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Assessing the Revenue Efficiency of Domestic and Foreign Islamic Banks: Empirical Evidence from Malaysia

(Penaksiran Kecekapan Hasil Bank Islam Domestik dan Asing: Bukti Empirikal dari Malaysia)

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ABSTRACT

The present paper provides new empirical evidence regarding revenue efficiency in the Malaysian Islamic banking sector during the period from 2006 to 2010. The sample is comprised of 17 domestic and foreign Islamic banks. The Data Envelopment Analysis (DEA) method is employed to compute the revenue efficiency levels. The results indicate that the domestic Islamic banks exhibit lower revenue efficiency levels compared to foreign counterparts. In addition, the empirical findings suggest that the foreign Islamic banks exhibit higher efficiency levels for all three efficiency measures and are consistent with the global advantage theory. In essence, revenue efficiency seems to play the main role in lower or higher profit efficiency levels. The findings of the present study are expected to be relevant to regulators and policymakers, the Islamic banking industry and investors; and contribute significantly to existing knowledge on the operating performance of the Malaysian Islamic banking sector.

Keywords: Islamic banks; revenue efficiency; data envelopment analysis; Malaysia

ABSTRAK

Kajian ini menyediakan bukti empirikal baru mengenai kecekapan hasil dalam sektor perbankan Islam Malaysia sepanjang tempoh 2006-2010. Sampel kajian terdiri daripada 17 bank Islam domestic dan asing. Kami menggunakan kaedah Analisis Menyampul Data (DEA) untuk mengira tahap kecekapan hasil. Keputusan menunjukkan bahawa bank Islam domestik telah mempamerkan tahap kecekapan hasil yang lebih rendah berbanding dengan bank Islam asing. Di samping itu, hasil kajian ini menyarankan bahawa bank Islam asing telah menunjukkan tahap kecekapan yang lebih tinggi untuk ketiga-tiga ukuran kecekapan dan konsisten dengan teori kelebihan global. Pada dasarnya, kecekapan hasil memainkan peranan utama yang membawa kepada tahap kecekapan keuntungan yang lebih rendah atau tinggi. Dapatan kajian ini dijangka dapat menyumbang kepada pengawal selia atau dasar, perbankan Islam itu sendiri, pelabur dan pengetahuan sedia ada mengenai prestasi operasi sektor perbankan Islam Malaysia.

Kata kunci: Bank Islam; kecekapan hasil; analisis balutan data; Malaysia

INTRODUCTION

The globalization era has improved the financial institutions all over the world through greater deregulation and liberalization. Islamic banking is the one of the fastest growing institutions and has become more competitive. The International Monetary Fund (2005) reports that the number of Islamic financial institutions increased from 75 in 1975 to over 300 in 2005, covering more than 75 countries. The total assets of the Islamic financial institutions are estimated to be US$250 billion. The growth rate is estimated to be 15% per year, which is three times higher than the rate for conventional banks. According to Ghafour (2007) and Dubai Islamic Bank (2006), the assets of the world-wide Islamic banking industry are estimated to have grown to more than US$265 billion from merely hundreds of thousands of dollars in the 1970s.

Since Islamic financial institutions are rapidly evolving, the efficiency of the banks is also expected to improve. Berger and Humphrey (1997) note that studies focusing on the efficiency of financial institutions have become an important part of banking literature since the early 1990s. Berger et al. (1993b) find that if banks are efficient, improved profitability, better prices and better service quality can be expected by consumers and the efficiency can lead to greater amounts of funds being intermediated. The general concept of efficiency covers three dimensions: cost, revenue and profit efficiency (Adongo et al. 2005; Bader et al. 2008). Evidence on bank efficiency could be produced by discovering these three types or dimensions of efficiency concept. However, few studies examine efficiency comprehensively in light of all three components. Most extant studies primarily focus upon the efficiency of cost, profit, or both (Bader et al. 2008).

Studies on bank efficiency that ignore revenue are criticized (Bader et al. 2008), principally because most of the studies only reveal the levels of cost efficiency that are higher than profit efficiency without identifying the causes. According to Chong et al. (2006), banks desire to maximize profits to maximize the value or wealth of shareholders. However, the main problem that contributes to the lower profit efficiency stems from revenue inefficiency. Ariff and Can (2008) find that inefficient revenue affects the difference between cost and profit efficiency. However, the present study does not investigate the issue of revenue efficiency and the reasons for such an occurrence. Studies that investigate the causes of inefficiency include those by Maudos et al. (2002), Rogers (1998) and Berger et al. (1993a) and find that revenue inefficiency is caused either by the mispricing of outputs or giving the wrong choice of output.

Therefore, a simultaneous comparison of the proficiency of Islamic banks and cost efficiency is a better technique to identify the existence of revenue efficiency in foreign and domestic banks rather than focusing on the profit efficiency of Islamic banks in isolation. Additionally, the present paper focuses on whether the revenue efficiency of foreign banks differs from domestic Islamic banks, as well as addressing the reason for the difference in efficiency between foreign banks and domestic banks. According to Lensink et al. (2008) and Demirguc-Kuntand Huizinga (2000), two important reasons exist for such differences. First, foreign banks may be subject to fewer domestic credit allocation rules than domestic banks. Second, domestic banks may have informational advantages relative to foreign banks.

By employing the non-parametric data envelopment analysis (DEA) method, the efficiency of Malaysian Islamic banks is analyzed over the period of 2006 to 2010. The non-parametric DEA methodology allows the three different types of efficiency, which are cost, revenue and profit efficiency, to be distinguished. In addition to the non-parametric DEA, the present study performs a series of parametric (*t*-test) and non-parametric (Mann-Whitney [Wilcoxon] and Kruskall-Wallis) tests to examine whether domestic and foreign banks are drawn from the same population.

The article begins with a brief overview of the Malaysian Islamic banking sector. This is followed by section 3, where a review of related studies is provided. Section 4 discusses the methods employed in the present study and variables employed in the panel regression analysis. The empirical findings are presented in section 5. Section 6 concludes the study and provides discussion concerning potential policy implications.

BRIEF OVERVIEW OF ISLAMIC BANKING IN MALAYSIA

As with other Muslim countries, Malaysia has experienced the effects ofthe Islamic resurgence movement among intellectuals, especially around the 1970s. Individuals, groups and agencies of the government called for the establishment of Islamic banks to cater to the needs of Muslims in Malaysia. During the Bumiputera Economic Congress in 1980, the government passed a resolution which allowed the Pilgrimage Board (more commonly known as Lembaga Tabung Haji) to establish an Islamic bank for the purpose of collecting and investing money owned by Muslims. In 1981, the Malaysian government was urged at the National Seminar to promulgate a special law that would allow the establishment of banks and financial bodies whose operations would be based upon Islamic principles (Haron & Azmi 2009).

In line with these requests, the first Islamic bank was established in 1983. Ten years later, the government allowed other conventional banks to offer Islamic banking services under their existing infrastructure and branches. The move to create Islamic banking window operations allowed the country to enjoy Islamic banking services at the lowest cost and within the shortest time frame. Today, Malaysia has succeeded in implementing a dual banking system and has emerged as one of the first nations to have a full-fledged Islamic banking system (IBS) operating side-by side with the conventional banking system. The first country to implement a dual banking system was the United Arab Emirates with the establishment of the Dubai Islamic Bank in 1973, with a paid-up capital of US$14 million (Metwally 1997). As presented in Table 1, the Malaysian Islamic banking sector, at the end of 2008, was comprised of two full-fledged domestic Islamic banks: three full-fledged foreign Islamic banks; 11 domestic IBS banks; and 4 foreign IBS banks.

While the history of the Malaysian Islamic banking system can be traced back as early as 1963, Malaysia became the only country in the world to implement a dual banking system in 2001. According to Khiyar (2012), Bank Negara Malaysia (BNM, the Central Bank of Malaysia) adjusted several approaches and principles in developing a dual banking system and the whole process can be divided into three phases. The first phase lasted from 1963 until 1982, which is also known as the foundation years, during which time the BNM began to establish non-banking Islamic financial institutions, such as the Pilgrimage Board (also known as Tabung Haji). The second phase lasted from 1983 until 1993, which is also known as the developing years, during which time BNM established the Government Investment Certificate, Bank Islam Malaysia Berhad (BIMB) and Takaful companies. The final phase lasted from 1994 until 2001, which is also known as the take-off years, during which time the Islamic Inter-bank Cheque Clearing system, the Islamic Inter-bank Market, the National Syariah Advisory Council on Islamic Banking and Takaful (NSAC-IBAT) and new Islamic financial instruments were established. At this point, the country had achieved a full-fledged Islamic financial system.

Throughout the years, the Malaysian Islamic banking sector has gained prominence and has been on a progressive

TABLE 1. Foreign and Domestic Islamic Banks

Bank	Ownership	Paid Up Capital
Affin Islamic Bank	100% Affin Holdings	RM160.0m
Am Islamic Bank	100% AMMB Holdings	RM435.8m
Bank Islam Malaysia[1,2]	51% BIMB Holdings 40% Dubai Investment Group 9% LembagaTabung Haji	RM1,725.5m
Bank Muamalat Malaysia[1]	70% DRBHicom 30% KhazanahNasional	RM500.0m
CIMB Islamic Bank	100% Bumiputera Commerce Holdings	RM550.0m
EONCAP Islamic Bank	100% EON Capital	RM389.0m
Hong Leong Islamic Bank	100% Hong Leong Bank	RM500.0m
Maybank Islamic	100% Malayan Banking	RM184.7m
Alliance Islamic Bank	100% Alliance Financial Group	RM300.0m
Public Islamic Bank	100% Public Bank	RM159.2m
RHB Islamic Bank	100% RHB Capital	RM523.4m
Al-Rajhi Banking and Investment Corporation[1,2,3]	100% Al-Rajhi Bank, Saudi Arabia	RM600.0m
Asian Finance Bank[1,2,3]	70% Qatar Islamic Bank 20% RUSD Investment Bank, Saudi Arabia 10% Financial Assets, Bahrain	RM355.0m
Kuwait Finance House (Malaysia)[1,2,3]	100% Kuwait Finance House, Kuwait	RM1,053.5m
HSBC Amanah Malaysia[2]	100% Hong Kong and Shanghai Banking Corporation	RM50.0m
Standard Chartered Saadiq[2]	100% Standard Chartered Group	RM50.0m
OCBC Al-Amin Bank[2]	100% OCBC Bank (Malaysia)	NA

Source: Bank Negara Malaysia and individual banks' annual reports
Note: [1]Full-fledged Islamic banks, [2]Islamic banks with foreign flavor, and [3]De Novo banks (state banks that have been operating for five years or less).The value of paid-up capital presented reflects the value as of 31 December 2008.

trend. Since 2000, the Malaysian Islamic banking industry has grown at an average rate of 18.9% per annum in terms of assets. Figure 1 illustrates that the total assets of the Malaysian Islamic banking sector increased from RM1.2 billion in 1996 to RM157.1 billion in 2007, accounting for 12.8% of the total assets of the banking system, while the market share of Islamic deposits and financing stood at 14% of the total deposits and financing of the banking sector. With the growth in Islamic banking far surpassing the expansion in the conventional banking system's asset base, the Malaysian Islamic banking industry is expected to be able to achieve the government's aspiration of Islamic banking assets making up 20% of the total assets of the country's banking system by the year 2020.

LITERATURE REVIEW

Despite the considerable developments in the Islamic banking sector, very few extant studies focus on the efficiency of Islamic banks. A number of studies examine banking efficiency in less developed countries (Bader

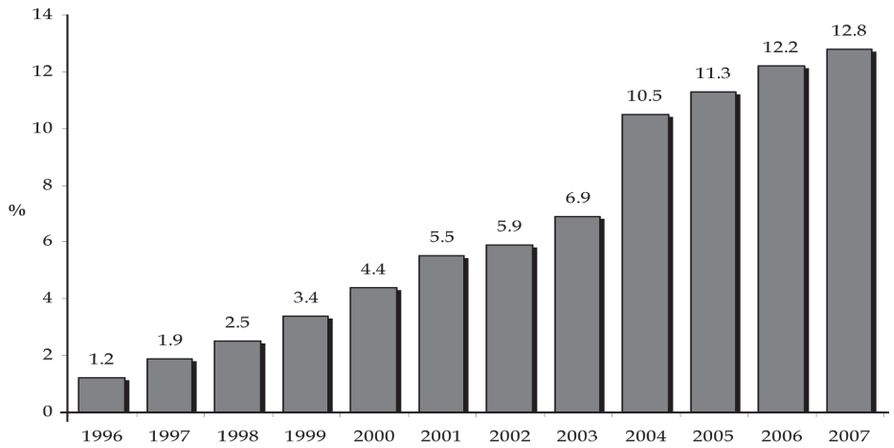

FIGURE 1. Islamic Banking Assets as a Percentage of Malaysian Banking System Assets (1996-2007)

Source: Bank Negara Malaysia

et al. 2008). Some documented studies compare the performance of Islamic banks with their conventional counterparts. Nevertheless, such studies focus more on the profitability aspect of efficiency with the help of financial ratios; and are constrained by time span and the number of Islamic banks (Samad & Hassan 1999; Iqbal 2001). Previous studies primarily concentrate on the technical, pure technical and scale efficiency in Islamic banking sectors (Isik & Hassan 2002; Hassan & Hussein 2003; Yudistira 2004). Despite the significant importance of Islamic banking sector, few studies address issues pertaining to the cost, revenue and profit efficiency of Islamic banks (Yudistira 2004; Hassan 2005; Brown & Skully 2005).

THEORETICAL FRAMEWORK ON EFFICIENCY AND PRODUCTIVITY

The concept of efficiency essentially measures how well a firm succeeds in transforming inputs into outputs in accordance with the behavioral objective of the firm. The firm is said to be efficient if it is able to achieve its goals and inefficient if it fails (Fare et al. 1994b). The goal of a firm is assumed to be the minimization of production costs under normal circumstances. Thus, any waste of input is to be avoided so that no idleness in the use of resources exists. In production theory, it is often assumed that firms are behaving efficiently in an economic sense. According to Fare et al. (1985), firms are able to successfully allocate all resources in an efficient manner relative to the constraints imposed by the structure of the production technology; by the structure of input and output markets; and relative to whatever behavioral goals are attributed to the producers.

In previous studies, a wide variety of models are developed to investigate a wide range of efficiency related issues in a wide range of environments. Koopmans (1951) provides the first definition of the technical efficiency where the producer is technical efficient if an increase in any output requires a reduction in at least in one output; and if a reduction in any input requires an increase in at least one other input or a reduction in at least an output. Meanwhile, Liebenstein (1966) is the first to introduce the concept of X-efficiency, which defines cost inefficiencies as those due to wasteful use of inputs or managerial weakness. The X-efficiency concept seeks to explain why all firms do not succeed in minimizing the cost of production and recognizes that the sources of X-efficiency may also be from outside of the firm. Therefore, Button and Jones (1992) posit that X-inefficiency is due to both the actions of the firm and exogenous factors in the environment

EFFICIENCY ON FOREIGN AND DOMESTIC BANKS

Lensink et al. (2008) define foreign bank as a bank in which more than 50 percent of the shares are owned by non-domestic residents. The definition indicates that a bank may be a domestic bank in one country, but a foreign bank everywhere else. For example, Citibank is a domestic bank in the US, but regarded as a foreign bank in all other countries.

Isik and Hassan (2002) study the impact of different ownership and organizational structures on the efficiency of the Turkish banking industry over the period of 1988 to 1996 using a series of parametric and non-parametric techniques. They find that the foreign banks operating in Turkey are relatively more efficient than their domestic counterparts, while private banks are found to be more efficient relative to public banks for all efficiency measures. Other studies also conclude that foreign banks in transition and developing markets are more efficient than their domestically-owned counterparts, such as DeYoung and Nolle (1996), Grigorian and Manole (2002), Jemric and Vujcic (2002), Miller and Parkhe (2002), Matousek and Taci (2004) and Havrylchyk (2006). In developed countries, foreign banks are reported to be at a disadvantaged position relative to their domestic counterparts.

Berger and Humphrey (1997) examine the efficiency of 130 financial institutions, partly to address the impact of foreign ownership. Meanwhile, Berger et al. (2000) investigate cross-border banking efficiency in France, Germany, Spain, the United Kingdom and US during the 1990s. The findings of both studies indicate that the relative efficiency of foreign vs. domestic ownership appears to depend on the host and home country conditions. Theory suggests that some inherent characteristics of foreign banks exist that limit their performance when compared with domestic banks.

Berger et al. (2000) suggests two theories: the global advantage theory and the home field advantage theory. The global advantage theory suggests that foreign banks benefit more from competitive advantages relative to their domestically-owed peers. Foreign banks are also likely to use more advanced technologies due to stiff home market competition. Furthermore, foreign banks also have an active market for corporate control in the home country and have access to an educated labor force that is able to adapt new technologies. Similarly, the findings of Havrylchyk (2006) also suggest that foreign banks can produce higher profits due to modern information technologies and better risk management.

Meanwhile, home field advantage theory states that foreign banks suffer some disadvantages when compared to domestic banks. Foreign banks are assumed to perform worse than domestic banks due to lower revenue (revenue inefficient) or higher costs (cost inefficient) when offering the same financial services. Hymer (1976) points out that the foreign firms are likely to face competitive disadvantages relative to national firms because the latter are well informed about their country's economy, language, laws and politics. Therefore, this disadvantage leads to the hypothesis that foreign banks suffer more than domestic banks from bad institutional framework in the host country.

TECHNICAL, PURE TECHNICAL, AND SCALE EFFICIENCY

Yudistira (2004) is the first to use the frontier non-parametric approach (DEA) to assess the efficiency of Islamic banks. The study discovers new evidence on the performance of 18 Islamic banks over the period of 1997-2000, the period during which Islamic banks suffered slight inefficiencies during the 1998-1999 crisis. Indeed, 1998 and 1999 were a period of turmoil in the global economy. The level of inefficiency in 1998 is, therefore, more attributable to pure technical inefficiency rather than scale inefficiency.

Sufian et al. (2008) perform an analysis on the efficiency of Islamic Banks using empirical evidence from the MENA (Middle East and North Africa) and Asian Countries. Using the DEA method, three different types of efficiency measures are estimated: technical, pure technical and scale efficiency. The results indicate that pure technical inefficiency (PTIE) outweighs scale inefficiency (SIE) in Islamic banks. Although Islamic banks have been operating at a relatively optimal scale of operations, managerially inefficiency prevents the fullest exploitation of their resources.

On the other hand, Hassan and Hussein (2003) study the efficiency of the Sudanese banking system during the period of 1992 and 2000 by applying a variety of parametric and non-parametric DEA techniques to a panel of 17 Sudanese banks. The Sudanese banking system is discovered to exhibit a 37 percent allocative efficiency (AE) and 60 percent technical efficiency (TE), suggesting that the overall cost inefficiency of the Sudanese Islamic banks are mainly due to technical efficiency (managerial related) rather than allocative efficiency (regulatory issues).

Sufian (2007) investigates the efficiency of the domestic and foreign Islamic banks in the Malaysian banking sector. The study employs the DEA methodology to identify the differences of technical efficiency (TE), pure technical efficiency (PTE) and scale efficiency (SE) between domestic and foreign Islamic banks. The results suggest that Malaysian Islamic banks efficiency declines in 2002 before it recovers slightly in 2003 and 2004. The domestic Islamic banks are more efficient compared to foreign Islamic banks, albeit marginally. The source of inefficiency among Malaysian Islamic banks in general has been scale, suggesting that Malaysian Islamic banks have been operating at the wrong scale of operations.

COST, REVENUE, AND PROFIT EFFICIENCY

Many studies examine cost and profit efficiency in conventional banks rather than Islamic banks and discover that the varying levels of cost and profit efficiency are caused by the inefficiency from the revenue side (e.g. Chu & Lim 1998; Rogers 1998; Berger & Mester 2003). Revenue can be defined as how effectively a bank sells its outputs. Maximum revenue is obtained as a result of producing the output bundle efficiently (Rogers 1998). Revenue efficiency can be decomposed into technical and allocative efficiency, which are related to managerial factors and regularly associated with regulatory factors (Isik & Hassan 2002). English et al. (1993) posit that in order to improve revenue efficiency, banks should focus on both technical efficiency (managerial operating based upon production possibilities) and allocative efficiency (banks producing a revenue maximizing mix of outputs based upon certain regulations).

Another approach to improve revenue efficiency proposed by several studies is for banks to produce higher quality services; to charge higher prices; to avoid any improper choice of inputs and outputs quantities; and to avoid the mispricing of outputs (Rogers 1998). Revenue inefficiency can be identified via the profit function because the function combines both cost and revenue efficiency to evaluate profit efficiency (Akhavein et al. 1997). Revenue efficiency affects the efficiency of the profit even when cost efficiency is high. In essence, revenue efficiency would be a major factor that influences profit efficiency. Berger and Humphrey (1997), Akhavein et al. (1997), and Bader et al. (2008) state that limited studies exist that examine the revenue efficiency of banks. However, a more significant pacity exists in relation to studies examining revenue efficiency in the narrowed context of the Islamic banking industry, particularly in regards to domestic and foreign Islamic banks.

The review of the extant literature reveals the following research gaps. First, the majority of the previous studies have primarilyconcentrated on the conventional banking sectors of Western and developed countries. Second, empirical evidence on the banking industry in developing countries, particularly the Islamic banking sector, is scarce. The present paper seeks address such gaps in extant research by providing new empirical evidence on cost, revenue and profit efficiency in the Malaysian Islamic banking sector.

The remainder of this paper is organized as follows. The next section describes the data and methodology employed in this study. This is followed by a section that reports and discusses the results. The final section presents the conclusion.

DATA AND METHODOLOGY

The present study gathers data from all Malaysian Islamic banks between 2006 and 2010. The period is selected due to the availability of data and to find the latest results on foreign and domestic Islamic banks in Malaysia. The primary source of financial data is BankScope, published by the Bureau van Dijk, which provides banks' balance sheets and income statements. Data are analyzed from banks that offer Islamic banking products and services under the Islamic Banking Scheme. Contemporarily, conventional banks that offer Islamic products are required to operate the Islamic banking separately from their conventional banking operations. One example of such a conventional bank is Maybank Bhd, which

operates its conventional bank under its original name of Maybank Bhd and conducts Islamic banking under the name Maybank Islamic Bhd. Data is collected from 17 Islamic banking institutions, comprised of 11 domestic banks that provide Islamic banking services and 6 foreign full-fledged Islamic banks (see Table 2). Therefore, the present results purely examine the revenue efficiency of Islamic banks, specifically in relation to domestic and foreign Islamic banks in Malaysian banking sector.

TABLE 2. List of Malaysian Islamic Banks, 2006-2010

	Domestic Banks		Foreign Banks
1	Affin Islamic Bank Bhd	1	Al Rajhi Banking & Investment Bhd
2	Alliance Islamic Bank Bhd	2	Asian Finance Bank Bhd
3	AmIslamic Bank Bhd	3	HSBC Amanah Malaysia Bhd
4	Bank Islam Malaysia Bhd	4	Kuwait Finance House (Malaysia) Bhd
5	Bank Muamalat Malaysia Bhd	5	OCBC Al-Amin Bank Bhd
6	CIMB Islamic Bank Bhd	6	Standard Chartered Saadiq Bhd
7	EONCAP Islamic Bank Bhd		
8	Hong Leong Islamic Bank Bhd		
9	Maybank Islamic Bhd		
10	Public Islamic Bank Bhd		
11	RHB Islamic Bank Bhd		

Source: Bank Negara Malaysia

DATA ENVELOPMENT ANALYSIS

The level of revenue efficiency is measured using the data envelopment analysis (DEA) method. The DEA method constructs a frontier of the observed input-output ratios by linear programming techniques. The linear substitution is possible between observed input combinations on an isoquant (the same quantity of output is produced while changing the quantities of two or more inputs) that is assumed by the DEA method. Charnes et al. (1978) was the first to introduce the DEA to measure the efficiency of each decision making units (DMUs), obtained as a maximum of the ratio of weighted outputs to weighted inputs. The higher the output produced from given inputs the more efficient the production is perceived to be.

The present study estimates efficiency under the assumption of variable returns to scale (VRS). The VRS assumption was proposed by Banker, Charnes and Cooper (1984). This VRS model extended the model proposed by Charnes et al. (1978) by relaxing the constant return to scale (CRS) assumption. The resulting model (known as BCC model) is used to assess the efficiency of DMUs characterized by VRS assumption. The VRS assumption provides the measurement of pure technical efficiency (PTE), which measures the efficiency of DMU sseparately from the scale effects. Hence, the results derived from the VRS assumption provide more reliable information on the efficiency of DMUs compared to the CRS assumption (Coelli et al. 1998).

There are six reasons why the present study adopts the DEA method. As suggested by Sufian (2007, 2004), the DEA method assigns each DMU a single efficiency score that allows ranking amongst the DMUs in the sample. Second, the DEA method highlights the areas for improvement for each single DMU by showing whether the input has been excessively used or the output has under produced (so they could improve on efficiency). Third, the possibility exists for making inferences on the DMU's general profile. The DEA method allows for the comparison between the production performances of each DMU to a set of efficient DMUs (called reference set). Thus, the owner of the DMUs may be interested to know which DMU frequently appears in this set. A DMU that appears more than others in this set is called the global leader. Apparently, the DMU owner can benefit from this information particularly in relation to positioning its entity in the market. Fourth, several studies suggest that the DEA method does not require a pre-conceived structure or specific functional form to be imposed on the data in identifying and determining the efficient frontier, error and inefficiency structures of the DMUs (Bauer et al. 1998; Evanoff & Israelvich 1991; Grifell-Tatje & Lovell 1997). Fifth, the DEA method does not require standardization and this allows the researchers to choose any kind of input and output of managerial interest (arbitrary), regardless of the different measurement units (Ariff & Can 2008; Avkiran 1999; Berger & Humphrey 1997). Finally, the DEA method is suitable for small samples.

The revenue, cost and profit efficiency models are given in Equations (1) – (3), respectively. As shown in equations below, the revenue, cost and profit efficiency scores are bounded within the 0 and 1 range (Zhu 2009).

Revenue Efficiency:
(VRS Frontier)

$$max \sum_{r=1}^{s} q_r^{o} \tilde{y}_{ro}$$

subject to

$$\sum_{j=1}^{n} \lambda_j x_{ij} \le \tilde{x}_{io} \qquad i = 1,2,..., m;$$

$$\sum_{j=1}^{n} \lambda_j y_{rj} \ge \tilde{y}_{ro} \qquad r = 1,2,..., s; \qquad (1)$$

$$\lambda_j \tilde{y}_{ro} \ge 0$$

$$\sum_{j=1}^{n} \lambda_j = 1$$

Cost Efficiency:
(VRS Frontier)

$$min \sum_{i=1}^{m} p_i^o \tilde{x}_{io}$$

$$subject\ to$$

$$\sum_{j=1}^{n} \lambda_j x_{ij} \leq \tilde{x}_{io} \qquad i = 1, 2, ..., m;$$

$$\sum_{j=1}^{n} \lambda_j y_{rj} \geq y_{ro} \qquad r = 1, 2, ..., s; \qquad (2)$$

$$\lambda_j, \tilde{x}_{io} \geq 0$$

$$\sum_{j=1}^{n} \lambda_j = 1$$

Profit Efficiency:
(VRS Frontier)

$$max \sum_{r=1}^{s} q_r^o \tilde{y}_{ro} - \sum_{i=1}^{m} p_i^o \tilde{x}_{io}$$

$$subject\ to$$

$$\sum_{j=1}^{n} \lambda_j x_{ij} \leq \tilde{x}_{io} \qquad i = 1, 2, ..., m;$$

$$\sum_{j=1}^{n} \lambda_j y_{rj} \geq \tilde{y}_{ro} \qquad r = 1, 2, ..., s; \qquad (3)$$

$$\tilde{x}_{io} \leq x_{io}, \tilde{y}_{ro} \geq y_{ro}$$

$$\lambda_j \geq 0$$

$$\sum_{j=1}^{n} \lambda_{j=1}$$

where

s = output observation,
m = input observation,
r = s^{th} output,
i = m^{th} input,
q = unit price of output r of DMU*0* (DMU*0* represents one of the n^{th}DMUs),
p = unit price of input i of DMU*0*,
$\tilde{y}_{ro}$ = r^{th} output that maximize revenue for DMU*0*,
$\tilde{x}_{io}$ = i^{th} input that minimize cost for DMU*0*,
y_{io} = r^{th} output for DMU*0*,
x_{io} = i^{th} input for DMU*0*,
n = DMU observations,
j = n^{th} DMU,
λ_j = non-negative scalars,
y_{ij} = s^{th} output for n^{th} DMU, and
x_{ij} = m^{th} input for n^{th} DMU.

By calculating the three efficiency measures (e.g. revenue, cost and profit), the present examination is capable of obtaining more robust results for the domestic and foreign in Malaysian Islamic banks over the period under study. However, the present study places greater emphasize on the revenue efficiency measure compared to the other efficiency measures (e.g. cost and profit).

THE INPUT AND OUTPUT VARIABLES IN DEA

The appropriate definition and measurement of the inputs and outputs of a bank in the banking function remain contested among researchers (Sufian 2007). To determine what constitutes the inputs and outputs of banks, one should first decide on the nature of banking technology (bank's approaches). According to Das and Ghosh (2006), the selection of variables in efficiency studies significantly affects the results. The problem is compounded by the fact that variable selection is often constrained by the paucity of data on relevant variables. Most of the financial services are jointly produced and the prices of cost and output are typically assigned to a bundle of financial services, thus it is difficult for measuring the bank's cost and output.

According to Cooper et al. (2002), a rule exists that must be complied with in order to select the number of inputs and outputs. The 'rule of thumb' can be provided as follows:

$$n \geq \max \{m \text{ x } s, 3 (m+s)\}$$

where:

n = number of DMUs,
m = number of inputs, and
s = number of outputs.

Three main approaches exist that are widely used in banking theory literature: production, intermediation and value-added approaches (Drake, Hall & Simper 2006; Frexias & Rochet 1997). The first two approaches apply the traditional microeconomic theory of firm to banking and differ only in the specification of banking activities. The third approach modifies the classical theory by incorporating some specific activities of banking.

The production approach assumes that financial institutions should serve as producers of services for account holders by performing transactions on deposit accounts and process documents, such as loans. Previous studies that focus on this approach are Ferrier and Lovell (1990), Fried et al. (1993) and DeYoung (1997). The intermediation approach is more popular among researchers to apply in the first stage of a DEA analysis. The approach views that banks basically act as financial intermediaries whose primary role is to obtain funds from savers in exchange for their liabilities. The banks, in turn, provide loans to others for profit making (Chu & Lim 1998).

The intermediation approach is also known as an asset approach whereby the financial firms are assumed

to act as an intermediary between the savers and borrowers. Banks are seen as purchasing labor, materials and deposits funds that produce outputs of loans and investments. The inputs include interest expenses, non-interest expenses, deposits, other purchased capital, number of staff (full time equivalent), physical capital (fixed assets and equipment), demographics and competition. The potential outputs are measured as the dollar value of the bank's earning assets, whose costs include both the interest and operating expenses (Berger et al. 1987). Under this approach, the bank's outputs are found on the asset side of the balance sheet and deposits are seen as inputs. Avkiran (1999) suggests that potential outputs include net interest income, non-interest income, consumer loans, housing loans, commercial loans and investments. Previous banking efficiency studies that have adopted this approach include Charneset al. (1990), Bhattacharya et al. (1997), Sathye (2001) and Sufian (2009).

The value-added approach identifies those balance sheet categories (assets or liabilities) as outputs that contribute to the bank value added, for example, business associated with consumption of real resources (Berger et al. 1987). Under this approach, deposits and loans are generally viewed as outputs because they are responsible for a significant proportion of value added.

In the context of the present study, the intermediation approach is favored because it normally includes a large proportion of bank's total costs (Elyasiani & Mehdian 1990; Berger & Humphrey 1991; Avkiran 1999). Furthermore, the present study uses the intermediation approach for four reasons. First, the present study evaluates the bank's efficiency as a whole. Second, the approach is widely employed (Bader et al. 2008; Isik & Hassan 2002; Hassan 2005). Third, according to Drake, Hall and Simper (2006), financial institutions normally employ labor, physical capital and deposits as their inputs to produce earning assets. Finally, fundamental principles of Islamic banking (Mokhtar et al. 2006) mandate that the Islamic financial system be based upon equity participation, such as by employing funds on the basis of profit and loss sharing. Therefore, the principles serve as the basis for the nature of the intermediary activities that Islamic banks perform. In developing economies, such as Malaysia where the capital market can still be considered underdeveloped, the role of banks as a financial intermediary is more prevalent. Therefore, the assumption is reasonable that the efficiency of banks in relation to their intermediation functions is crucial as an effective channel for business funding. In this vein, Jaffry et al. (2007) point out that banks play an important economic role in providing financial intermediation by converting deposits into productive investments in developing countries. The banking sectors of developing countries have also been shown to perform critical role in the intermediation process by influencing the level of money stock in the economy with their ability to create deposits (Mauri 1983; Bhatt 1989; Askari 1991).

The selection of the bank inputs and outputs could be difficult in the evaluation of the bank efficiency in the first stage of the DEA analysis. Bader et al. (2008) state explicitly that 'no perfect approach' exists for the selection of the bank inputs and outputs. Berger and Humphrey (1997) also find that there are restrictions on the type of variables since a need exists for comparable data and the minimization of possible biases due to different accounting practices in the collection of the variables. Different banks might apply different accounting standards even if they are operating in the same country. The results of the efficiency scores for each study on bank efficiency will be affected by the selection of the variables. Since the issue of selecting the approaches is arbitrary (Ariff & Can 2008; Berger & Humphrey 1997), the present study decides to use the assumption of the intermediation approach that a bank is more appropriately classified as an intermediary entity. Table 3 provides the list of inputs and outputs selected by selected extant studies.

Accordingly, two inputs; two input prices; two outputs; and two output prices variables are chosen in the present study. The two input vector variables consist of $x1$ (deposits) and $x2$ (labor). The input prices consist of $w1$ (price of deposits) and $w2$ (price of labor). The two output vectors are $y1$ (loans) and $y2$ (investment). Meanwhile, the

TABLE 3. A summary of Inputs and Outputs on Bank Efficiency Analysis

Study	Inputs (x)	Outputs (y)	Input Prices	Output Prices
Ariff& Can (2008)	1. Deposits 2. No. of employees 3. Physical capital	1. Loans 2. Investment (short and long term)	1. Price of deposits (interest paid/ deposits) 2. Price of labor(personnel expenses/no. of employees) 3. Price of physical capital (other operating expenses/physical capital)	1. Price of loans(interest from loans/ loans) 2. Price of investment(investment income/investment)

(*continued*)

TABLE 3. A summary of Inputs and Outputs on Bank Efficiency Analysis (*continue*)

Study	Inputs (x)	Outputs (y)	Input Prices	Output Prices
Bader et al. (2008)	1. Labor 2. Fixed assets 3. Total Funds	1. Total loans 2. Investment 3. Off-balance sheet items	1. Price of labor (total personnel expenses/total funds) 2. Price of fixed assets (depreciation expenses/fixed assets) 3. Price of funds (interest expenses on deposits and non-deposits funds plus other operating expenses/total funds)	1. Price of loans (interest income/total loans) 2. Price of investment (investment/ other earning assets) 3. Price of off-balance sheet items (net commission revenue plus net earning income/off-balance sheet items)
Maudos & Pastor (2003)	1. Deposits and other funding 2. No. of employees 3. Physical capital	1. Loans and other earnings assets 2. Securities	1. Price of deposits (interest paid/ deposits and other funding) 2. Price of labor (personnel expenses/no. of employees) 3. Price of physical capital (other expenses/physical capital)	1. Price of loans and other earnings assets (interest received and other operating income/loans and other earnings assets) 2. Price of securities (profits from financial operations/securities)
Fare et al. (2004)	1. Labour 2. Capital 3. Non-transaction deposits	1. Securities 2. Real estate loans 3. Commercial and industry loans 4. Personal loans 5. Transaction deposits	1. Price of labor (total salaries and employee benefits/no. of full-time equivalent employees) 2. Price of capital (expenses of premises and fixed assets/value of premises and fixed assets) 3. Price of non-transaction deposits (interest expenses on non-transaction account deposits/ value of non-transaction account deposits)	1. Price of securities (interest income on securities/securities) 2. Price of real estate loans (interest income on real estate loans/ real estate loans) 3. Price of commercial and industry loans (interest income on commercial and industry loans/ commercial and industry loans) 4. Price of personal loans (interest income on personal loans/personal loans) 5. Price of transaction deposits (interest income on transaction deposits/ transaction deposits)
Sufian et al. (2012)	1. Deposit 2. Labour 3. Physical capital	1. Loans 2. Investment 3. Off-balance sheet item	1. Price of deposit(total interest expenses/deposits) 2. Price of labor(personnel expenses/total assets) 3. Price of physical capital(Other operating expenses/fixed assets)	1. Price of loans (interest income on loans and others interest income/loan) 2. Price of investment (other operating income/investment) 3. Price of off-balance sheet items (net fees and commissions/off-balance sheet items)
Devaney & Weber (2002)	1. Labour 2. Physical capital 3. Non-transaction account deposits	1. Real estate loans 2-5. Commercial and industry loans (a,b,c,d) 6. Personal loans 7. Securities 8. Transaction account deposit	1. Price of labor (total salaries and employee benefits/ no. of full-time equivalent employees) 2. Price of physical capital (expenses of premises and fixed assets/value of premises and fixed assets) 3. Price of non-transaction account deposits (interest expenses on non-transaction account deposits/ value of non-transaction account deposits)	1. Price of real estate (interest income on real estate loans/real estate loans) 2-5.Price of commercial and industry loans a,b,c,d (interest income on commercial and industry loans a,b,c,d/ commercial and industry loans a,b,c,d) 6. Price of personal loans(interest income on personal loans/personal loans) 7. Price of securities (interest income on securities/securities) 8. Price of transaction account deposit (interest income on transaction account deposit/transaction account deposit)

two output prices consist of *r*1 (price of loans) and *r*2 (price of investment). The summary of data used to construct the efficiency frontiers is provided in Table 4.

TABLE 4. Descriptive Statistics for Inputs, Inputs Prices, Outputs, and Outputs Prices

Variables	Min (RM mill)	Max (RM mill)	Mean (RM mill)	Std. Dev. (RM mill)
*x*1	41.86	35,190.40	9,018.06	7,555.57
*x*2	0.60	431.00	49.02	73.043
*w*1	0.001	0.04	0.021	0.007
*w*2	0.000	2.27	0.043	0.24
*y*1	2.40	33,410.20	6,074.59	5,981.69
*y*2	1.65	1,855.60	472.45	410.67
*r*1	0.006	0.66	0.06	0.06
*r*2	0.001	15.16	0.47	1.62

Notes: x1 = Deposits (deposits and short term funding), x2 = Labor (personnel expenses), w1 = Price of deposits (total interest expenses/ deposits), w2 = Price of labor (personnel expenses/ total assets), y1= Loans (net loans and interbank lending), y2 = Income (gross interest and dividend income), r1 = Price of loans (interest income on loans and others interest income/ loans), and r2 = Price of income (other operating income/ income).

EMPIRICAL RESULTS

Before proceeding with the DEA results, it is important to report that the total number of DMUs (17 banks) included in the present study is greater than the minimum required (Cooper et al. 2002), i.e., the number of input and output variables (2 inputs x 2 outputs @ 3 [2 inputs + 2 outputs]). Therefore, the selection of variables is valid and allows the efficiencies of DMUs to be measured reliably. By calculating the three efficiencies measures (e.g. revenue, cost and profit), robust results are obtained for both the domestic and foreign Islamic banks efficiency. Table 5 illustrates the revenue efficiency estimates along with the cost and profit efficiency measures for both the domestic and foreign Islamic banks.

EFFICIENCY OF DOMESTIC ISLAMIC BANKS

Table 5 shows the mean cost, revenue and profit efficiency of Malaysian domestic Islamic banks are 74.5%, 71.2%, and 62.5%, respectively. In other words, the domestic Malaysian Islamic banks have been inefficient in producing outputs by using the same input (revenue inefficiency) and by not fully using the inputs efficiently to produce the same outputs (cost inefficiency). Banks are said to have slacked if they fail to fully minimize the cost and maximize the revenue (profit inefficiency). The results indicate that levels of cost inefficiency, revenue inefficiency, and profit inefficiency are 25.5%, 28.8%, and 37.5%, respectively.

In terms of cost efficiency, the results indicate that Malaysian domestic Islamic banks, on average, have utilized only 74.5% of the resources or inputs to produce the same level of outputs. In other words, the average Malaysian domestic Islamic bank has wasted 25.5% of its inputs or could have saved 25.5% of its inputs to produce the same level of outputs. It is also worth noting that, on average, Malaysian domestic Islamic banks have been more cost efficient in utilizing their inputs compared to their ability to generate revenues and profits. In relation to revenue efficiency, the average Islamic bank could only generate 71.2% of revenues, less than what it was initially expected to generate. Hence, 28.8% of revenue, indicating that the average Islamic bank loses an opportunity to receive 28.8% more revenue with the same amount of resources or could have produced 28.8% greater outputs with the same level of inputs.

Overall, the results suggest that the greatest inefficiencies occur on the revenue side, followed by the

TABLE 5. Cost, Revenue, and Profit Efficiency of Domestic and Foreign Islamic Banks

	Domestic Islamic Banks				Foreign Islamic Banks		
Bank	VRS CE	VRS RE	VRS PE	Bank	VRS CE	VRS RE	VRS PE
Bank 1	0.506	0.497	0.278	Bank 1	0.855	0.720	0.634
Bank 2	0.985	0.987	1.000	Bank 2	0.922	1.000	1.000
Bank 3	0.840	0.941	1.000	Bank 3	0.956	0.935	0.919
Bank 4	0.697	0.501	0.410	Bank 4	0.701	0.643	0.506
Bank 5	0.627	0.594	0.482	Bank 5	0.688	0.767	0.697
Bank 6	0.632	0.516	0.423	Bank 6	0.670	1.000	1.000
Bank 7	0.781	0.782	0.661				
Bank 8	0.600	0.586	0.358				
Bank 9	1.000	1.000	1.000				
Bank 10	0.873	0.807	0.752				
Bank 11	0.654	0.619	0.515				
Mean	0.745	0.712	0.625	Mean	0.799	0.844	0.793
Min	0.506	0.497	0.278	Min	0.670	0.643	0.506
Max	1.000	1.000	1.000	Max	0.956	1.000	1.000
Std. Dev.	0.163	0.198	0.273	Std. Dev.	0.128	0.154	0.209

Notes: The bank numbering here does not in any way reflecting the sequence of banks listed in Table 2. Abbreviation CE = Cost Efficiency, RE = Revenue Efficiency, PE = Profit Efficiency, VRS = variable returns to scale, and CRS = constant return to scale.

profits side. Similarly, the average Islamic bank could have earned 62.5% of what was available, and lost the opportunity to make 37.5% more profits from the same level of inputs. Even though cost efficiency is higher among the domestic Islamic banks, revenue efficiency is found to be lower and leads to higher revenue inefficiency. When both efficiency concepts (revenue and cost) are compared, the higher revenue inefficiency seems to have contributed to the higher profit inefficiency levels.

EFFICIENCY OF FOREIGN ISLAMIC BANKS

The empirical findings presented in Table 5 suggest that foreign Islamic banks in Malaysia exhibit a mean cost, revenue and profit efficiency (inefficiency) of 79.9% (20.1%), 84.4% (15.6%), and 79.3% (20.7%), respectively. Furthermore, it is interesting to note that, on average, foreign Islamic banks in Malaysia are found to be more efficient compared to their domestic bank peers. In terms of revenue efficiency, the average foreign Islamic bank could only generate 84.4% of revenues that it was expected to generate. Hence, the average foreign Islamic bank lost an opportunity to receive 15.6% more revenue with the same amount of resources.

As for cost efficiency, the results seem to suggest that the average foreign Islamic bank could have utilized 79.9% of the resources or inputs to produce the same level of output. In other words, on average, foreign Islamic banks wasted 20.1% of their inputs or could have saved 20.1% of their inputs to produce the same level of outputs. Therefore, substantial room exists for significant cost savings among foreign Islamic banks in Malaysia if they employ inputs efficiently. Noticeably, the highest level of inefficiency is on the cost side, followed by the profits side. Similarly, the average foreign Islamic bank could have earned 79.3% of what was available, and lost the opportunity to make 20.7% more profits when utilizing the same level of inputs.

In conclusion, the empirical findings of the present study seem to suggest that the foreign Islamic banks in Malaysia exhibit higher efficiency levels for all three efficiency measures: cost efficiency (84.4% vs. 71.2%), revenue efficiency (79.9% vs. 74.5%) and profit efficiency (79.3% vs. 62.5%). In essence, revenue efficiency seems to play the main factor leading to the lower or higher profit efficiency levels. Additionally, the results for the domestic Islamic banks show that the level of cost efficiency is higher than profit efficiency due to lower revenue efficiency levels. Meanwhile, the level of cost efficiency is slightly higher than profit efficiency due to the higher revenue efficiency levelsamong the foreign Islamic banks in Malaysia.

ROBUSTNESS TESTS

After examining the results derived from the DEA method, the issue of interest now is whether the difference in the cost, revenue, and profit efficiency of the domestic and foreign Islamic banks is statistically significant. Coakes and Steed (2003) suggest that the Mann-Whitney [Wilcoxon] test is a relevant test for two independent samples coming from populations having the same distribution. The most relevant reason is that the data violate the stringent assumptions of the independent group's *t*-test. The non-parametric Mann-Whitney [Wilcoxon] test is performed along with a series of other parametric (*t*-test) and non-parametric Kruskall-Wallis tests to obtain robust results.

Table 6 shows the results of the robustness tests. The results from the parametric *t*-test and non-parametric Mann-Whitney (Wilcoxon) test suggest that the Malaysian domestic Islamic banks exhibit a lower mean cost efficiency level than their foreign Islamic bank peers (0.745 < 0.799). Likewise, the Malaysian domestic Islamic banks also exhibit a lower mean profit efficiency level compared to foreign Islamic banks in Malaysia (0.625 < 0.793). The

TABLE 6. Summary of Parametric and Non-Parametric Tests on Domestic and Foreign Islamic Banks

	Parametric test		Non-parametric tests			
Individual tests	*t*-test		Mann-Whitney		Kruskall-Wallis	
Hypothesis			Median Domestic = Median Foreign		Equality of Populations test	
Test statistics	*t(Prb>t)*		*z(Prb>z)*		X^2 *(Prb> X^2)*	
	Mean	*t*	Mean Rank	*z*	Mean Rank	X^2
			Cost Efficiency			
Domestic Islamic banks	0.745	-1.131	41.09	-0.973	41.09	0.947
Foreign Islamic banks	0.799		46.50		46.50	
			Revenue Efficiency			
Domestic Islamic banks	0.712	–2.726***	37.49	–2.827***	37.49	7.992***
Foreign Islamic banks	0.844		53.10		53.10	
			Profit Efficiency			
Domestic Islamic banks	0.625	–2.551**	38.46	–2.352**	38.46	5.533**
Foreign Islamic banks	0.793		51.32		51.32	

Note: *** and ** indicate significance at the 1% and 5% levels, respectively.

results from the parametric *t*-test are further confirmed by the non-parametric Mann-Whitney (Wilcoxon) and Kruskall-Wallis tests. Similarly, the parametric *t*-test and non-parametric Mann-Whitney (Wilcoxon) and Kruskall-Wallis tests results indicate that the domestic Islamic banks exhibit lower revenue efficiency levels compared to the foreign Islamic banks in Malaysia ($0.712 < 0.844$).

Based upon the results presented in Table 6, the null hypothesis that the domestic and foreign Islamic banks come from the same population and have identical technologies is not rejected since the revenue efficiency levels of the domestic Islamic banks is lower than the foreign Islamic banks in Malaysia, at a 1% level of significance. The significant results on lower levels of revenue efficiency in domestic Islamic banks indicate that the revenue efficiency could influence the lower profitability of the banks due to lower profit efficiency levels. Therefore, the revenue efficiency represents the most important efficiency measure that, in turn, could lead to higher profit efficiency levels.

CONCLUSIONS

The present study examines the revenue efficiency of the Malaysian Islamic banking sector during the period of 2006 to 2010. Most extant research focuses upon cost and profit efficiency in banking sectors, with only a few examining issues related to revenue efficiency. Furthermore, most of these studies are conducted on the context of conventional banking sectors, while empirical evidence on the Islamic banking sectors is relatively scarce. In the present study, the non-parametric data envelopment analysis (DEA) method is applied to distinguish between three different types of efficiency measures: cost, revenue and profit. Additionally, a series of parametric (*t*-test) and non-parametric (Mann-Whitney [Wilcoxon] and Kruskall-Wallis) tests are performed to examine whether the domestic and foreign Islamic banks in Malaysia are drawn from the same population.

A statistically significant difference is found to exist between the revenue efficiency of domestic and foreign Islamic banks in Malaysia. The result of the present study show that the revenue efficiency of the domestic Islamic banks is relatively lower compared to their foreign peers due to the difference between the cost and profit efficiency levels. In addition, the empirical findings of the present study suggest that the foreign Islamic banks in Malaysia exhibit higher efficiency levels for all three efficiency measures (cost, revenue and profit efficiencies). In essence, revenue efficiency seems to play the main role in lower or higher profit efficiency levels. Furthermore, the results for the domestic Islamic banks show that the level of cost efficiency is higher than profit efficiency due to the lower revenue efficiency levels. Meanwhile, the level of cost efficiency is slightly higher than profit efficiency due to the higher revenue efficiency level among the foreign Islamic banks in Malaysia. The empirical findings clearly indicate that better revenue efficiency could improve the level of profit efficiency and, consequently, contribute to higher profits among Malaysian Islamic banks.

The empirical findings from the present study fail to reject the null hypothesis that the domestic banks and foreign banks come from the same population and have identical technologies since the revenue efficiency of the domestic Islamic banks is statistically significantly lower compared to that of foreign Islamic banks in Malaysia. The results of the present study support the global advantage theory of Berger et al. (2000) and Havrylchyk (2006), while contradicting the theory on home field advantage proposed by Hymer (1976). The results imply that the foreign Islamic banks in Malaysia benefit from competitive advantages; exercise more advanced technologies; actively market for corporate control in the home country; and employ a more efficient labor force to adapt to new technologies.

Finally, the findings of the present study are expected to contribute significantly to the existing knowledge on the operating performance of the Malaysian Islamic banking sector. Nevertheless, the present study also provides further insight for management of specific banks, as well as policymakers, in regards to attaining an optimal utilization of capacities; improvement in managerial expertise; efficient allocation of scarce resources; and the most productive scale of operation of Islamic banks operating in the Malaysian Islamic banking sector. The finding may also facilitate directions for the sustainable competitiveness of the Malaysian Islamic banking sector operations in the future.

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