Global Financial Crisis and Islamic Bank Efficiency: Are Efficiencies Stable or Impacted? Evidence From Malaysian Islamic Banks

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In examining the impact of the global financial crisis on loan and deposit efficiencies, Data Development Analysis (DEA) is applied in estimating the technical efficiency of loans and deposits of the Islamic of Malaysia during 2008-2013. This study found that the average loan efficiency was 0.83., 0.88, 0.87, 0.95, 1.0, and 0.94 and the deposit efficiency was 0.87, 0.94, 0.94, 0.96, 0.92, and 0.96 during 2008-213 respectively. A comparison of two efficiencies found deposit efficiency dominated the loan efficiency. Second, in testing stability of the efficiencies, this paper used both parametric and the non-parametric tests, as suggested by Jarque Bera Test. Results of parametric test,(ANOVA F-test, t-test, and Welch F-test, and the non-parametric tests, Wicoxon/Mann-Whitney, Median Chi-square, performed on loans and deposits between the global financial crisis period and the post global financial crisis period, found no significant differences between efficiencies of the two period. The failure to reject the null hypothesis of the equality of the mean and median efficiencies between the global financial crisis and the post global financial crisis period suggests that the efficiencies of the Islamic banks of Malaysia are stable. The global financial crisis had no impact on the technical efficiencies of the Islamic banks of Malaysia.

Keywords: Malaysia, Islamic bank efficiency, stability, DEA, parametric and non-parametric tests, global financial crisis

INTRODUCTION

The Global Financial Crisis had a serious impact on the world economy, banking sector in particular. The U.S. housing market collapsed, unemployment exceeded over 10 percent, and the growth rate of the economy was negative. The most devastating effect was seen in the financial sector.

In the banking sector, one hundred forty banks went bust in 2009 and 157 banks were wiped out in 2010 (Time: January 2012). Such large-scale bank failure never occurred in the financial history of the United States since the Great Depression (Samad, 2013).

During the same period (2009-2013), there is a phenomenal growth of Islamic Banking. The deposits and assets of Islamic banks grew globally. According to the Ernst & Young firm's estimates "Islamic banking assets grew at an annual rate of 17.6% between 2009 and 2013 and will grow by an average of 19.7% to 2018" (Economist: September 13th -19th, 2014). Paul Koster, Chief Executive of DFSA said the Islamic finance industry is set to grow from $700 billion to $4 trillion by 2013, and despite the global financial crisis (GFC), Islamic banking is still projected to grow by 15-20 percent annually (Koster, 2009).

Given Ernest & Young's (2014) claim that "Islamic banking asset grew at an annual rate of 17.6% between 2009 and 2913" when there were large bank failures in the U.S. and around the world, the study

of the efficiencies of Malaysian Islamic banks during the global financial crisis period and the post global financial period is an important contribution in the banking literature.

In South East Asia, Malaysia is an important hub of the Islamic banking. It has a large number of Islamic banks operating side by side with interest-based conventional banks. The growth of Islamic banks in Malaysia is phenomenal. The number of Islamic banks is almost the same as the number of conventional banks. There are sixteen Islamic banks competing with twenty-seven conventional banks. Competition is strong and growing. The increased competition had an impact on banks' efficiency. The growth of loan efficiency and deposit efficiency of the Islamic banks is presented in Figure 1 and Figure 2.

FIGURE 1
LOAN EFFICIENCY OF BANKS DURING 2008-2013

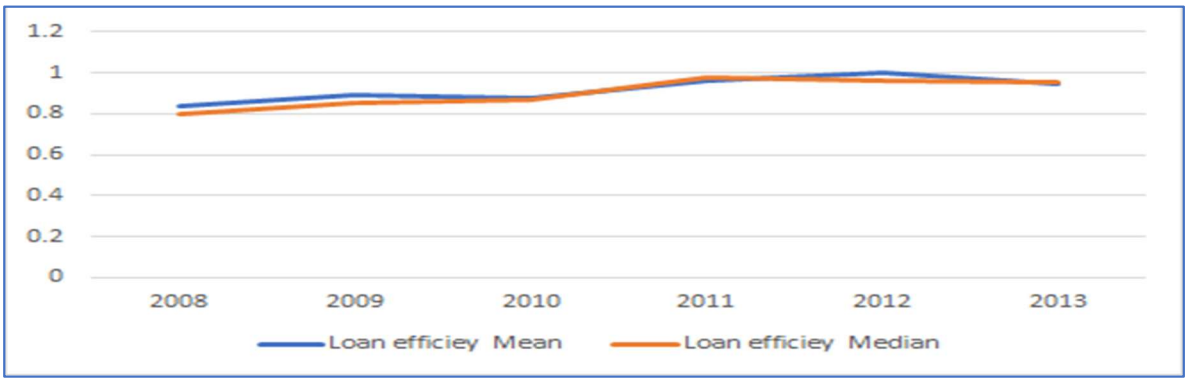
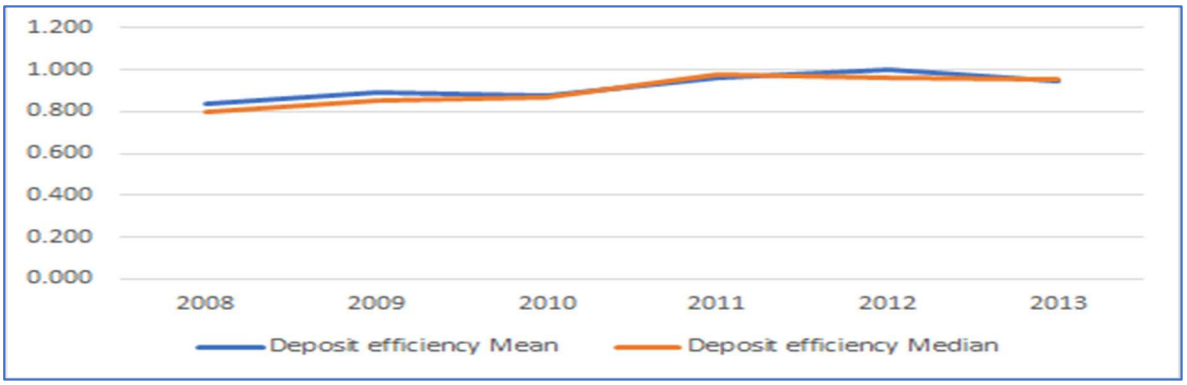


FIGURE 2
DEPOSIT EFFICIENCY OF BANKS DURING 2008-2013



Both Figure 1 and Figure 2 shows that the mean efficiency for the loans and deposits increased and were in the range between low 80 percent and high 90 percent except in 2012. In 2012 the average loan and deposit efficiency was 100 percent.

Both figures show that the median efficiency for the loans and deposits increased and were in the range between the low 80 percent and high 90 percent except in 2012. In 2012 the average loan and deposit efficiency was 100 percent.

However, the stability of the efficiency of Islamic banks has not been explored in the context of the 2008-2010 global financial crisis.

The exploration of the stability of efficiency of the Islamic banks of Malaysia is important from both microeconomic and Macroeconomic points as viewed by Berger and Mester (1997). From a microeconomic perspective, it is seen that there is an increase in competition in the banking sector. The competition in the

Malaysian banking industry is enhanced due to (i) a large entry of foreign banks and (ii) the increase in the number of domestic banks. The growing economy of Malaysia opens the door of more conventional and Islamic banks. As a result, competition among banks in Malaysia is enhanced.

The efficiency of the productivity of banks including Islamic banks is of great interest to public authorities supervising and regulating banks, bank managements and bank depositors and borrowers. Each of them is interested to know how their loans and deposit efficiency of banks. In a competitive market environment, bank depositors and borrowers are certainly interested to know the efficiency status of individual banks before they deposit their hard-earned savings. The borrowers of banks move to the banks which are more efficient in advancing loans.

The study of the efficiency level of Malaysian Islamic banks is compelling for other reasons. Although Ernst & Young firm and Paul Kushner provided a laudable picture of Islamic banks, there is no empirical evidence to substantiate their claims. Sufian and Majid (2006) rightly remarked: "empirical work on Islamic banks efficiency, particularly in Malaysia is still in its infancy" (p. 4). More empirical studies are emphasized.

More importantly, the survey literature shows that there is no empirical study on the stability/comparative efficiency of Malaysian Islamic banks between the Global Financial Crisis period (GFCP) and the post Global Financial Crisis (PGFC). Providing an empirical evidence, this study is, thus, an important contribution to banking literature.

This paper is organized as: Section 2 outlines the unique characteristics of Islamic bank. Section 3 outlines a short survey of literature. Section 4 describes data, methodology, and the variable of models. Empirical results and conclusions follow in Section 5.

Islamic Banking and Its Product Features

Exploring efficiency of the Islamic banks requires an understanding of the Islamic banking mode of operation. Because Islamic banks are a different breed of financial institution. In Islam, there is no separation of religion and the everyday business-economic or/and state-political activities. The most distinguishing feature of Islamic financial institutions/ banks (IFI) derived from the Quran and the Shariah law is the prohibition of" riba" i.e. usury. Although the Quran did not explain what riba is, the word "riba" currently interpreted by the Shariah scholars as equivalent to interest rate and the Quran, the Divine book of Islam strongly prohibits riba in all business transactions. The Quran says: "…whereas Allah permitted trading and forbidden riba" (Quran: 2: 275). However, neither the Quran nor the Prophet of Islamic did define what riba is[1]. Because of its prohibition, Islamic banks do not charge interest in lending and borrowing activities.

The prohibition of interest in business gives rise to the development of unique financial products by the Islamic banks. Such as (i) Musharakah (ii) Muderabah (iii) Murabahah (iv) Bai Baithaman Ajil' (v) bai al-salam (vi) Ijarah (vii) Istisna.

There are two types of the financing contracts of Islamic banks. They are equity type and debt type contracts. Musharakah' (partnership) and Mudarabah'(trust financing) are equity type contracts (Hamwi and Aylward (1999).

Musharakha is a partnership and joint venture contract between the Islamic bank and the investor where both parties provide capital and manage funds and projects. Profits or losses accruing from the venture are distributed based on the proportion of capital and predetermined agreement. The key features of this contract are: (i) Profit and loss sharing (PLS). Both parties share profits or loss. Unlike conventional bank equity contracts where banks do not bear the risk of financing investments, Islamic banks share the risk of investment. (ii) Unlike conventional banks' equity contracts where banks enjoy the fixed rate of return from investments, even when there are losses for the project, there is no predetermined rate of returns on investments for Islamic banks. Thus, PLS, avoiding fixed interest, is a key feature of Islamic financing. Justice requires that both share the risk of business.

Mudarabah is a trust financing contract between Islamic banks and investors where Islamic banks provide all funds for a project and investors provide physical labor, intellectual, and management skills. Profits from the projects are distributed based on a pre-agreed (ratio) arrangement. However, in cases of

losses, banks, the provider of funds (called rab al maal), will bear the losses of fund and investor will bear the loss of his labor. The key feature of this contract is that there is no predetermined fixed rate of returns for the bank; and both parties share the risk of investment.

The key features of the *Musharakha* and *Muderaba* contract are: (i) Profit and loss sharing (PLS). Both parties share profits or losses. Unlike conventional bank equity contracts where banks do not bear the risk of financing investments, Islamic banks share the risk of investment. (ii) Unlike conventional banks' equity contracts where banks enjoy the fixed rate of return from investments, even when there are losses for the project, there is no predetermined rate of returns on investments for Islamic banks. Thus, PLS, avoiding fixed interest, is a key feature of Islamic financing. Justice requires that both share the risk of business.

Murabaha financing is a debt type contract. Murabaha mode of financing is based on a 'mark-up' arrangement in which goods or assets are purchased by the bank on behalf of a client, and are sold to the client at a price equal to the cost of the item(s) plus a profit margin. Under the Murabaha financing contract, a client wishing to buy goods or assets approaches an Islamic bank to buy them on his behalf. The Islamic bank then buys the product at the current market price and adds a profit margin to it, and then re-sells the product to the client. The key feature is that there is no fixed interest involved, although the critiques of Islamic banks do not admit it. They call it a "back door for interest-based financing" (Chong and Liu, 2009).

Bai Baithaman Ajil' is a variant of the Murabah (cost plus) financing contract. The difference is that the delivery of goods is immediate, but the payment of goods is deferred. The payment may be made at installment. However, the price of the product is agreed to both parties at the time of the sale but should not include charges for the deferred payment.

Bai al-salaam is a forward sale contract where an entrepreneur sells some specific goods to the Islamic bank at a price agreed upon and paid at the time of contract, but the delivery of goods is deferred for the future.

Al-Ijera is a lease financing contract and is similar to a conventional bank lease contract. Under this contract, the Islamic bank purchases an asset for a customer and then leases it out to him for a fixed period at a fixed rental charge agreed upon at the time of purchase. A key difference with conventional bank leases is that the lessor i.e. Islamic bank retains the risk of property ownership. Note that Shariah permits fixed rental charges for the use of asset/property services.

Istisna is a financing contract under which a manufacturer or a producer produces specific goods for future delivery at a predetermined price.

The key feature of *Bai Baithaman Ajil', bai al-salam, Ijarah, and Istisna*[2] is that financing is fully securitized, and asset based. Unlike conventional banks, Islamic banks own the ownership of the goods until full payment is made.

On the liability side, deposit accounts of Islamic banks are classified into three major categories. They are: (i) Al wadiah demand deposits (ii) Mudarabah/Al Wadiah saving deposits (iii) Muderabah investment deposits.

Al Wadiah demand deposits are current deposits and are similar to conventional banks' current deposits that provide the guarantee of the safety of deposits and the payment of money on demand. However, the key difference with conventional banks' demand deposits is that the depositors of Al Wadiah deposit contract are not entitled to a fixed rate of return for their deposits. That is, depositors are not eligible for any share of profits. However, banks, at their discretion, may give a part of their profits, called hibah, to depositors for attracting deposits.

Mudarabah saving deposits of the Islamic bank are similar to conventional banks' saving deposits. The key feature of this account is the guarantee of safety and payment. Since this is a fixed deposit, banks guarantee the payments of some profits, if they are, to depositors, but banks do promise any fixed rate or amount.

Unlike the Al Wadiah demand deposits and the Mudarabah/Al Wadiah saving deposits, Muderabah investment deposit is a profit and loss sharing deposit. Muderabah investment depositors share the risk of investing their funds with banks for investment. Depositors get profits or losses based on agreements.

Usually the rate of returns is higher than Al Wadiah demand deposits and Mudarabah/Al Wadiah saving deposits. The key feature of this liability contract is that Islamic banks neither guarantee the safety of

depositors' capital nor any return on deposits. In this sense, Islamic banks', Muderabah investment deposits are riskier than those of conventional banks' fixed deposits. Second, the profits and losses sharing under this contract (Muderabah investment deposit) are not symmetric. Under this contract, banks share profits but share no losses. Depositors bear all losses ((Chong and Liu, 2009).

To sum, complete securitization of assets whether the loan financing is under the debt-type contacts or equity-type contacts is the key distinguishing feature of the Islamic banks that insulated Islamic banks assets as hypothesized in this paper, from the global financial shock, as h needs to be empirically explored.

Survey of Literature

This study mainly focuses on the efficiency literatures of single country-bank level and cross-country-bank level studies. Important studies on the single country-bank level efficiencies included are the followings:

- Using the data envelopment analysis (DEA), El-gamal and Inanoglu (2004) estimated the comparative cost efficiency of the Turkish banks for the period 1990-2000 and found that the Islamic banks were more efficient due to Islamic banks' asset-based financing.
- Sufian and Majid (2006) investigated the comparative efficiency of the foreign and domestic banks of Malaysia during 2001-2005. They found that banks' scale inefficiency dominated pure technical efficiency during the period. They also found that the foreign banks had higher technical efficiency than the domestic banks.
- Kumar and Gulati (2008) examined the technical, pure technical and scale efficiencies of the 27 public sector banks of India just for 2004. The empirical evidence of the paper showed public sector banks operated at 88.5 percent level of TE i.e. the inefficiency was 11.5 percent. Only 7 banks were technically efficient. The regression results of the paper found that the off-balance activities positively affected the Indian bank efficiency.
- Sufiyan (2009) the efficiency determinants of the Malaysian banks and found that the efficiencies were negatively related to bank expenses and economic conditions, while the efficiencies were positively related to loan intensity.
- Samad (2009) estimated technical efficiency of the Bangladesh commercial banks using stochastic frontier approach and found that the average efficiency of the Bangladesh commercial banks was 69.6 percent.
- Samad (2010) estimated the technical efficiency of the micro-financing activities of Grameen bank developed by the Nobel Laureate, Dr. Muhammad Younus.

Important cross country-bank efficiencies studies included the followings:

- Applying both Stochastic Frontier Analysis (SFA) and Data Envelopment Analysis (DEA) on 43 Islamic banks in 21 countries from Middle East, Asia, Africa and Europe over the period 1995-2001, Hassan (2006) found that Islamic banks were more cost inefficient than profit inefficient, meaning that Islamic banks were more efficient in profit-making. Technical inefficiency dominated the scale efficiency. His study confirmed the findings of Yudistira (2004) that the cross-country technical inefficiency of 18 Islamic banks of GCC during the period 1997-2000 was on average just over 10%.

  Samad (2013) investigated the efficiency of Islamic banks using the time varying Stochastic Frontier function on the Islamic banks of 16 countries. Mean efficiencies between the pre global financial crisis and the post global crisis were estimated at 39 and 38 percent respectively and the difference was not statistically significant suggesting that the efficiencies of Islamic banks did not deteriorated during the global financial crisis.

  Sufian and Noor (2009) applied the panel DEA method in estimating the technical efficiencies of the MENA Islamic banks and the Asian Islamic banks and then compared their technical efficiency over the period 2001-2006. They found that the efficiency score of the MENA Islamic banks were higher than the technical efficiency of the Asian Islamic banks. Pure

technical inefficiency was less prominent than the scale inefficiency i.e. scale inefficiency was the major source of inefficiency.

Chong and Liu (2009) examined Malaysian Islamic banks and found that the profit and loss sharing mode of finance was minimum. The growth of Islamic banking was largely driven by the Islamic resurgence rather than by advantage of the profit and loss sharing mode of production.

- Using DEA Noor and Ahmad (2012) investigated the efficiency of 78 Islamic banks operating in 25 countries during the period 1992–2009 and found that the technical efficiency of many Islamic banks in the world have increased during and after the global financial crisis period. According to them, the financial crisis has decreased trust in the conventional banking system in favor of the Islamic banking model. They further found that the pure technical efficiency scores of sampled Islamic banks were higher than their scale efficiency scores which contradicted the findings of Sufian and Noor (2009) and Yudistira (2004).
- Using the data of 25 Islamic banks in GCC countries for the period 2003-2009 and applying DEA, Srairi and Kouki (2012) found: (i) the overall technical inefficiency of GCC Islamic banks was the result of pure technical inefficiency (29.3%) rather than that of the scale inefficiency (17%). (ii) The overall technical efficiencies of the Islamic banks increased during and after the global financial crisis.
- Applying the DEA method, Rahman and Rosman (2013) and Rosman et al. (2014) compared the technical efficiency levels of Middle Eastern Islamic banks with those of their Asian counterparts over periods 2007-2009 and 2007-2010, respectively and found the technical efficiency of Middle Eastern Islamic banks declined, while the technical efficiency of the Asian Islamic banks increased.

  Hassine and Limani (2014) examined 22 MENA Islamic banks over the period 2005-2009 found that the pure technical inefficiency was the main source of Islamic banks' technical inefficiency.

  Bahrini (2016) examined the technical efficiencies of the 33 MENA Islamic banks during and after the global financial crisis using DEA and bootstrap DEA and found that the technical inefficiencies of the MENA Islamic banks were mainly attributed to pure technical inefficiencies (17.9%) rather than scale inefficiencies (9.1%).

  Nafla and Hammas (2016) compared the technical efficiencies of Islamic banks vis-à-vis conventional banks of eight countries and then determined the determinants of the technical efficiencies using DEA and Tobit models. They found that the asset quality of the Islamic banks had a positive impact during the crisis.

In sum, the survey of literature shows that no studies investigated the comparison of the stability of Malaysian Islamic banks' efficiencies as to whether efficiencies were affected by the global financial crisis. Applying both parametric and nonparametric tests on the GFC TE and the post GFC TE, this paper tested stability of efficiency. This study is, thus, an important contribution to banking literature.

DATA AND METHODOLOGY

Data

Data for all variables in estimating loan and deposit efficiencies for the period 2008-2014 are obtained from the Website if each bank's annual reports. Variables used were (i) fixed capital (FK) (ii) labor cost (wage), (iii) interest expenses (INTEX), (iv) deposit (DEPOSIT), and (v) loans. The descriptive statistics for the variables used are provided in Table 7 in the Appendix.

Methodology

Data Envelope Analysis (DEA)

This study uses DEA in obtaining the technical efficiency of each bank because the DEA is widely used in the measure of industrial efficiency since the method was originally developed by Charnes, Cooper, and

Rhodes (1978). The original model assumed that the DMUs were operating at their optimum scale and under constant returns to scale (CRS). Later the DEA model was modified by Banker, Charness, and Cooper (1984) and introduced the variable returns to scale (VRS) efficiency instead of CRS. The introduction of VRS implies that a firm may have increasing returns to scale (IRS) or decreasing returns to scale (DRS) or constant returns to scale (CRS) in efficiency. Thus, the introduction of VRS allows the breakdown of efficiency into (1) technical efficiencies (TE) and (2) scale efficiencies (SE).

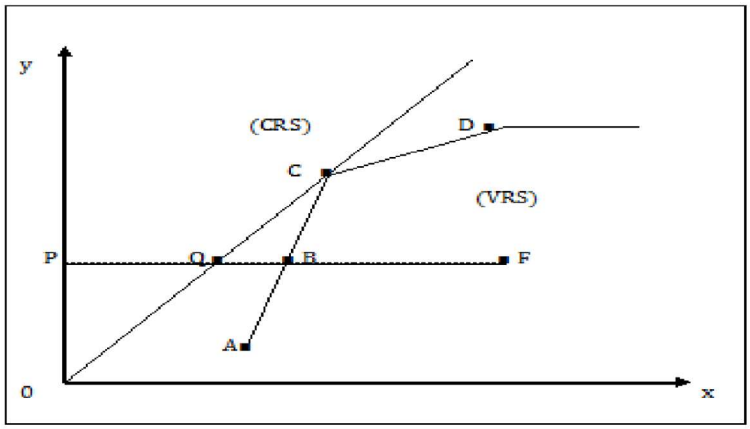
Technical efficiency (TE) of a DMU is the maximum (optimum) amount of output produced by the use of minimum inputs. In other words, TE can be achieved when the DMU produces a given level of outputs with the least amount of inputs. TE efficiency relates **to producing outputs without wasting inputs** and that cannot be deviated from the optimum scale (scale efficiency).

On the other hand, a DMU is said to be scale efficient (SE) when its size of operation is optimal so that any modification of its size will make the DMU less efficient. Kirigia and Asbu (2013) classified TE into pure TE (PTE) and SE where the SE is defined as "a measure of the extent to which a health decision making unit deviates from the optimum scale (defined as the region in which there are constant returns to scale in the relationship between inputs and outputs). Following Charness, Cooper, and Rhodes (1978), the technical efficiency (TE) of a DMU (a bank) can be expressed as a maximum ratio of total sum of weighted outputs to the total sum of weighted inputs. In other words,

$$\text{TE}= \frac{Weigthed\ sum\ of\ bank\ outputs}{Weighted\ sum\ of\ bank\ inputs}.$$

The difference between the CCR and BCC models can be illustrated by the following figure:

FIGURE 3
CRS AND VRS EFFICIENCY FRONTIERS



Coelli et a, 2005

The line through the points Q and C represents the CRS efficiency frontier and the curve (ABCD) represents the VRS efficiency frontier. Each DMU that is on the frontier is technically efficient. For this reason, the particular DMU "F" is technically inefficient. When we refer to the CRS frontier, the distance FQ measures the technical inefficiency of the DMU "F". However, when we consider the VRS frontier, the technical inefficiency of the DMU "F" is only the distance FB. The difference between the CRS and the VRS frontiers is the distance QB which is a measure of scale inefficiency.

The overall technical efficiency score (under the CRS frontier): TE_{CRS} = PQ/PF

The pure technical efficiency score (under VRS frontier): TE_{VRS} = PB/PF

The scale efficiency score: SE = PQ/PB

From this, we can deduce that $TE_{CRS} = TE_{VRS}$ x SE which means that the overall technical efficiency (OTE) of a particular DMU is the product of two efficiencies: pure technical efficiency (PTE) and scale efficiency (SE).

Suppose that there are n-number of DMUs to be evaluated. Each DMUj, *j =1, …., n* uses *m* different inputs, noted *(i = 1, . . ., m),* to produce *s* different outputs, noted *(r = 1, . . ., s)*. The technical efficiency score for a particular DMU, called DMUo, is determined by solving the following linear programming problem. The technical efficiency score θ for a particular DMU, called DMUo, is determined by solving the following linear programming problem:

$$\begin{aligned} &\theta^* = \text{Min } \theta \\ &\text{s.t. } \sum_{j=1}^{n} \lambda_j x_{ij} \leq \theta x_{io} \qquad i = 1, \ldots \ldots, m; \\ &\quad \sum_{j=1}^{n} \lambda_j y_{rj} \geq y_{ro} \qquad r = 1, \ldots \ldots, s; \\ &\quad \lambda_j \geq 0 \qquad j = 1, \ldots \ldots, n; \end{aligned} \tag{1}$$

$\theta < 1$ Means that the evaluated DMU is technically inefficient. $\theta = 1$ Indicates a point on the frontier and hence a technically efficient DMU. In order to estimate the efficiency scores of all the DMUs in the sample, the above problem must be solved n times, once for each DMUj, *j =1, n* (Coelli et al., 2005).

Input-Output Controversy and Model Selection

In a single production firm such as coal mine, inputs and outputs are easy to find. The output is the amount of coal and the inputs are labor and capital. However, in the multiproduct firms such as banks which produces a series of services and uses vectors of inputs, deciding inputs and outputs are controversial. Which are bank's inputs and which are bank's outputs are a debatable issue for a long time.

Based on the production approach (Benston, 1965), a bank is a producer of services for the bank account holders and it produces deposit accounts and loan services with labor and capital. In this sense, the number of deposit accounts or deposits can be used as output. Depositors' income which is equivalent to interest paid to depositors is an import factor for mobilizing total deposits.

Under the intermediation approach, a bank is a financial intermediary which collects deposits from the savers and channels funds to borrowers. In this sense, loans and advances are the outputs of a bank and inputs are labor, capital and deposits.

Based on the production and intermediary approach discussed above, this paper estimates the following two models using DEA method with variable returns to scale assumption for each bank during 2008-2013.

Model A: $Deposit_j = X1 + X2 + X3$

where X1-= Capital costs, X2 = Interest expenses, X3 = Labor cost

Model B = $Loans_j = X1 + X2 + X3$

where X1-= Fixed capital, X2 = Deposit, X3 = Labor cost

Parametric and Non-Parametric Tests

The stability of efficiency between the 2008-210 GFC and the 2011-2013 post GFC was tested by comparing the Null hypothesis that GFC had no impact against the alternative hypothesis that the post global financial crisis (postGFC) had impact.

The testable Null hypothesis is: H_0: $\mu_{GFC} = \mu_{postGFC}$

where μ_{GFC} = mean efficiency of the global crisis period and $\mu_{tpostGFC}$ =mean efficiency of the post global crisis period.

The testable Alternative hypothesis is: $H_a : \mu_{GFC} \neq \mu_{postGFC}$: There is a difference in the efficiency level between the global financial crisis and the post global financial crisis.

If the null hypothesis ($H_{0:}\ \mu_{GFC} = \mu_{tpostGFC}$) that there no difference in the efficiencies of Islamic banks between the GFC and post GFC is rejected, it can be concluded that the efficiency level of the Islamic banks is not stable i.e. global financial crisis had has impacted on the efficiencies Malaysian Islamic banks. On the other hand, if the null hypothesis cannot be rejected, it can be concluded that the efficiencies of Islamic banks remained the same between the two periods, suggesting that the global financial shock has had no impact on the efficiencies of Islamic banks. The efficiencies of the Islamic banks were stable.

For testing the null and the alternative hypotheses, efficiency of banks for the entire period 2008-2013 is divided into two samples. Sample 1 consists of bank efficiencies during the 2008-2010 global financial crisis period (GFC). Sample 2 consists of the bank efficiency during 2011-2013 as the post global financial crisis (PGFC) period.

Whether the efficiency level of the Islamic banks between the global financial crisis period and the post global financial crisis period remains stable is tested by the parametric tests and non-parametric tests. Parametric tests include t-test, ANOVA (Analysis of Variance) F-test, and Walch-F test. On the other hand non-parametric tests include Wilcoxon/Mann-Whitney test, Kruskal-Wallis test.

Jarque Bera Test

Whether to apply the parametric test or the non-parametric or the both tests depends on the normal distribution of the series. Parametric test is appropriate if the variables (efficiency) of both sample periods are normally distributed. On the other hand, both parametric and non-parametric tests are applied if the variable of one sample is normally distributed and the other is not.

In this paper, a Jarque Bera test is applied in determining whether the efficiency series are normally distributed. The failure to reject the null hypothesis at a probability less than 0.10 confirms that the variable is normally distributed. Otherwise, the variable is not normally distributed.

Empirical Results

The descriptive statistics of the technical efficiency for loans and deposits of the Islamic banks of Malaysia during 2008-2013 Table 1 and Table 2.

Comparative loans efficiency and deposits efficiency is presented in Figure 3. The division of the descriptive statistics of loan efficiency into the 2008-2010 GFC and the 2011-213 post GFC is presented in Table 3.

The descriptive statistics of the division of deposit technical efficiency into the GFC and the post GFC is presented in Table 4.

Result of parametric test for loans efficiency and deposits efficiency between the GFC and the post GFC is presented in 5.

Result of non-parametric test for loans efficiency and deposits efficiency between the GFC and the post GFC is presented in 6.

TABLE 1
DESCRIPTIVE STATISTICS OF THE DEA LOAN EFFICIENCY OF ISLAMIC BANKS

	2008	**2009**	**2010**	**201111**	**2012**	**2013**
Mean	0.836000	0.888412	0.873059	0.958706	1.0047867	0.942800
Median	0.795000	0.855000	0.868000	0.978000	0.961000	0.952000
Observations	17	17	17	17	15	15

Table 1 shows that the mean loan efficiency of the Islamic banks increased over the years 2008-20013 except in 2012. The average loan efficiency during 2008-2013 was 0.83., 0.88, 0.87, 0.95, 1.0, and 0.94 respectively.

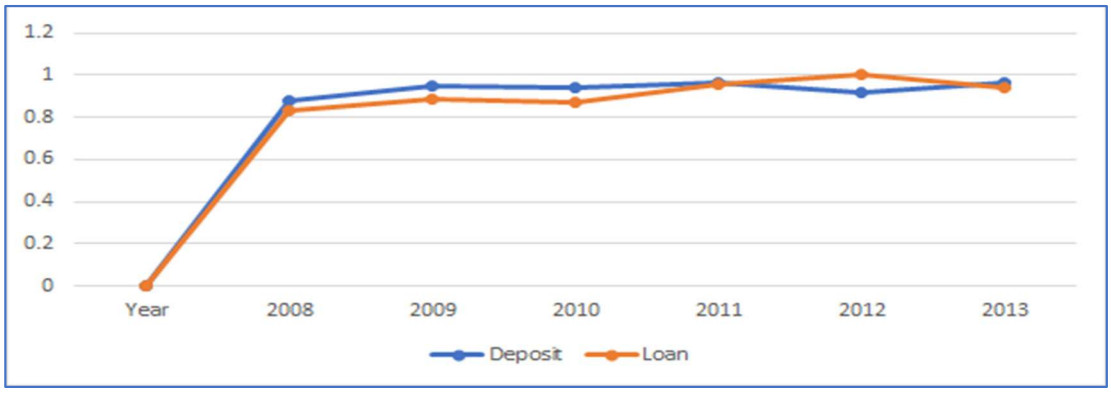
This efficiency i.e. 0.83., 0.88, 0.87, 0.95, 1.0, and 0.94 indicates that the average input wastage of banks was 17 percent, 12 percent, 13 percent, 5 percent, 0 percent, 4 percent respectively during the years. Banks were 100% loan efficient in 2012. Except 2012, the percentage of inefficiency suggests that banks could easily increase their loan financing either by using the existing level of resources or keep the same level of efficiency without using existing resources.

TABLE 2
DESCRIPTIVE STATISTICS OF THE DEA DEPOSIT EFFICIENCY OF ISLAMIC BANKS

	2008	**2009**	**2010**	**2011**	**2012**	**2013**
Mean	0.876353	0.948000	0.942529	0.963176	0.921333	0.963667
Median	0.880000	0.981000	0.950000	1.000000	0.914000	1.000000
Observations	17	17	17	17	15	15

Table 2 shows that the mean deposit efficiency of the Islamic banks increased over the years 2008-20013 except in 2012. The average loan efficiency during 2008-2013 was 0.87, 0.94, 0.94, 0.96, 0.92, and 0.96 respectively. This efficiency i.e. 0.83., 0.88, 0.87, 0.95, 1.0, and 0.94 indicates that the average input wastage of banks was 13 percent, 6 percent, 6 percent, 4 percent, 8 percent, 4 percent respectively during the years. Banks' percentage of inefficiency suggests that banks could easily increase their loan financing either by using the existing level of resources or keep the same level of efficiency without using existing resources.

FIGURE 4
A COMPARISON OF MEAN AND LOAN EFFICIENCY



A comparison between the mean deposit efficiency and the mean loan efficiency shows deposit efficiency of the Islamic banks of Malaysia dominated the loan efficiency. This was reflected by the higher percentage of technical efficiency in deposits than loans except in 20112. In 1212 loans' technical efficiency was higher than that of deposits.

TABLE 3
DESCRIPTIVE STATISTICS OF LOAN EFFICIENCY DURING GFC AND THE POST GFC

Variables	2008-2010 GFC Efficiency	2011-2013 Post GFC Efficiency
Mean	2.597471	3.156353
Median	2.529000	2.793000
Maximum	3.000000	11.72700
Minimum	2.057000	1.000000
Std. Dev.	0.336928	2.284848
Skewness	-0.159506	3.318321
Kurtosis	1.571183	13.21472
Jarque-Bera	1.518161	105.1065
Probability	0.468097	0.000000
Sum	44.15700	53.65800
Sum Sq. Dev.	1.816332	83.52851
Observations	17	17

TABLE 4
DESCRIPTIVE STATISTICS OF DEPOSITS EFFICIENCY DURING THE GLOBAL FINANCIAL CRISIS AND THE POST GLOBAL CRISIS

Variables	2008-2010 GFC Efficiency	2011-2013 Post GFC Efficiency
Mean	2.766882	2.626412
Median	2.740000	2.874000
Maximum	3.000000	3.000000
Minimum	2.433000	1.000000
Std. Dev.	0.173971	0.565915
Skewness	-0.122115	-1.816672
Kurtosis	2.054387	5.259020
Jarque-Bera	0.675630	12.96559
Probability	0.713327	0.001530
Sum	47.03700	44.64900
Sum Sq. Dev.	0.484252	5.124148
Observations	17	17

The important point to notice in Table 3 is that the data of loan efficiency variables of banks during the global financial crisis is normally distributed. This is evidenced from the probability 0.468 associated with the Jarque Bera statistics 1.518. On the other hand, the efficiency series of the post global financial crisis is not normally distributed. The null hypothesis of normal distribution is rejected and is evidenced by the probability 0.000 associated with the Jarque Bera statistics 105.105.

The normal distribution of efficiency variables during the GFC period and the non-normal distribution of the series during the post GFC period suggests the application of parametric tests and non-parametric tests in determining whether two means of the two periods are equal.

Similarly, it is found in Table 4 that two series of deposit efficiencies of the Islamic banks were not equally distributed during the global financial crisis and the post global crisis period. The normal distribution of efficiency variables during the GFC period and the non-normal distribution during the post GFC period suggests the application of parametric tests and non-parametric tests in determining the equality of two means.

This is evidenced from the probability 0.7133 associated with the Jarque Bera statistics 0.6756. On the other hand, the efficiency variable of banks during the post global financial crisis is not normally distributed. The null hypothesis of normal distribution is rejected and is evidenced by the probability 0.0015 associated with the Jarque Bera statistics 12.965.

The normal distribution of deposit efficiency during the GFC period and the non-normal distribution during the post GFC period suggests the application of parametric tests and non-parametric tests for determining the equality of efficiency between the two periods.

Results of the parametric tests and non-parametric tests are provided in Table 5 and Table 6.

TABLE 5
PARAMETRIC TEST RESULTS OF THE NULL HYPOTHESIS

	Parametric Tests: H_0: $\mu_{GFC} = \mu_{Pgfc}$								
	ANOVA F-test			**t-test**			**Welch F-test***		
Variable	df	Values	Probability	df	Values	Probability	df	Values	Probability
Loan eff	(1, 32)	0.99	0.32	32	-0.99	0.32	(1,16.69	0.99	0.32
Deposit eff	(1,32)	0.95	0.33	32	0.97	0.33	(1,18.99	0.95	0.34

*Test allows for unequal cell variances

The results of all parametric tests, ANOVA F-test, t-test, and Welch F-test, for both loans and deposits efficiency fail to reject the null hypothesis of the equality mean efficiency between the global financial crisis and the post global financial crisis period. The failure to reject the null hypothesis suggests that the efficiencies of Islamic banks are the same. This also suggests that the global financial shock has had no adverse impact on the efficiencies of Islamic banks of Malaysia. The efficiencies of the Islamic banks are stable.

TABLE 6
NON-PARAMETRIC TEST RESULTS OF THE NULL HYPOTHESIS

	Non Parametric Tests: H_0: $Median_{GFC} = Median_{pGFC}$								
	Wilcoxon/Mann-Whitney			**Median Chi-square**			**Kruskal-Wallis**		
Variable	df	Values	Probability	df	Values	Probability	df	Values	Probability
Loan eff		0.79	0.42	1	1.05	0.30	1	0.65	0.41
Deposit eff		0.34	0.73	1	1.05	0.30	1	0.13	0.71

The results of all non-parametric tests such as Wicoxon/Mann-Whitney, Median Chi-square, and Kruskal-Wallis for both loans and deposits efficiency fail to reject the null hypothesis of the equality mean efficiency between the global financial crisis and the post global financial crisis period. The failure to reject the null hypothesis suggests that the efficiencies of Islamic banks are the same between the global financial crisis and the post global financial crisis.

As there are no significant differences between the median efficiencies of the two periods, this suggests that the efficiencies of the Islamic banks were stable. The global financial crisis hds had no adverse impact on the efficiencies of Islamic banks of Malaysia. The efficiencies of the Islamic banks are stable. Global financial crisis did impact the efficiencies of the Islamic banks of Malaysia.

CONCLUSIONS

In examining the impact of the global financial crisis on loan and deposit efficiencies, DEA is applied in estimating the technical efficiency of loans and deposits of the Islamic of Malaysia during 2008-2013. The results of the DEA estimate showed that the average technical efficiency of Islamic banks in loan financing ranged between 83 percent and 100 percent during 2008-2013.

Results of the estimate of loan efficiency, Table 1, were. 0.83., 0.88, 0.87, 0.95, 1.0, and 0.94 during 2008-2013 which suggested that the average input wastage of Islamic banks of Malaysia was 17 percent, 12 percent, 13 percent, 5 percent, 0 percent, 4 percent respectively during the years.

Results of the estimate of deposit efficiency, Table 2, showed that the mean deposit efficiency of the Islamic banks increased over the years 2008-20013 except in 2012. The average loan efficiency during 2008-2013 was 0.87, 0.94, 0.94, 0.96, 0.92, and 0.96 respectively suggesting that the average input wastage of banks was 13 percent, 6 percent, 6 percent, 4 percent, 8 percent, 4 percent respectively during the years. Banks' percentage of inefficiency suggests that banks could easily increase their loan financing either by using the existing level of resources or keep the same level of efficiency without using existing resources.

Results of the comparative efficiencies, Figure 4, demonstrated that deposit efficiency of the Islamic banks of Malaysia dominated the loan efficiency. This was reflected by the higher percentage of technical efficiency in deposits than loans except in 20112. In 1212 loans' technical efficiency was higher than that of deposits.

In testing stability of the efficiency i.e. whether the global financial crisis had an impact on the Islamic banks of Malaysia, this study applied both parametric and non-parametric tests, as suggested by Jarque Bera Test.

Results of parametric test,(ANOVA F-test, t-test, and Welch F-test, and the non-parametric tests, Wicoxon/Mann-Whitney, Median Chi-square, performed on loans and deposits between the global financial crisis period and the post global financial crisis period, found no significant differences between efficiencies of the two period. The failure to reject the null hypothesis of the equality of the mean and median efficiencies between the global financial crisis and the post global financial crisis period suggests that the efficiencies of the Islamic banks of Malaysia are stable. The global financial crisis had no impact on the technical efficiencies of the Islamic banks of Malaysia.

Results of this paper should be interpreted carefully because of limited observation. The result of this study is based on six years. Future study should include more extended periods and robust conclusions.

ENDNOTES

1. [Umar b. al-Khattab said, "There are three thing: If God's Messenger had explained them clearly, it would have been dearer to me than the world and what it contains: (These are) *kalalah*, *riba*, and *khilafah*." (*Sunan Ibn Majah*, Book of Inheritance, Vol. 4, #2727;
2. see Samad, Gardner, and Cook (2005) and (Chong and Liu, 2009) for definition and features.
3. Values are =,000 Ringit

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APPENDIX

TABLE 7
DESCRIPTIVE STATISTICS OF INPUTS AND OUTPUTS[3]

Fixed Capital (FX)

	FK2008	FK2009	FK2010	FK2011	FK2012	FK2013
Mean	90647.72	136516.0	94464.90	93817.96	39334.58	33820.62
Median	5349.243	7500.000	7822.000	5662.000	11734.00	6642.500
Maximum	1156318.	1907143.	1160265.	1170183.	222240.0	209278.0
Minimum	176.0000	464.0000	578.0000	417.0000	235.0000	146.0000
Std. Dev.	276669.4	457554.2	278412.1	281957.1	65625.29	60474.40

Interest Expenses (INTEX)

	INTEX2008	INTEX2009	INTEX2010	INTEX2011	INTEX2012	INTEX2013
Mean	413836.5	649960.4	355639.2	439183.3	176264.1	195421.6
Median	43054.00	165113.0	111139.0	152363.0	58430.00	57076.00
Maximum	5012989.	4528635.	3160604.	3654518.	1196288.	1308113.
Minimum	6604.000	27288.00	8358.000	9594.000	9957.000	1016.000
Std. Dev.	1193114.	1203876.	750951.3	869315.9	298116.5	337067.8

Wages (WAG)

	WAG2008	WAG2009	WAG2010	WAG2011	WAG2012	WAG2013
Mean	37820.58	46431.19	193529.7	220731.7	83127.44	88120.35
Median	9281.000	19123.25	43249.00	59852.00	65148.00	69048.00
Maximum	212863.0	224561.0	2184302.	2546570.	386129.0	438850.0
Minimum	614.0000	1010.000	677.0000	799.0000	1608.000	10297.00
Std. Dev.	56247.94	57393.81	522802.4	605292.1	100234.1	110872.3

Deposits

	DEP2008	DEP2009	DEP2010	DEP2011	DEP2012	DEP2013
Mean	9551287.	11077900	17113306	20100695	15453935	18471228
Median	4306094.	4431772.	4027754.	5496732.	5377039.	8853076.
Maximum	55768861	64131506	1.75E+08	2.01E+08	70984469	83017613
Minimum	34498.65	48334.11	15306.73	20029.94	181688.0	201872.0
Std. Dev.	13398271	15758539	41494349	47568326	18329346	21655959

Loans and Advances

	LOAN2008	LOAN2009	LOAN2010	LOAN2011	LOAN2012	LOAN2013
Mean	8128836.	10260044	14835495	18936355	13915779	16564054
Median	4242329.	4833591.	4138867.	5298429.	8483879.	9175173.
Maximum	52574320	56947831	1.51E+08	1.82E+08	61308071	86135734
Minimum	249827.7	1911270.	2331.000	4561.000	148059.0	182405.0
Std. Dev.	12486782	14025794	35682146	43966797	15508633	20649469
Observations	17	16	17	16	17	17