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Cost, Revenue and Profit Efficiency in Islamic vs. Conventional Banks: Empirical Evidence using Data Envelopment Analysis (DEA)

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ABSTRACT

The objective of this study is to compare the cost, revenue and profit efficiency of Islamic and conventional banks in Malaysia over the period 2006 to 2009. To represent the Malaysian Islamic and conventional banking sector, a sample of 39 banks were selected to participate in the study. The level of efficiencies was measured using the Data Envelopment Analysis (DEA) method, which applied the intermediation approach. The result shows that the levels of cost and profit efficiency for Malaysian Islamic banks are lower compared to the Malaysian conventional banks. The difference levels between cost and profit efficiency in the Malaysian banking sector are not influenced by revenue efficiency but, rather are subject to influence by internal and external factors.

Keywords: Cost efficiency, revenue efficiency, profit efficiency, Malaysian Islamic bank, Malaysian conventional banks

INTRODUCTION

Like all banks in general, the Islamic bank is an intermediary and trustee of the money belonging to others, but the difference between the Islamic bank and conventional banks is in how profit and loss is shared with depositors. The element of mutuality in Islamic banking gives its depositors as customers some ownership right in an Islamic bank (Dar & Presley, 2000).While the conventional banking system follows the familiar, longstanding interest-based principle, Islamic banking is based on the principles of interest-free transactions and Profit-and-Loss (PLS) sharing in their business role as intermediaries (Arif, 1988).

The main factor that distinguishes Islamic banking from conventional banking is that transactions are administered without involving the element of *riba*. *Riba* , or

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an increase or growth, is prohibited in Islam, and this is acknowledged by all Muslims. The prohibition of riba is clearly mentioned in the *Quran*, the Muslim holy book, and in the traditions of Prophet Muhammad (*sunnah*). Some insist that *riba* is the increase imposed on the debtor at the maturity of the debt in case the debtor fails to settle the debt but wants to roll it over. Debtors say so because they think the predominant from of transactions involving *riba* was sale on credit, in which case, the (deferred) price is higher than the spot price in lieu of deferment, and the need for an explicit increase arises only in case of further postponement of payment.

Nevertheless, most scholars believe that *riba* covers the interest stipulated at the time of the contract in the case of loans as well as the subsequent increase in the case of a loan or debt that arises when sale on credit is rolled over because the debtor does not pay it at the time stipulated in the contract (Badawi, 1964). Technically, *riba*, in a loan transaction, denotes any increase or premium advantage obtained by the lender as a condition of the loan. This means that earning an income is *haram* in Islam, and Muslims are thus forbidden from giving or receiving *riba*. More importantly, the principal objective of the establishment of Islamic banks is to cater for the needs of Muslims engaged in banking transactions in accordance to the rulings set in the *Al Quran* and *Hadith* (Haron and Azmi, 2009). The business management of the banks is governed by the concepts of justice and fairness towards the interests of society as a whole.

Globalisation has improved financial institutions over the world through greater deregulation and liberalisation. Islamic Banking is the one of the most fast growing institutions and has become competitive against conventional banking. The practice of Islamic banking is now spreading world-wide, from Malaysia to Bahrain to Europe and the USA.

The International Monetary Fund reported in 2005 that the number of Islamic financial institutions had increased from 75 to over 300 from 1975 to 2005, and that it was being practised in more than 75 countries. The total assets of the Islamic financial institutions are estimated to be US$250 billion, which is rising at a rate of about 15 % per year, three times the rate for conventional banks. According to Ghafour (2006) and Dubai Islamic Bank (2006), the size of the assets of the world-wide Islamic banking industry is estimated to have grown to an excess of $265 billion from merely hundreds of thousands of dollars in the 1970s.

Since Islamic financial institutions have so rapidly evolved, we expect the efficiency of the banks has also improved. Berger and Humphrey (1997) suggest that studies focused on the efficiency of financial institutions have become an important part of banking literature since the early 1990s. A study by Berger *et al*. (1993b) suggests that if banks were efficient, they could expect improved profitability, better prices

and better service quality for consumers, and that greater amounts of funds would be intermediated.

The general concept of efficiency covers three components, namely, cost, revenue and profit efficiency (Adongo *et al*., 2005; Bader *et al*., 2008). Evidence of bank efficiency could be produced by discovering these three types of efficiency concept. However, few studies have examined the comprehensive efficiency that consists of these three components. Most previous studies have mainly focused on the efficiency of cost, profit or both (cost and profit efficiency combined) (Bader *et al*., 2008).

Studies on bank efficiency that ignore revenue have been criticised (Bader *et al*., 2008). This is mainly because most of the studies have only revealed the levels of cost efficiency, which are higher than profit efficiency, but they have not identified the causes. According to Chong *et al*. (2006), banks desire maximising profit to maximise shareholders' value or wealth. However, the main problem contributing to lower profit efficiency comes from revenue inefficiency (Kamarudin *et al*., 2013; Sufian *et al.*, 2013). Ariff and Can (2008) find that inefficient revenue affected the difference between cost and profit efficiency, but they do not investigate further on the revenue efficiency and on the reasons for such an occurrence. A study which investigates the causes of inefficiency was done by Maudos et al. (2002), Rogers (1998) and Berger et al. (1993a), who find that revenue inefficiency was caused either by mispricing of outputs or the giving of wrong choice of output.

Therefore, instead of focusing on profit efficiency of Islamic and conventional banking alone, it would be better to compare profit efficiency with cost efficiency as well in order to identify the existence of revenue efficiency. By employing the non-parametric Data Envelopment Analysis (DEA) method, we have analysed cost, revenue and profit efficiencies of Malaysian Islamic and conventional banks over the period from 2006 to 2009. The preferred non-parametric Data Envelopment Analysis (DEA) methodology allowed us to distinguish between three different types of efficiency, which are cost, revenue and profit efficiencies. This information could be useful to several parties and may have several implications for regulators, bankers, investors and academicians.

The article begins with a brief overview of the Malaysian Islamic banking sector. This is followed by Literature Refiew, where we provide a review of related studies. Data and Methodology discusses the methods employed in the study and the variables employed in the panel regression analysis. We present the empirical results in next section. The article is concluded in last section, which also provides discussion on policy implications.

LITERATURE REVIEW

There are some documented studies that compare the performance of Islamic banks with their conventional counterparts. Nevertheless, those studies focus on

profitability with the help of financial ratios and are constrained by the time span and the number of Islamic banks (Samad & Hassan, 1999; Iqbal, 2001). The previous studies mostly concentrate on the technical and pure technical and on scale efficiency (Isik & Hassan, 2002; Hassan & Hussein, 2003; Yudistira, 2004; Tahir & Haron, 2008). Despite the significant importance of this area, documented studies that address cost, revenue and profit efficiency are very few (Yudistira, 2004; Hassan, 2005; Brown and Skully, 2005).

Technical Efficiency, Pure Technical and Scale Efficiency

Technical efficiency (TE) measures the proportional reduction in input usage that can be attained if the bank operates on the efficient frontier, or when the effectiveness of the limited set of inputs is used to produce a maximum of outputs. On the other hand, the allocative efficiency (AE) measures the proportional reduction in costs if the bank chooses the right mix of inputs to be used (English *et al*., 1993; Al-Sharkas *et al*., 2008). TE is related to managerial factors, while AE is often associated with regulatory factors (Isik & Hassan, 2002). Pure technical efficiency (PTE) is the measurement of technical efficiency devoid of the scale efficiency or the firm's size efficiency (SE) effects (Sufian, 2004; Coelli, 1998).

Based on the literature, it can be said that most international Islamic banks face a similar problem, where their pure technical inefficiency (PTIE) outweighs scale inefficiency (SIE) (Sufian *et al.*, 2008; Hassan & Hussein, 2003; Yudistira, 2004; Saaid, 2003). In other words, although Islamic banks have been operating at a relatively optimal scale of operations, they were managerially inefficient in exploiting their resources. On the other hand, the opposite is true for international conventional banks. Most of these studies have presented inefficiency from the scale side (wrong scale of operations).

Islamic and conventional banks in Malaysia experience a similar situation, namely, that the TE of both types of bank is not dominated by scale efficiency, but rather, it is dominated by PTE (managerial efficiency). Based on previous observation recorded in the literature, the contra findings discovered between studies on international Islamic banks and Malaysian Islamic banks (Samad, 1999; Katib, 1999; Tahir & Haron, 2008; Sufian, 2007), the technical inefficiency (TIE) of international Islamic banks is dominated by PTIE (managerially inefficient) while the TIE of Malaysian Islamic banks is dominated by SIE (inefficient bank's size).

Cost Efficiency, Revenue Efficiency and Profit Efficiency

Many studies have conducted cost and profit efficiency tests on practices by the conventional banks rather than by Islamic banks and have discovered that the different levels between cost and profit efficiency are caused by the inefficiency generated by revenue procurement (Chu & Lim, 1998; Rogers, 1998; Maudos *et al*., 2002; Berger & Mester, 2003).

Cost efficiency means that a firm is able to minimise the costs of inputs while producing the same amount of outputs sold at certain prices (Berger & Mester, 1997; Ariff & Can, 2008). Berger and Humphrey (1997) claim that most of the previous studies focused on cost efficiency (Srinivasin, 1992; Linder & Crane, 1992; Shaffer, 1993; Berger & Humphrey, 1992; Rhoades, 1993; Pilloff, 1996; Resti, 1997), and suggest that research on revenue and profit efficiency has been scarce. Most ignored the influence of revenue and profit on the efficiency of banks (Akhavein *et al*., 1997; Bader *et al*., 2008).

Profit efficiency is also a firm's maximisation of profit since it takes into account both the cost and revenue effects on the changes in output scale and scope. Profit efficiency measures how close a bank comes to producing maximum profit, given an amount of inputs and outputs and a level of their prices (Akhavein *et al*. 1997; Akhigbe & McNulty, 2003: Ariff & Can, 2008). Thus, profit efficiency provides a complete description of the economic goal of a bank, which requires banks to reduce cost and increase revenue. Furthermore, according to Berger and Mester (2003) and Maudos and Pastor (2003), profit efficiency offers more useful information on management efficiency.

Revenue is defined as how effectively a bank sells its outputs. Maximum revenue is obtained as a result of producing the output bundle efficiently (Rogers, 1998; Andogo *et al*., 2005). In fact, revenue efficiency is decomposed of technical and allocative efficiency which are related to managerial factors and is regularly associated with regulatory factors (Isik and Hassan, 2002). English *et al*. (1993) posit that in order to ascertain revenue efficiency, banks should focus on both technical efficiency (managerial operations that explore production possibilities) and allocative efficiency (bank producing revenue-maximising mix of outputs based on certain regulations).

Another way to improve revenue efficiency as proposed by several studies is for banks to produce higher quality services and charge higher prices and struggle to avoid any improper choice of input and output quantities and mispricing of outputs (Andogo *et al*., 2005; Rogers, 1998). The revenue inefficiency could be well identified via the profit function because this function combines both the cost and revenue efficiency to evaluate the profit efficiency (Lozano, 1997; Akhevein *et al*., 1997). The revenue efficiency would totally affect the efficiency of the profit even though the cost efficiency is high. In essence, the revenue efficiency would be the major factor that influences the efficiency on profit. Berger and Humphrey, 1997, Akhavein *et al*., 1997, Bader *et al*., 2008, Sufian *et al*., 2012a and Sufian *et al*., 2012b state that there have been limited studies done on the revenue efficiency of banks.

Nevertheless, several studies point to factors that may influence the differences between cost and profit efficiency levels (e.g. De Young *et al*., 2004; Akhigbe & McNulty, 2005; Andogo *et al*., 2005; Sufian

& Chong, 2008; Sufian & Habibullah, 2009; Kosmidou, 2008; Delis *et al*., 2008; Sufian & Habibullah, 2010). These studies suggest that the difference levels of cost and profit efficiency may be the influence by internal (bank-specific characteristics) and external (macroeconomics) factors. The internal factors include size of banks, asset quality, capitalisation, market power, management quality and liquidity, among others. Meanwhile, the external or macroeconomic factors consist of economic growth, inflation and banks' concentration ratio, among others.

The above literature reveals the following research gaps. First, the majority of these studies have mainly concentrated on conventional banking sectors of the Western and developed countries. Second, empirical evidence directly related to developing countries, particularly for the Islamic banking sector, is scarce. Finally, virtually nothing has been published on cost, revenue and profit efficiency and their determinants in the Malaysian Islamic and conventional banking sectors. In the light of these knowledge gaps, this paper seeks to provide new empirical evidence on cost, revenue and profit efficiency with regards to the Malaysian Islamic and the conventional banking sectors.

DATA AND METHODOLOGY

This study gathers data from all Malaysian Islamic and conventional banks from 2006 to 2009. The primary source for financial data is obtained from the BankScope database produced by the Bureau van Dijk which provides the banks' balance sheets and income statements. The data were collected from 39 banks (17 Islamic banks and 22 conventional banks) as presented in Table 1.

Data Envelopment Analysis

The level of revenue efficiency is measured using the Data Envelopment Analysis (DEA) method which applies the intermediation approach. It constructs the 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 was assumed by the DEA. Charnes *et al*. (1978) were the first to introduce the term DEA to measure the efficiency of each decisionmaking unit (DMU) obtained as a maximum of a ratio of weighted outputs to weighted inputs. The more the output produced from given inputs, the more efficient is the production. According to Bader *et al*. (2008), the DEA technique is extensively used in many recent banking efficiency studies (Drake *et al*., 2006; Sufian & Habibullah, 2009).

This study employs estimates efficiency under the assumption of variable returns to scale (VRS). The VRS model was proposed by Banker, Charnes and Cooper (1984). The BCC model (VRS) extended the CCR model that was proposed by Charnes, Cooper and Rhodes (1978) by relaxing the constant return to scale (CRS) assumption. The resulting BCC model was used to assess

TABLE 1
List of Malaysian Islamic and Conventional Banks During the Years 2006-2009

No.	Islamic Bank	No.	Conventional Bank
1	Affin Bank	1	Affin Bank Berhad
2	Alliance Bank	2	Alliance Bank Malaysia Berhad
3	Al-Rajhi Bank	3	AmBank (M) Berhad
4	Arab-Malaysia (AmIslamic Bank)	4	Bangkok Bank Berhad
5	Asian Finance Bank	5	Bank of America Malaysia Berhad
6	Bank Islam Malaysia	6	Bank of China (Malaysia) Berhad
7	Bank Muamalat	7	Bank of Tokyo-Mitsubishi UFJ (Malaysia) Berhad
8	Commerce Tijari (CIMB)	8	CIMB Bank Berhad
9	EON Bank Islamic	9	Citibank Berhad
10	Hong Kong Bank (HSBC)	10	Deutsche Bank (Malaysia) Berhad
11	Hong Leong Bank	11	Hong Leong Bank Berhad
12	Kuwait Finance House	12	HSBC Bank Malaysia Berhad
13	Maybank	13	J.P. Morgan Chase Bank Berhad
14	OCBC	14	Malayan Banking Berhad
15	Public Bank	15	OCBC Bank (Malaysia) Berhad
16	RHB Islamic Bank	16	Public Bank Berhad
17	Standard Chartered Bank	17	RHB Bank Berhad
		18	Standard Chartered Bank Malaysia Berhad
		19	The Bank of Nova Scotia Berhad
		20	The Royal Bank of Scotland Berhad
		21	United Overseas Bank (Malaysia) Bhd.
		22	EON Bank

Source: Bank Negara Malaysia (2009)

the efficiency of DMUs characterised by VRS. The VRS assumption provides the measurement of pure technical efficiency (PTE), measuring the efficiency of the DMU's managerial. The PTE measures the efficiency of the DMU's pure managerial without being contaminated by scale. Therefore, VRS results may provide more reliable information on the DMU's efficiency rather than the CRS (Coelli, *et al*., 1998; Sufian, 2004). The DEA Excel Solver developed by Zhu (2009) under the VRS model is adopted in order to solve the revenue efficiency and also cost and profit efficiency.

The cost, revenue and profit efficiency models are given in Equations (1) – (3). As can be seen, the cost, revenue and profit efficiency scores are bounded within the 0 and 1 range (Table 2).

By calculating these three efficiency concepts (cost, revenue and profit), we may observe the Islamic and conventional banks on these efficiency levels and, in addition, more robust results may be obtained.

Variables Used in DEA

According to Cooper *et al*. (2002), there is a rule required to be complied with in order to select the number of inputs and outputs. A rough rule of thumb which could provide guidance is as follows:

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

where,
n is a number of DMUs
m is a number of inputs
s is a number of outputs

Because this study uses the intermediation approach, two inputs, two input prices, two outputs and two output

TABLE 2
The cost, revenue and profit efficiency models

Frontier Type	Cost Efficiency (Eq. 1)	Revenue Efficiency (Eq. 2)	Profit Efficiency (Eq. 3)
VRS	$min \sum_{i=1}^{m} p_i^o \tilde{x}_{io}$ *subject to* $\sum_{j=1}^{n} \ddot{e}_j x_{ij} \leq \tilde{x}_{io}$ $i=1,2,...,m;$ $\sum_{j=1}^{n} \ddot{e}_j y_{rj} \geq y_{ro}$ $r=1,2,...,s;$ $\ddot{e}_j, \tilde{x}_{io} \geq 0$ $\sum_{j=1}^{n} \ddot{e}_j = 1$	$max \sum_{r=1}^{s} q_r^o \tilde{y}_{ro}$ *subject to* $\sum_{j=1}^{n} \lambda_j x_{ij} \leq \tilde{x}_{io}$ $i=1,2,...,m;$ $\sum_{j=1}^{n} \ddot{e}_j y_{rj} \geq \tilde{y}_{ro}$ $r=1,2,...,s;$ $\lambda_j \tilde{y}_{ro} \geq 0$ $\sum_{j=1}^{n} \lambda_j = 1$	$max \sum_{r=1}^{s} q_r^o \tilde{y}_{ro} - \sum_{i=1}^{m} p_i^o \tilde{x}_{io}$ subject to $\sum_{j=1}^{n} \lambda_j x_{ij} \leq \tilde{x}_{io}$ $i=1,2,...,m;$ $\sum_{j=1}^{n} \ddot{e}_j y_{rj} \geq \tilde{y}_{ro}$ $r=1,2,...,s;$ $\tilde{x}_{io} \leq x_{io}, \tilde{y}_{ro} \geq y_{ro}$ $\lambda_j \geq 0$ $\sum_{j=1}^{n} \lambda_{j=1}$

Source: Zhu (2009)

where,

s	is output observation
m	is input observation
r	is s^{th} output
i	is m^{th} input
q_r^o	is unit price of the output r of DMU0 (DMU0 represents one of the *n* DMUs)
p_i^o	is unit price of the input i of DMU0
$\tilde{y}_{ro}$	is r^{th} output that maximises revenue for DMU0
$\tilde{x}_{io}$	is i^{th} input that minimises cost for DMU0
y_{ro}	is r^{th} output for DMU0
x_{io}	is i^{th} input for DMU0
n	is DMU observation
j	is n^{th} DMU
λ_j	is non-negative scalars
y_{rj}	is s^{th} output for n^{th} DMU
x_{ij}	is m^{th} input for n^{th} DMU

price variables are chosen. The overall selection of the variable of banks' input and output is based on Ariff and Can (2008) and other major studies on the efficiency of banks (Sufian & Habibulah, 2009; Bader *et al*., 2008; Isik & Hassan, 2002; Hassan, 2005). The two input vector variables consist of x1: deposits and x2: labour. The input prices consist of w1: price of deposit, w2 and price of labour.

The two output vector variables are y1: loans and y2: investment. Meanwhile, two output prices consist of r1: price of loans and r2: price of investment. The summary of data used to construct the efficiency frontiers are presented in Table 3.

EMPIRICAL RESULTS

This study first tested the rule of thumb on the selection of input and output variables suggested by Cooper *et al.* (2002). Since the total number of DMUs (39 banks) in this study is more than the number of input and output variables (2 inputs x 2 outputs @ 3 [2 inputs + 2 outputs]), the selection of variables is valid since it complies with the rule of thumb and allows the efficiencies of DMUs to be measured.

Next, by calculating all three efficiencies concepts (revenue, cost and profit), we may observe Islamic and conventional banks at these efficiency levels and further obtain more robust results. Table 4 and Fig.1 illustrate all efficiency concepts, namely, cost, revenue and profit efficiency for Malaysian Islamic and conventional banks.

Malaysian Islamic Bank

Table 4 shows the mean for cost efficiency, revenue efficiency and profit efficiency of 73.4 %, 74.5 % and 67 % respectively for the Malaysian Islamic banks. Another way of interpreting this result is to suggest that these banks have slacked (inefficient) by not fully producing the outputs efficiently using the same input (revenue inefficiency) and by not fully using the inputs efficiently to produce the same outputs (cost inefficiency).

TABLE 3
Descriptive Statistics for Inputs, Outputs, Inputs Prices and Outputs Prices

Variable	Minimum	Maximum	Mean	Std. Deviation
x1	41.86	243,132.00	29,596.4545	46,432.68774
x2	0.60	2,554.00	239.6037	414.31223
y1	2.41	185,783.20	19,998.3287	33,016.50439
y2	1.65	61,677.50	5,655.2189	10,090.18753
w1	0.00	0.10	0.0254	0.01056
w2	0.00	2.27	0.0264	0.18375
r1	0.01	2.51	0.1371	0.25546
r2	0.00	15.16	0.6732	1.24391

Note: x1: Deposits (deposits and short term funding), x2: Labour (personnel expenses), y1: Loans (net loans and interbank lending), y2: investment (total securities), w1: Price of deposits (total interest expenses/ deposits), w2: Price of labour (personnel expenses/total assets), r1: Price of loans (interest income on loans and other interest income/loans), r2: Price of investment (other operating income/investment)

TABLE 4
Cost, Revenue, and Profit Efficiency for Malaysian Islamic and Conventional Banks

No.	Islamic Bank	CE	RE	PE	No.	Conventional Bank	CE	RE	PE
1	Affin Islamic Bank Berhad	0.465	0.465	0.256	1	Affin Bank Berhad	0.805	0.582	0.575
2	Alliance Islamic Bank Berhad	0.982	1.000	1.000	2	Alliance Bank Malaysia Berhad	0.833	0.665	0.672
3	Al Rajhi Banking & Investment Corporation (Malaysia) Berhad	0.822	0.653	0.547	3	AmBank (M) Berhad	0.998	0.639	1.000
4	AmIslamic Bank Berhad	0.800	0.957	1.000	4	Bangkok Bank Berhad	0.856	0.655	0.835
5	Asian Finance Bank Berhad	0.902	1.000	1.000	5	Bank of America Malaysia Berhad	0.890	1.000	1.000
6	Bank Islam Malaysia Berhad	0.685	0.513	0.438	6	Bank of China (Malaysia) Berhad	0.997	0.780	0.792
7	Bank Muamalat Malaysia Berhad	0.567	0.588	0.470	7	Bank of Tokyo-Mitsubishi UFJ (Malaysia) Berhad	0.777	0.721	0.808
8	CIMB Islamic Bank Berhad	0.603	0.470	0.413	8	CIMB Bank Berhad	1.000	0.967	1.000
9	EONCAP Islamic Bank Berhad	0.773	0.776	0.640	9	Citibank Berhad	0.734	0.691	0.642
10	HSBC Amanah Malaysia Berhad	0.952	0.926	0.909	10	Deutsche Bank (Malaysia) Berhad	1.000	0.683	1.000
11	Hong Leong Islamic Bank Berhad	0.601	0.596	0.365	11	Hong Leong Bank Berhad	0.849	0.905	0.858
12	Kuwait Finance House (Malaysia) Berhad	0.653	0.583	0.442	12	HSBC Bank Malaysia Berhad	0.879	0.789	0.796
13	Maybank Islamic Berhad	1.000	1.000	1.000	13	J.P. Morgan Chase Bank Berhad	0.874	0.491	0.899
14	OCBC Al-Amin Bank Berhad	0.624	0.752	0.686	14	Malayan Banking Berhad	1.000	1.000	1.000
15	Public Islamic Bank Berhad	0.853	0.807	0.755	15	OCBC Bank (Malaysia) Berhad	0.920	0.750	1.000
16	RHB Islamic Bank Berhad	0.613	0.578	0.471	16	Public Bank Berhad	0.944	0.969	1.000
17	Standard Chartered Saadiq Berhad	0.588	1.000	1.000	17	RHB Bank Berhad	0.959	0.862	0.928
					18	Standard Chartered Bank Malaysia Berhad	0.816	0.780	0.760
					19	The Bank of Nova Scotia Berhad	0.922	0.658	1.000
					20	The Royal Bank of Scotland Berhad	0.740	0.659	0.681
					21	United Overseas Bank (Malaysia) Bhd.	0.991	0.779	0.933
					22	EON Bank	0.960	0.578	0.645
	MEAN	0.734	0.745	0.670		MEAN	0.897	0.755	0.856

Note: CE: Cost Efficiency, RE: Revenue Efficiency, PE: Profit Efficiency

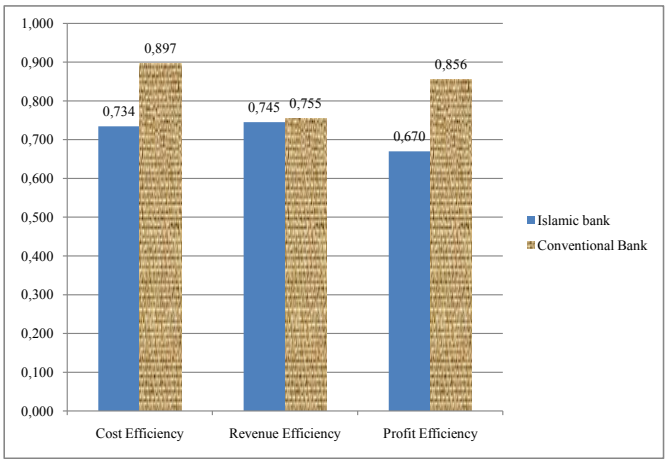

Fig.1: Graph on Cost, Revenue and Profit Efficiencies for Malaysian Islamic and Conventional Banking Sectors in Period 2006-2009

Banks are said to have slacked if they fail to fully minimise the cost and maximise the revenue (profit inefficiency). The levels of cost inefficiency, revenue inefficiency and profit inefficiency are shown as 26.6 %, 25.5 % and 33 % respectively.

Findings are noted in which on the average, the Islamic banks are found to be more revenue efficient. They managed to utilise their inputs to generate revenues and profits. For revenue efficiency, the average bank could generate 74.5 % of the revenues than it was expected to generate. Hence, there is only a slack of 25.5 %, meaning that the average bank lost an opportunity to receive 25.5 % more revenue, giving the same amount of resources, or it had to produce 25.5 % of its outputs with the same level of inputs.

As for cost efficiency, the results mean that the average bank had utilised only 73.4 % of the resources or inputs in order to produce the same level of output. In other words, on the average, the Malaysian banking sector had wasted 26.6 % of its inputs, or it could have saved 26.6 % of its inputs to produce the same level of outputs. Therefore, there was substantial room for significant cost savings for these banks if had they employed their inputs efficiently.

Noticeably, the highest level of inefficiency is on the cost side, followed by profits. Similarly, the average bank could earn 67 % of what was available, and lost the opportunity to make 33 % more profits when utilising the same level of inputs. Consequently, profit efficiency (67 %) is lower than cost efficiency (73.4 %) due to higher revenue efficiency (74.5 %) levels. Therefore, the higher revenue efficiency seems to have contributed to the lower profit efficiency or higher profit inefficiency levels compared to cost efficiency levels.

Malaysian Conventional Banks

The empirical findings presented in Table 4 seem to suggest that Malaysian conventional banks have exhibited a mean of cost

efficiency, revenue efficiency and profit efficiency (inefficiency) of 89.7 % (10.3 %), 75.5 % (24.5 %) and 85.6 % (14.4 %) respectively.

For cost efficiency, the results mean that the average bank utilised only 89.7 % of the resources or inputs to produce the same level of output for conventional banks. In other words, on the average, conventional banks wasted 10.3 % of their inputs, or they could have saved 10.3 % of their inputs to produce the same level of outputs. If the conventional banks had fully utilised their inputs, they could have saved on costs.

Nevertheless, it is noted that on the average, conventional banks were more cost-efficient in utilising their inputs compared to their ability to generate revenue and profit. For revenue efficiency, the average bank could only generate 75.5 % of revenue, less than what it was initially expected to generate. Hence, revenue was lost by 24.5 %, meaning that the average bank lost an opportunity to receive 24.5 % more revenue given the same amount of resources, or it could have produced 24.5 % of its outputs given the same level of inputs.

Obviously, the inefficiency is on the revenue side, followed by profit. Similarly, the average bank could earn 85.6 % of what was available, but lost the opportunity to make 14.4 % more profits from the same level of inputs. Even though the cost efficiency is highest in conventional banks, the revenue efficiency is found to be lower, and this led to higher revenue inefficiency. When both efficiency concepts (revenue and cost efficiency) are compared, the higher revenue inefficiency is seen to have contributed to the higher profit inefficiency.

In conclusion, the empirical findings from this study seem to suggest that conventional banks have exhibited a higher efficiency level for all three efficiency measures [e.g. cost efficiency (89.7 % vs. 73.4 %), revenue efficiency (75.5 % vs. 7.45 %), and profit efficiency (85.6 % vs. 67 %)]. In essence, revenue efficiency seems to have played the main factor that led to the lower or higher profit efficiency levels. Besides, results for the conventional banks show that the level of profit efficiency is lower than that of cost efficiency due to the lower revenue efficiency or higher inefficiency level from revenue. Meanwhile, the level of profit efficiency is lower than cost efficiency due to the higher revenue efficiency level from revenue for the Islamic banks.

The levels of cost, revenue and profit efficiency on conventional and Islamic banks were performed by a series of parametric (t-test) and non-parametric (Mann-Whitney [Wilcoxon]) and Kruskal-Wallis tests. Coakes and Steed (2003) suggest that the Mann-Whitney (Wilcoxon) 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, so it was decided that Mann-Whitney tests should be used. This study uses parametric and non-parametric tests in order to obtain robust results.

Robustness Tests

Table 5 shows the robustness tests results from the parametric and non-parametric tests of the data. The results of cost efficiency from the parametric t-test show that Malaysian Islamic banks exhibit a lower cost efficiency mean than conventional banks (0.734<0.897), and it is significantly different. Meanwhile, the profit efficiency reported that the Islamic banks also show a lower profit efficiency mean than conventional banks (0.67<0.856) and that it is significantly different. The results from the parametric t-test were further confirmed by non-parametric Mann-Whitney (Wilcoxon) and Kruskall-Wallis tests. Therefore, this suggests that the cost and profit efficiency of Islamic banks was lower than for conventional banks.

However, an interesting result is obtained regarding the revenue efficiency of Malaysian Islamic and conventional banks. The results from the parametric *t*-test indicate that revenue efficiency of the Islamic banks was lower compared to that of conventional banks (0.745<0.755). However, the results should be interpreted with caution since the difference is not statistically significant at any conventional levels. The results seem to suggest that the revenue efficiency of the conventional banks is not as efficient as that of Islamic banks. Furthermore, this revenue efficiency has not significantly influenced the levels of the cost

TABLE 5
Summary of Parametric and Non-Parametric Tests on Malaysian Islamic and Conventional Banks

	Test groups					
	Parametric test		Non-parametric test			
Individual tests	t-test		Mann-Whitney [Wilcoxon Rank-Sum] test		Kruskall-Wallis Equality of Populations test	
Hypothesis			MedianIslamic = MedianConventional			
Test statistics	*t(Prb>t)*		*z(Prb>z)*		*X^2 (Prb > X^2)*	
	Mean	*t*	Mean Rank	*z*	Mean Rank	*X^2*
Cost Efficiency						
Islamic banks	0.734	–5.835***	59.86	–4.593***	59.86	21.097***
Conventional bank	0.897		92.90		92.90	
Revenue Efficiency						
Islamic banks	0.745	-0.238	76.60	-0.470	76.60	0.221
Conventional bank	0.755		79.97		79.97	
Profit Efficiency						
Islamic banks	0.670	–4.415***	63.85	–3.805***	63.85	14.481***
Conventional bank	0.856		89.82		89.82	

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

and profit efficiency in both types of bank. Both the non-parametric Mann-Whitney (Wilcoxon) and Kruskall-Wallis tests also indicate the same. This study concludes that only cost and profit efficiency have higher levels in Malaysian conventional banks rather than in Islamic banks.

CONCLUSION

The study was carried out with the main purpose of identifying the levels of the cost, revenue and profit efficiency in Malaysian Islamic and conventional banks over the period 2006 to 2009. To recap, a few studies have examined the comprehensive efficiency that consists of these three components of cost, revenue and profit efficiency. Most of the previous studies have mainly focused on the efficiency of cost or profit or both. Therefore, by examining overall efficiency including revenue efficiency, more robustness results can be produced in order to identify the most efficient banks in Malaysia.

The non-parametric Data Envelopment Analysis (DEA) methodology was applied to distinguish between the three different types of efficiency, which are cost, revenue and profit efficiency. Furthermore, this study has performed a series of parametric (t-test) and non-parametric tests (Mann-Whitney [Wilcoxon] and Kruskall-Wallis) in order to obtain robustness results.

The results of this study show that they are statistically significant in terms of difference on cost and profit efficiency levels between Malaysian Islamic and conventional banks. The study discovers that the cost and profit efficiency for Malaysian Islamic banks are at the lower levels compared to the Malaysian conventional banks. In addition, the difference levels between cost and profit efficiency in the Malaysian banking sector are not influenced by the revenue efficiency level since the insignificant results are discovered but it may be due to the internal (bank-specific characteristics) and external (macroeconomics) factors.

The research concludes that Malaysian conventional banks are more efficient since both cost and profit efficiency show higher levels than for Islamic banks. Findings from studies on these efficiency concepts provide guidance and better information and fill in the gaps in current literature, therefore, benefiting regulators, the banking sector itself, investors and academicians when they have to make decisions for the future. In addition, to ensure the competitiveness of the Malaysian Islamic and conventional banking sectors, the other determinants on internal and external factors need to be considered as well. Thus, from the regulatory perspective, the performance of banks will be based not only on their efficiency but also on the other potential determinants.

Moreover, in view of the increasing competition attributed to the more liberalised banking sector, bank management as well as policymakers will be more inclined to identify and find an effective and efficient way to obtain the optimal utilisation of capacities. Therefore, the resources will fully utilise and eliminate wastage during the production of banking products and services.

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