malaysia) Berhad (9.6%) in the third period, Affin Islamic Bank Berhad (88.6%) in the fourth period and fifth period (11.6%), and lastly CIMB Islamic Bank Berhad (9.3%) in the sixth period.

Table 3 also demonstrates that technical progress was experienced by three banks in the first period, one bank in the second, three banks in the third period, nine banks in the fourth period, three banks in the fifth, and only one bank in the last period. On average, all periods except the fourth are found to have been quarters of technical regress (0.6%, 15.6%, 4.3%, 8.7%, 11.7%, respectively). Islamic Banks recorded 4.4% technical progress during the fourth period. In addition, Affin Islamic Bank Berhad is found to have been the most technically progressive bank (12.8%), whereas Al Rajhi Banking & Investment Corporation (Malaysia) Berhad was found to have been the most technically regressive bank with -26.9%.

Table 4 displays change in relative efficiency for each individual bank. The results indicate considerable variation across banks and periods. Only four banks were found efficient including Kuwait Finance House (Malaysia) Berhad, CIMB Islamic Bank Berhad, EONCAP Islamic Bank Berhad, and

Affin Islamic Bank Berhad. These four banks showed no change in efficiency in all periods. For the others, there were periods with positive, negative or no change in efficiency. Furthermore, the results show that many banks improved their efficiency during the fifth period (Q4, 2007–Q1, 2008).

During the entire period, Alliance Islamic Bank Berhad achieved the highest efficiency change of 5.9%, followed by Hong Leong Islamic Bank Berhad (5.3%) and Bank Islam Malaysia Berhad (1.0%). Al Rajhi Banking and Investment Corporation (Malaysia) Berhad experienced efficiency deterioration of -0.8%, which is by no means the worst performance – that is the case of Asian Finance Bank Berhad, which deteriorated 20.3%.

Table 2: Islamic Banks Relative Malmquist Change between Time Period *t* and *t+1*, (Q4, 2006) – (Q2, 2008)

	Q4, 2006	**Q1, 2007**	**Q2, 2007**	**Q3, 2007**	**Q4, 2007**	**Q1, 2008**	**Mean**
	to	***to***	***to***	***to***	***to***	***to***	
Islamic Banks in Malaysia	**Q1, 2007**	**Q2, 2007**	**Q3, 2007**	**Q4, 2007**	**Q1, 2008**	**Q2, 2008**	
Kuwait Finance House (Malaysia) Berhad	1.067	0.727	1.096	0.846	0.908	0.946	0.932
Al Rajhi Banking & Investment Corporation (Malaysia) Berhad	0.887	0.717	0.892	1.484	0.875	0.826	0.947
Asian Finance Bank Berhad	1.607	1.666	0.912	0.903	1.070	0.722	1.147
RHB Islamic Bank Berhad	0.914	0.833	1.029	0.937	0.898	1.148	0.960
CIMB Islamic Bank Berhad	1.095	0.811	0.994	0.902	1.010	1.093	0.984
Hong Leong Islamic Bank Berhad	1.040	1.045	1.044	0.959	1.006	0.980	1.012
EONCAP Islamic Bank Berhad	0.994	1.000	0.970	1.085	0.972	0.790	0.969
Affin Islamic Bank Berhad	0.838	0.980	1.076	1.886	1.116	0.869	1.128
AmIslamic Bank Berhad	0.943	0.959	1.031	0.914	1.048	0.955	0.975
Alliance Islamic Bank Berhad	1.089	1.019	1.075	1.062	0.831	0.985	1.010
Bank Islam Malaysia Berhad	0.895	1.000	0.939	1.093	1.048	0.968	0.991
Bank Muamalat Malaysia Berhad	0.902	0.875	0.872	1.362	0.941	0.757	0.952
Mean	1.023	0.969	0.994	1.119	0.977	0.920	1.000

Table 3: Islamic Banks Relative Technical Change between Time Period *t* and *t+1*, (Q4, 2006) – (Q2, 2008)

Islamic Banks in Malaysia	Q4, 2006 *to* Q1, 2007	Q1, 2007 *to* Q2, 2007	Q2, 2007 *to* Q3, 2007	Q3, 2007 *to* Q4, 2007	Q4, 2007 *to* Q1, 2008	Q1, 2008 *to* Q2, 2008	Mean
Kuwait Finance House (Malaysia) Berhad	1.067	0.727	1.096	0.846	0.908	0.846	0.915
Al Rajhi Banking & Investment Corporation (Malaysia) Berhad	0.687	0.717	0.792	0.598	0.776	0.816	0.731
Asian Finance Bank Berhad	1.607	0.143	0.865	0.924	0.801	0.819	0.860
RHB Islamic Bank Berhad	0.835	0.967	0.907	1.036	0.899	0.894	0.923
CIMB Islamic Bank Berhad	1.095	0.811	0.994	0.902	1.010	1.093	0.984
Hong Leong Islamic Bank Berhad	0.978	0.969	0.911	1.035	0.889	0.904	0.948
EONCAP Islamic Bank Berhad	0.994	1.000	0.970	1.085	0.672	0.790	0.919
Affin Islamic Bank Berhad	0.838	0.980	1.076	1.886	1.116	0.869	1.128
AmIslamic Bank Berhad	0.997	0.934	1.055	1.089	1.045	0.926	1.008
Alliance Islamic Bank Berhad	0.987	0.943	0.983	1.020	0.943	0.856	0.955
Bank Islam Malaysia Berhad	0.957	0.950	0.989	1.108	1.030	0.865	0.983
Bank Muamalat Malaysia Berhad	0.880	0.985	0.840	1.003	0.872	0.923	0.917
Mean	0.994	0.844	0.957	1.044	0.913	0.883	0.939

As for overall performance over the whole period, we can see an improvement from deterioration -2.4% to -0.8%. In order to identify a change in scale efficiency, the efficiency change is further decomposed into two sub components, known as pure technical change (*PEch*) and scale efficiency change (*SEch*). The results are shown in Table 5.

The results tell us that these two elements are crucial as sources of growth to efficiency change. Four banks Kuwait Finance House (Malaysia) Berhad, CIMB Islamic Bank Berhad, EONCAP Islamic Bank Berhad and

Affin Islamic Bank Berhad are identified as recording no change during the whole period of study for both the pure and scale efficiencies. Relative to other banks, on average, Asian Finance Bank Berhad had the highest deterioration of scale efficiency at -37.7%.

Table 4: Changes in Firms Relative Efficiency between Time Period *t* and *t+1*, (Q4, 2006) – (Q2, 2008)

Islamic Banks in Malaysia	Q4, 2006 *to* Q1, 2007	Q1, 2007 *to* Q2, 2007	Q2, 2007 *to* Q3, 2007	Q3, 2007 *to* Q4, 2007	Q4, 2007 *to* Q1, 2008	Q1, 2008 *to* Q2, 2008	Mean
Kuwait Finance House (Malaysia) Berhad	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Al Rajhi Banking & Investment Corporation (Malaysia) Berhad	1.000	1.000	1.000	0.810	1.127	1.012	0.992
Asian Finance Bank Berhad	1.000	0.461	0.707	0.761	1.335	0.515	0.797
RHB Islamic Bank Berhad	1.094	0.862	1.134	0.905	0.777	1.284	1.009
CIMB Islamic Bank Berhad	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Hong Leong Islamic Bank Berhad	1.064	1.078	1.146	0.926	1.132	0.973	1.053
EONCAP Islamic Bank Berhad	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Affin Islamic Bank Berhad	1.000	1.000	1.000	1.000	1.000	1.000	1.000
AmIslamic Bank Berhad	0.946	1.026	0.977	0.840	1.003	1.031	0.971
Alliance Islamic Bank Berhad	1.103	1.081	1.094	1.041	0.882	1.151	1.059
Bank Islam Malaysia Berhad	0.935	1.053	0.949	0.987	1.018	1.119	1.010
Bank Muamalat Malaysia Berhad	0.571	0.685	1.051	1.358	1.080	0.820	0.928
Mean	0.976	0.937	1.005	0.969	1.030	0.992	0.985

Looking at the pure efficiency side, again Asian Finance Bank Berhad reported the highest deterioration by -46.2% in the last period of study. Interestingly, Bank Muamalat Malaysia Berhad had the highest growth in pure efficiency during the fourth period of study with 55.5%. In addition, the growth in pure efficiency reached maximum during the fourth period of study by 2.6%. Although scale efficiency reached maximum during the third period by 3.9%, it deteriorated in the following period. Taking into consideration the whole period of study, the second, third, fourth, and fifth periods marked as pure efficiency improvements, while the second, third and fifth period marked as scale efficiency improvements.

4.3. Operative efficiency compared: Domestic vs. foreign

Table 6 reports the sample statistics of the various efficiency scores of the Malaysian Islamic banks for domestic banks only (Panel 1), foreign banks only (Panel 2) and all banks for all quarters (Panel 3). The results of the study shown that the domestic Malaysian Islamic banks (Panel 1) have exhibited mean overall efficiency of 92.4%, suggesting mean input waste of 7.6 %. In other words, the domestic banks could have produced the same amount of outputs by only using 92.4% of the amount of inputs they currently use. From Panel 1 of Table 6, it is clear that scale inefficiency dominates pure technical inefficiency of the domestic Malaysian Islamic banks.

The results from Panel 2 suggests that foreign banks that offered Islamic banking services in Malaysia have exhibited mean overall efficiency of 90.4%, slightly lower compared to their local counterparts. By contrast with the domestic banks, our results suggest that the foreign banks' inefficiency was mainly attributed to pure technical than scale at a degree of 6.7%.

On the other hand, our findings suggest that domestic banks have exhibited higher pure technical efficiency of 97% while foreign banks are only at 93.3%, suggesting that although domestic banks were more managerially efficient in controlling costs, they were mainly operating at the wrong scale of operations during the period of study.

The results for all banks in all periods have in general confirmed our earlier findings that size is the dominant factor influencing Malaysian Islamic banks' efficiency. During the seven periods of the study, our results from Panel 3 suggest that Malaysian Islamic banks have exhibited mean overall (technical) efficiency of 96.8%. The decomposition of the overall efficiency into its pure technical and scale components suggest that the inefficiency could be attributed mainly to pure technical (2.2%) rather than scale (0.9%).

Table 5: Changes in Efficiency Components by Banks between Time Period t and t+1, (Q4, 2006) – (Q2, 2008)

	Q4, 2006-Q1, 2007		Q1, 2007-Q2, 2007		Q2, 2007-Q3, 2007		Q3, 2007-Q4, 2007		Q4, 2007-Q1, 2008		Q1, 2008-Q2, 2008	
Islamic Banks in Malaysia	*PEch*	*SEch*	*PEch*	*SEch*	*PEch*	*SEch*	*PEch*	*SEch*	*PEch*	*SEch*	*PEch*	*SEch*
Kuwait Finance House (Malaysia) Berhad	**1.000**	1.000	**1.000**	0.727	**1.000**	1.000	**1.000**	1.000	**1.000**	1.000	**1.000**	1.000
Al Rajhi Banking and Investment Corporation (Malaysia) Berhad	**1.000**	1.000	**1.000**	1.000	**1.000**	1.000	**1.000**	0.810	**1.000**	1.127	**1.000**	1.002
Asian Finance Bank Berhad	**1.000**	1.000	**0.739**	0.623	**0.689**	1.027	**0.833**	0.913	**1.327**	1.007	**0.538**	0.957
RHB Islamic Bank Berhad	**1.000**	1.094	**1.000**	0.862	**1.000**	1.134	**1.000**	0.905	**0.912**	0.852	**1.097**	1.171
CIMB Islamic Bank Berhad	**1.000**	1.000	**1.000**	1.000	**1.000**	1.000	**1.000**	1.000	**1.000**	1.000	**1.000**	1.000
Hong Leong Islamic Bank Berhad	**1.050**	1.013	**0.958**	1.125	**1.022**	1.121	**0.924**	1.003	**1.081**	1.047	**0.988**	0.985
EONCAP Islamic Bank Berhad	**1.000**	1.000	**1.000**	1.000	**1.000**	1.000	**1.000**	1.000	**1.000**	1.000	**1.000**	1.000
Affin Islamic Bank Berhad	**1.000**	1.000	**1.000**	1.000	**1.000**	1.000	**1.000**	1.000	**1.000**	1.000	**1.000**	1.000
AmIslamic Bank Berhad	**0.781**	1.211	**1.280**	0.802	**0.912**	1.071	**0.847**	0.991	**0.964**	1.041	**0.983**	1.049
Alliance Islamic Bank Berhad	**1.093**	1.009	**0.845**	1.280	**1.205**	0.908	**1.068**	0.975	**0.933**	0.945	**0.999**	1.153
Bank Islam Malaysia Berhad	**1.118**	0.837	**0.944**	1.115	**1.020**	0.930	**1.002**	0.985	**1.036**	0.982	**1.000**	1.119
Bank Muamalat Malaysia Berhad	**0.910**	0.628	**0.809**	0.847	**0.823**	1.277	**1.555**	0.873	**1.061**	1.017	**0.889**	0.922
Mean	**0.996**	**0.983**	**0.965**	**0.948**	**0.973**	**1.039**	**1.019**	**0.955**	**1.026**	**1.002**	**0.958**	**1.030**

Note: *PEch*= Pure Efficiency Change; *SEch*= Scale efficiency Change

4.4. Productivity performance of the industry

Table 7 shows the performance of the *Malmquist productivity index* of the Islamic banking industry in Malaysia over the seven quarters starting from Q4, 2006 until Q2, 2008. On average, Affin Islamic Bank Berhad achieved the highest growth in TFP with 8.3% and technical change at about the same value. On the other hand, Asian Finance Bank Berhad had the lowest TFP with -47.7%, mainly due to technical efficiency regress -25.5%. On average, the TFP of the Islamic banking industry in Malaysia mainly due to the negative change in technical and scale efficiency, -8.7% and -2.9% respectively. In addition, the efficiency change is largely contributed by scale efficiency rather than pure efficiency.

This indicator suggests that the size of the bank does matter in affecting changes. Our finding of negative growth in technical and efficiency change was due to better improvements in efficiency rather than the improvements in technical components. On average, the banks do show efficiency improvement. Even though there was deterioration in efficiency change, the subcomponent of this efficiency change, namely scale efficiency, was rather small, 1%. Due to almost similar impact of negative efficiency change and technical change, the overall *TFP* for these banks over the period of study decreased (reflected in the mean 0.886 of *TFP* change).

Table 6: Summary Statistics of Efficiency Measures

	Mean	Minimum	Maximum	SD
Panel 1: Domestic Banks Only				
Overall efficiency	0.924	0.786	1.000	0.075
Pure technical efficiency	0.970	0.950	1.000	0.012
Scale efficiency	0.967	0.940	1.000	0.020
Panel 2: Foreign Banks Only				
Overall efficiency	0.904	0.820	1.000	0.079
Pure technical efficiency	0.933	0.846	1.000	0.061
Scale efficiency	0.961	0.874	1.000	0.056
Panel 3: All Banks				
Overall efficiency	0.968	0.915	1.000	0.031
Pure technical efficiency	0.978	0.945	1.000	0.026
Scale efficiency	0.991	0.952	1.000	0.036

Table 7: Summary of Malmquist Productivity Index of Islamic Banks, (Q4, 2006) – (Q2, 2008)

Islamic Banks in Malaysia	*TFPch*	*EFFch*	*TECch*	*Pech*	*Sech*
Kuwait Finance House (Malaysia) Berhad	0.906	1.000	0.906	1.000	1.000
Al Rajhi Banking & Investment Corporation (Malaysia) Berhad	0.718	0.987	0.727	1.000	0.987
Asian Finance Bank Berhad	0.523	0.745	0.703	0.819	0.909
RHB Islamic Bank Berhad	0.915	0.994	0.921	1.000	0.994
CIMB Islamic Bank Berhad	0.979	1.000	0.979	1.000	1.000
Hong Leong Islamic Bank Berhad	0.994	1.050	0.946	1.002	1.048
EONCAP Islamic Bank Berhad	0.907	1.000	0.907	1.000	1.000
Affin Islamic Bank Berhad	1.083	1.000	1.083	1.000	1.000
AmIslamic Bank Berhad	0.974	0.968	1.006	0.949	1.020
Alliance Islamic Bank Berhad	1.006	1.055	0.954	1.017	1.037
Bank Islam Malaysia Berhad	0.988	1.008	0.980	1.019	0.990
Bank Muamalat Malaysia Berhad	0.814	0.889	0.915	0.981	0.907
Mean	**0.886**	**0.971**	**0.913**	**0.981**	**0.990**

Note: TFPch= Total Factor Productivity Change; *EFFch*= Efficiency Change; *TECch*= Technical Change; *PEch*= Pure Efficiency Change; and *SEch*= Scale Efficiency Change

Figure 1 presents the mean evolution over time of *TFP* and its components for the 12 Islamic Banks measured by the geometric mean of the *Malmquist productivity index* for each period. The figure shows that on average, *TFP* had the highest growth in technical efficiency. The deterioration of *TFP* in the fourth period also largely contributed to the deterioration of technical change rather than efficiency change.

Figure 1: Changes in Mean TFP and its Components for All Periods

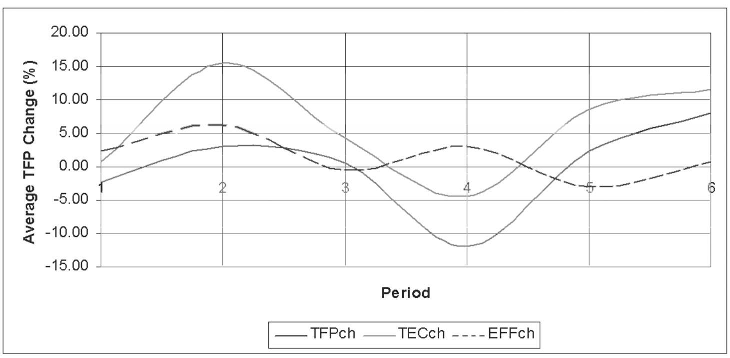
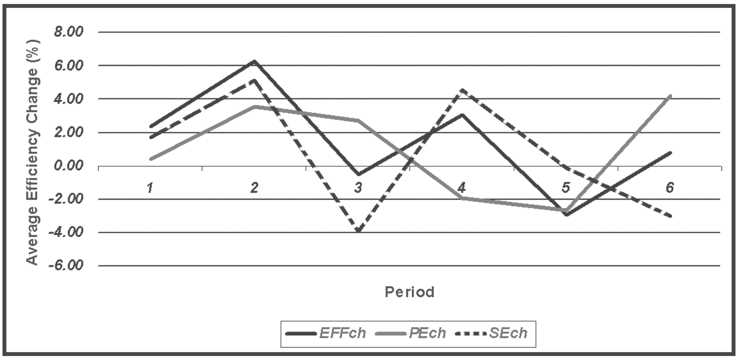


Figure 2 depicts the summary of changes in mean efficiency and its components, scale and pure efficiencies for the entire period of study. Overall, the efficiency is declining over the period and starts to increase in the last period. The deterioration is significant in contributing to the overall TFP change. From the figure, it seems that the change of efficiency is mainly attributable to change in scale efficiency rather than pure efficiency.

Figure 2: Changes in Mean Efficiency and its Components for All Periods



V. Conclusion

The study found that the mean overall or technical efficiency has been 92.4% and 90.4% for the domestic and the foreign Islamic banks respectively. In other words, during the period of study, the domestic Islamic banks could have produced the same amount of outputs by using only 92.4% of the inputs that they employed. Similarly, the foreign banks could have reduced 9.6% of the amount of inputs they employed during the period of study without affecting the amount of outputs that they produced. Overall, the results suggest that scale efficiency dominates over the pure technical efficiency effects in determining Malaysian Islamic banks' overall or technical efficiency. A general conclusion derived from the findings is that, domestic Islamic banks performances are better than those of their foreign owned counterparts.

In term of individual bank efficiency, Alliance Islamic Bank Berhad achieved the highest efficiency change with 5.6%, followed by Hong Leong Islamic Bank Berhad with 5.3% and Bank Islam Malaysia Berhad with 1.0%. Al Rajhi Banking & Investment Corporation (Malaysia) Berhad is found to have experienced efficiency deterioration with -0.8%. However, Al Rajhi Banking & Investment Corporation (Malaysia) Berhad is not at the worst position as compared to Asian Finance Bank Berhad, which deteriorated 20.3%. Over the whole period of study, the second, third, fourth, and fifth period marked pure efficiency improvements, while the second, third and fifth period marked scale efficiency improvements.

In general, the Malaysian Islamic banks are found to have experienced technical progress which indicates that Islamic banks in Malaysia have great potential to further increase in *TFP* through innovation and improvement in technical components like optimizing the use of information and communication technology in improving services to the customers. The study found that the size of a bank matters in determining its profitability as large size banks are found to be more efficient in utilizing their inputs in order to generate more outputs.

Overall, Affin Islamic Bank Berhad, which is classed as a domestic bank, is found to have been the most technically progressive bank (12.8%). In the case of efficiency, pure and scale, Affin Islamic Bank Berhad was above average. Therefore, Affin Islamic Bank Berhad can be considered as competitive if compared to foreign Islamic banks. However, the bank is not among the leading companies in overall efficiency. One way for it to improve its efficiency is through increasing the bank size either by increasing the customer base and market share or through merger with other domestic Islamic banks that show high overall efficiency, like Alliance Islamic Bank Berhad. Through these exercises, hopefully, Islamic banks can become stronger and gain a competitive edge over their conventional counterparts and eventually offer a better alternative banking system than the current conventional one.

References

Afriat, S. N. (1972). "Efficiency Estimation of Production Functions", *International Economic Review*, 13 (3), pp. 568-598.

Alam, I. (2001). "A Nonparametric Approach for Assessing Productivity Dynamics of Large U.S. Banks", *Journal of Money, Credit, and Banking*, 33 (1), pp. 121–139.

Avkiram, N. K. (2000). "Rising Productivity of Australian Trading Banks Under Deregulation 1986-1995", *Journal of Economics and Finance*, 24 (2), pp. 127-140.

Banker, R. D.; Charnes, A. and Cooper, W. W. (1984). "Some Models for Estimating Technical and Scale Inefficiencies in Data Envelopment Analysis", *Management Science*, 30 (9), pp.1078-1092.

Batchelor, V. B. and Wadud, I. K. M. M. (2003). *The Efficiencies in Malaysian Islamic Banking Operations: An Empirical Appraisal.* Unpublished Paper. The Islamic Banking Conference, September 9-10, Italy.

Berger, A. N. and Humprey, D. B. (1997). *Efficiency of Financial Institutions: International Survey and Directions For Future Research.* Discussion Paper, Wharton Financial Institutions Centre, The Wharton School, University of Pennsylvania.

Berger, A. N.; Hunter, W. C., and Timme, S. G. (1993). "The Efficiency of Financial Institutions: A Review and Preview of Research Past, Present and Future", *Journal of Banking and Finance*, 17 (2&3), pp. 221-250

Cebenoyan, A. S.; Cooperman E. S. and C. A. Register (1993). "Firm Efficiency and the Regulatory Closure of S & Ls: An Empirical Investigation", *Review of Economics and Statistics*, 75 (3), pp. 540-545.

Charnes, A.; Cooper, W. W.; Huang, Z. M. and Sun, D.B. (1990). "Polyhedral Cone – Ratio DEA Models with an Illustrative Application to Large Commercial Banks", *Journal of Econometrics*, 46 (1-2), pp.73-91.

Coelli, T.; Prasada-Rao, D.S. and Battese, G. E. (1998). *An Introduction to Efficiency and Productivity Analysis.* Boston, MA: Kluwer Academic Publishers.

Fare, R.; Grosskopf, S.; Lindgren, B. and Roos, P. (1989).*Productivity Developments in Swedish Hospitals: A Malmquist Output Index Approach.*Discussion Paper No. 89-3, Southern Illinois University.

Fare, R.; Shawna, G.; Mary, N. and Zhongyang, Z. (1994). "Productivity Growth, Technical Progress and Efficiency Change in Industrialized Countries", *American Economic Review*, 84 (1), pp. 66-83.

Fernández, A. I.; Gascón, F. and González, E. (2002).*Economic Efficiency and Value Maximization in the Banking Firms.* Paper presented at the 7th European Workshop on Efficiency and Productivity Analysis, Oviedo, September.

Ferrier, G. and Lovell, C. A. K. (1990). "Measuring Cost Efficiency in Banking: Econometric and Linear Programming Evidence", *Journal of Econometrics*, 46 (1-2), pp. 229-45.

Forsund, F. (1991). *The Malmquist Productivity Index.* Paper Presented at the 2nd European Workshop on Efficiency and Productivity Measurement. Belgium: Centre of Operations Research & Econometrics, University Catholique de Louvain, Lauvain-la-Neuve.

Fried, H. O.; Lovell, C. A. K. and Eeckaut, P. V. (1993). "Evaluating the Performance of US Credit Unions", *Journal of Banking and Finance*, 17 (2-3), pp. 251-265.

Grifell-Tatje, E. and Lovell, C. A. K. (1997). "The Sources of Productivity Change in Spanish Banking", *European Journal of Operational Research*, 98 (2), pp. 364-380.

Lewin, A. Y.; Morey, R. C. and Cook, T. J. (1982). "Evaluating the Administrative Efficiency of Courts", *Omega,* 10 (4), pp. 401–411.

Majid, M. A.; Nor, N. G. M. and Said, F. F (2003). "Efficiency of Banks in Malaysia", in *Proceedings of the fifth International Conference on Islamic Economics and Finance,* Vol. II, pp. 405-406, Bahrain.

Mao, W. and Koo, W. (1996). *Productivity Growth, Technological Progress and Efficiency Change in Chinese Agricultural Production from 1984 to 1993.* Agricultural Economics Report, No. 362. North Dakota University.

Mester, L. J. (1993). *Efficiency of Banks in the Third Federal Reserve District.* Discussion Paper, Wharton Financial Institutions Centre, The Wharton School, University of Pennsylvania.

Metwally, M. M. (1997). "Differences between the Financial Characteristics of Interest free Banks and Conventional Banks", *European Business Review,* 97 (2), pp. 92-98.

Mohammed Seidu, A. (2002). *Cost Competitiveness of Fixed Liability Financing: A Study of Bank Islam Malaysia Berhad's Financing Techniques.* Unpublished Ph.D thesis, University Tun Abdul Razak, Malaysia.

Molyneux, P. and Thornton, J. (1992). "Determinants of European Bank Profitability: A Note", *Journal of Banking and Finance,* 16 (6), pp.1173-1178.

Saaid, Abdelrahmen Elzahi; Rosly, S. A.; Ibrahim, M. H and Naziruddin, Abdullah (2003). "The X-Efficiency of the Sudanese Islamic Banks"|, *IIUM Journal of Economics and Management*, 11 (2), pp.1-20

Saleh, Ali S. and Zeitun, Rami (2005). "The Development of Islamic Banking in Lebanon Prospects and Future Challenges", *Review of Islamic Economics*, 9 (2), pp. 77-91.

Samad, Abdus and Hassan, M.K. (1999). "The Performance of Malaysian Islamic Bank during 1984-1997: An Exploratory Study", *International Journal of Islamic Financial Services,* 1 (3).

Sarker, M. A. A. (1999). 'Islamic Banking in Bangladesh: Performance, Problems and Prospects', *International Journal of Islamic Financial Services,* 1(3).

Sathye, M. (2001). "X-Efficiency in Australian Banking: An Empirical Investigation", *Journal of Banking and Finance*, 25 (3), pp.613-30.

Sealey, C. and Lindley, J. T. (1977). "Inputs, Outputs and a Theory of Production and Cost at Depository Financial Institutions", *Journal of Finance*, 32 (4), pp.1251-66.

Wheelock, D.C. and Wilson, P. W. (1999). "Technical Progress, Inefficiency, and Productivity Change in U.S. Banking, 1984–1993", *Journal of Money, Credit, and Banking,* 31, pp. 212–234

Worthington, A. C. (1999). "Measuring Technical Efficiency in Australian Credit Unions", *The Manchester School*, 67 (2), pp. 231-248.

Zaim, O. (1995). "The Effect of Financial Liberalization on the Efficiency of Turkish Commercial Banks", *Applied Financial Economics*, 5 (4), pp. 257-264.