



Do Bank Specifics and Macroeconomics Determine Banks' Efficiency? Evidence from Selected Asian Islamic Banks

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Abstract: Bank specifics and macroeconomics are utilized as banks' efficiency determinants in the 16 selected Asian Islamic banks during 2011 to 2015. First stage employed is Data Envelopment Analysis (DEA) to estimate cost efficiency, revenue efficiency and profit efficiency. Second stage employed is Dynamic panel data using Generalized Method of Moments (GMM) to determine banks' efficiency determinants. The findings suggest that revenue inefficiency found to be the biggest contributor of profit inefficiency averagely. The higher Financing intensity, capitalization and inflation are, the higher cost, revenue and profit efficiency. However, most of variables are found to be insignificant on revenue efficiency model.

Keywords: Asian Islamic banks, Bank efficiency, DEA, GMM

JEL classification: G21, C14

1. INTRODUCTION

The financial institutions has been improved in the entire world during the era of globalization by the greater of liberalization and deregulation. Islamic banking categorized as one of the institutions which rapidly grow and survive in a tough market competition (Sufian *et al.*, 2013). The World Bank (2015) briefly explained that to maintain the development of financing world widely one of effective tools commonly known as Islamic finance, non-Muslim countries are included.

International Monetary Fund (2017) added that instead of the small share in term of financial market globally, Islamic finance is still growing rapidly. The increasing of Islamic banking has penetrate in many member countries of International Monetary Fund (IMF) and systematically becomes important in Asia and the Middle East region. The assets of Islamic finance grew during 2003 to the end of 2013, from

about US\$200 billion to an estimated US\$1.8 trillion. For instance, the rate of Islamic banking surpass the conventional counterpart for about 15% in the Asia and Middle East countries.

Theoretically, it has significant differences between Islamic finance and conventional finance. The prohibition of interest payment charged (*riba*), in which the price should only be carried out by its goods and services without speculation. Therefore, the idea of profit and loss sharing and risk-sharing stand as the base of Sharia-compliant finance, which the assets and liability side should be involved with a tangible asset in the economic transactions. Thus the structures of its activity and funding will be defined clearly between Islamic and conventional banks (Becket *et al.*, 2013).

Asian countries especially Indonesia, Malaysia, Bangladesh and Pakistan categorized as several countries with the largest Muslims population in the world. The percentage of Muslim population during 2010 in Indonesia, Malaysia, Bangladesh and Pakistan were approximately 88.1%, 61.4%, 90.4% and 96.4% respectively (Pew Research Center, 2011). The study of cross country analysis, particularly in Asian countries is necessary and becomes important since Islamic banks are operating and well established in these countries.

By the rapid evolvement of Islamic financial institutions, it is expected a better efficiency of the banks to be improved. In the early 1990s, the efficiency studies of banking become crucial part to be discussed in the literature since then (Berger & Humphrey, 1997). The intermediated funds will be greater when the banks are found to be efficient, higher profitability, and the improvement of service quality hence better efficiency could be expected (Berger *et al.*, 1993). The measurement of cost and profit efficiency or even both has been the common studies (Hassan, 2006 and Mohanty *et al.*, 2016). However, it has been criticized regarding the ignorance of revenue efficiency since the level of cost efficiency used to be revealed higher than profit efficiency without discovering the causes (Bader *et al.*, 2008). Thus, Bader *et al.* (2008) and Kamarudin *et al.* (2014) measured the three concepts of efficiency and therefore this research will reveal the level of three efficiencies by employing data envelopment analysis (DEA) as non-parametric approach; cost efficiency, profit efficiency and revenue efficiency and its determinants in the Islamic banks of Asian countries during 2011 to 2015. The purpose of this research to fill the gap of efficiency studies in the Islamic banking literature by examining further steps in determining the efficiency determinants employing dynamic panel data approach in GMM procedure.

The remaining contents of the article are as follows. Literature review in the next section, followed with the data collection and methodology outlines in section 3. Empirical results and discussion provided in section 4 and conclusions in the section 5.

2. LITERATURE REVIEW

It is found to be a finite study in term of Islamic banking and finance study although the industry has been growing rapidly (Sufian & Noor, 2009). The efficiency study usually divided into two research group purposes, namely focusing in the Islamic banking efficiency and a comparison study between Islamic banking and its counterpart, conventional banking. There are several studies which focusing on Islamic banking efficiency such as; Batchelor & Wadud (2004), Shahooth *et al.* (2006), Sufian *et al.* (2008), Sufian *et al.* (2013) and Kamarudin *et al.* (2017). Furthermore, instead of only evaluating the efficiency score, some researchers

held a further study in finding the determinants of bank efficiency, namely; Yudistira (2004), Hassan (2006), Sufian & Noor (2009), Rahman & Rosman (2013) and Rosman *et al.* (2014). A comparison study as defined as the second group that compares the efficiency between Islamic and conventional banking conducted by Bader *et al.* (2008), Kamarudin *et al.* (2014) and Mohanty *et al.* (2016) as well as conducting the efficiency determinants as the second stage once efficiency scores are obtained, these researches are conducted by Foong (2016) and Al-Gasaymeh (2016).

There are several efficiency studies evaluate the cost efficiency, allocative efficiency, technical efficiency, pure technical efficiency and scale efficiency (hereafter referred as CE, AE, TE, PTE and SE) as it is a common studies among the researchers. Batchelor & Wadud (2004) attempted the efficiency in the Malaysian Islamic banking using the non-parametric method of Data Envelopment Analysis (DEA) during 1997 to 2002 to evaluate TE, PTE and SE.

Sufian *et al.* (2008) conducted an efficiency research in the industry of Islamic banking in MENA and Asian countries consist of 16 banks over the period of 2001 to 2006. They employed DEA method and the results suggest higher technical efficiency averagely in MENA countries compare to Asian Islamic banking sectors as their counterparts. Pure technical inefficiency caused by scale inefficiency in both, MENA and Asian Islamic banking industry.

Kamarudin *et al.* (2017) examined the TE, PTE and SE of Southeast Asian countries which is divided into domestic and foreign Islamic banks. There were 29 Islamic banks of domestic and foreign banks from Indonesia, Malaysia and Brunei during 2006 to 2014 employing DEA method. As exhibited by the results, it indicates a lower efficiency level of foreign Islamic banks compare to domestic Islamic banks. Domestic Islamic banks found to be higher in all types of efficiency, namely TE, PTE and SE.

Determinants of banks' efficiency are investigated once the efficiency scores are obtained and it has been done by some previous researchers. Yudistira (2004) measured TE, PTE and SE by utilizing non-parametric method DEA in the eighteen Islamic banks during 1997-2000 and the research suggests when it is compared to the conventional counterparts, the 18 Islamic banks was quite low in 10% level for the results of overall efficiency. Environmental variables are regressed on the second stage and it is found that market power has no significant impact on efficiency in the Middle East.

Hassan (2006) investigated both methods, parametric (cost and profit efficiency) and non-parametric DEA to measures CE, AE, TE, PTE and SE as a cross-country study, consist of 21 countries with 43 Islamic banks. The average efficiency score indicating less efficient of Islamic banks rather than their counterparts, conventional banks. Additionally, ROA and ROE have high correlation with the efficiency measurements.

Sufian & Noor (2009) estimated TE, PTE and SE in 16 Islamic banking industry as a comparison study of MENA and Asian countries. DEA is firstly attempted on the first stage and Tobit regression as the second stage to find the determinants of bank efficiency through internal and external factors. The results indicating that Islamic banks in MENA countries have higher technical efficiency averagely compare to the Asian countries counterparts. Financing intensity, profitability, size and capitalization have positive impact on bank efficiency, while loan loss provisions to total loans found to have negative impact.

Rahman & Rosman (2013) examined and compare the efficiency of Islamic banks in some selected MENA and Asian countries during 2006 to 2009. There are 63 Islamic banks as the sample of the research. Technical inefficiency was caused by the operations scale and pure technical efficiency was achieved generally. The results of the second stage by applying panel regression indicates a negative impact of ROA to TE and PTE, a positive impact and significant of size and capitalization to PTE and positive impact of GDP per capita to TE, PTE and SE. Rosman *et al.* (2014) examined the three efficiency measurements; TE, PTE and SE in MENA and Asian countries from 2007 to 2010 and then utilized bank specifics and risk factors to determine bank efficiency determinants. The findings indicate a positive and significant impact of profitability to TE and PTE in both MENA and Asian countries. Size found to have positive and significant impact on PTE in Asian countries. Capitalization found to have positive and significant impact to TE of MENA and Asian countries as well to PTE in Asian countries.

Briefly, most of the efficiency studies in Islamic banking are measuring the technical efficiency, pure technical efficiency and scale efficiency (TE, PTE and SE). It is a scarce study in term of cost efficiency, revenue efficiency and profit efficiency (hereafter CE, RE and PE). Shahooth *et al.* (2006) employed DEA to measure CE in 24 Islamic banking institutions and Sufian *et al.* (2013) measured the three efficiencies; CE, RE and PE in Malaysian Islamic banking sector from 2006 to 2010. Revenue inefficiency found to be the highest contributor of profit inefficiency in the domestic Islamic banks, while cost inefficiency as the highest contributor of profit inefficiency in foreign Islamic banks.

Several studies about the comparison between Islamic and conventional banks were conducted by Bader *et al.* (2008) measuring CE, RE and PE using DEA during 1990 to 2005 in Organization of Islamic Conference (OIC) countries, Kamarudin *et al.* (2014) also evaluated CE, RE and PE in Gulf Cooperative Council (GCC) countries during 2007 to 2011 with 27 Islamic and 47 conventional banks and Mohanty *et al.* (2016) examined the CE and PE in GCC countries during 1999 to 2010 in 43 banks of Islamic and conventional. Al-Gasaymeh (2016) and Foong (2016) employed Stochastic Frontier Analysis (SFA) to estimate the efficiency and apply Generalized Method of Moments (GMM) on the second stage to find its efficiency determinants. However, the determinants variables are different from this research.

As of the literatures above, the research gaps are the limited study in Islamic banks by estimating the cost efficiency, revenue efficiency and profit efficiency and then conduct the second stage to find the determinants of its banking efficiency. Therefore, this research will fill the research gap since the three efficiencies; CE, RE and SE are also important part of efficiency in the banking industry. Additionally, this research employs bank specifics and macroeconomics variables to determine the bank efficiency.

3. RESEARCH METHODS

Data Collection

The current research attempts to examine the determinants of bank efficiency by assessing its cost, revenue and profit efficiency in the selected Asian Islamic banks from 2011 to 2015. Due to data availability thus the latest five years back is selected and it would provide latest results of Islamic banks in the Asia. Bureau van Dijk produces the main source of data collection of this research, named BankScope

database that provides the balance sheets, income statements and bank specific ratios. In order to have a comparable measurement, the currencies are converted into US dollars (USD). Additionally, macroeconomics variables are selected from the world development indicator website. There were several countries in the Asian region that have Islamic banks, however there are only four countries with five years data availability in the Bank Scope. The selected countries are Indonesia, Malaysia, Bangladesh and Pakistan with 16 Islamic banks overall. Table 1 indicates the list of selected Islamic banks in this research.

Table 1
List of Asian Islamic banks during 2011-2015

<i>Islamic Banks</i>	<i>Country</i>	<i>Total</i>
PT Bank BRI Syariah	Indonesia	3
PT Bank Muamalat Indonesia Tbk		
PT Bank Panin Dubai Syariah Tbk		
Affin Islamic Bank Berhad	Malaysia	8
Al Rajhi Banking & Investment Corporation (Malaysia) Berhad		
Bank Islam Malaysia Berhad		
Bank Kerjasama Rakyat Malaysia Berhad		
HSBC Amanah Malaysia Berhad		
Maybank Islamic Berhad		
OCBC Al-Amin Bank Berhad		
Public Islamic Bank Berhad		
First Security Islami Bank Ltd	Bangladesh	3
Shahjalal Islami Bank Ltd		
Social Islami Bank Ltd		
Dubai Islamic Bank Pakistan Limited	Pakistan	2
First Habib Modaraba		
Total		16

Data Envelopment Analysis (DEA)

This research employs Data Envelopment Analysis (hereafter referred as DEA) as non-parametric approach to measure the cost efficiency, revenue efficiency and profit efficiency in the selected Asian Islamic banks using input oriented. Charnes *et al.* (1978) firstly introduced the CCR model (CRS assumption) of DEA by measuring the efficiency through each decision-making unit (DMU). Banker *et al.* (1984) then developed and extended the CCR model into BCC model which assess the DMU efficiency characterized by variable return to scale (VRS assumption). Variable return to scale indicates to the operation of bank not in the optimum scale which caused to face obstacles and competition among the industry and environment (Havidz & Setiawan, 2015a). Therefore, this research adopts the VRS frontier type to measure the cost efficiency, revenue efficiency and profit efficiency. Table 2 indicates the equations of each efficiency measurements.

Table 2
Cost Efficiency, Revenue Efficiency and Profit Efficiency Models

Frontier type	Cost efficiency (Eq. 1)	Revenue Efficiency (Eq. 2)	Profit Efficiency (Eq. 3)
VRS	$\min \sum_{i=1}^m p_i^o \tilde{x}_{io}$ <p>subject to</p> $\sum_{j=1}^n \lambda_j x_{ij} \leq \tilde{x}_{io} \quad i = 1, 2, \dots, m;$ $\sum_{j=1}^n \lambda_j y_{rj} \geq y_{ro} \quad r = 1, 2, \dots, s;$ $\lambda_j, \tilde{x}_{io} \geq 0$ $\sum_{j=1}^n \lambda_{j=1}$	$\max \sum_{r=1}^s q_r^o y_{ro}$ <p>subject to</p> $\sum_{j=1}^n \lambda_j x_{ij} \leq x_{io} \quad i = 1, 2, \dots, m;$ $\sum_{j=1}^n \lambda_j y_{rj} \geq y_{ro} \quad r = 1, 2, \dots, s;$ $\lambda_j, y_{ro} \geq 0$ $\sum_{j=1}^n \lambda_{j=1}$	$\max \sum_{r=1}^s q_r^o y_{ro} - \sum_{i=1}^m p_i^o \tilde{x}_{io}$ <p>subject to</p> $\sum_{j=1}^n \lambda_j x_{ij} \leq \tilde{x}_{io} \quad i = 1, 2, \dots, m;$ $\sum_{j=1}^n \lambda_j y_{rj} \geq y_{ro} \quad r = 1, 2, \dots, s;$ $\tilde{x}_{io} \leq x_{io}, y_{ro} \geq y_{ro}$ $\lambda_j \geq 0$ $\sum_{j=1}^n \lambda_{j=1}$

Source: Zhu (2009)

Where p_i^o and q_r^o are unit price of the input and unit price of output r of DMU_o , respectively. The DMU may vary one another based of the price data. The cost efficiency, revenue efficiency and profit efficiency of DMU_o are defined as:

$$\frac{\sum_{i=1}^m p_i^o \tilde{x}_{io}^*}{\sum_{i=1}^m p_i^o x_{io}^*}, \frac{\sum_{r=1}^s q_r^o y_{ro}}{\sum_{r=1}^s q_r^o y_{ro}^*} \text{ and } \frac{\sum_{r=1}^s q_r^o y_{ro} - \sum_{i=1}^m p_i^o \tilde{x}_{io}}{\sum_{r=1}^s q_r^o y_{ro}^* - \sum_{i=1}^m p_i^o \tilde{x}_{io}^*}$$

The Variables of Input and Output in DEA

The research will be having significant results when the variable choices of efficiency studies are correctly chosen. However, the paucity of relevant data constrain to cause variable selection problem. It has difficulties in measuring the cost and output of banking area since most of financial services produce collectively and typically the prices are assigned to them (Kamarudin *et al.*, 2017). The literature of banking theory are dominated by two approaches, intermediate and production approaches (Sealey & Lindley, 1977).

Production approach is usually applied to study the banks’ branches efficiency in which viewing the bank as service providers to customers, while viewing the bank as funds intermediation between investors and savers is known as intermediation approach. Bader *et al.* (2008), Rosman *et al.* (2014), Kamarudin *et al.* (2014), Havidz & Setiawan (2015b), Mohanty *et al.* (2016); Kamarudin *et al.* (2017) have adopted intermediation approach in their banks’ efficiency studies and it is found to be the common approach being employed generally. Hence, this research employs intermediation approach by viewing the bank as funds intermediation.

As intermediation approach being employed, two variables of each inputs and outputs are chosen along with the price of inputs and price of outputs. The two inputs consists of deposits (x1) and labour

(x2) with input prices consists of price of deposits (w1) and price of labour (w2). The variables of output consists of loans (y1) and income (y2) with its prices of loans (r1) and prices of income (r2). The variables of efficiency frontiers are summarized in Table 3.

Table 3
Descriptive statistics of Inputs, Input prices, Outputs and Output prices in DEA Model

<i>Variables</i>	<i>Min</i> <i>(mill USD)</i>	<i>Max</i> <i>(mill USD)</i>	<i>Mean</i> <i>(mill USD)</i>	<i>Std. Dev</i> <i>(mill USD)</i>
Inputs				
Deposits (x1)	0.67	32736.54	4338.00	6742.89
Labour (x2)	0.02	129.69	21.29	33.62
Input prices				
Price of deposits (w1)	0.0110	0.9553	0.0558	0.1049
Price of labour (w2)	0.0002	0.0270	0.0089	0.0060
Outputs				
Loans (y1)	0.03	35541.04	3587.52	6418.88
Income (y2)	0.06	1490.61	253.96	362.85
Output prices				
Price of loans (r1)	0.0228	413.5294	9.4669	58.7480
Price of income (r2)	0.0000	0.5708	0.0454	0.0895

Source: Bankscope database and own calculation of authors. *Notes:* x1 = Deposits (deposits and short term funding), x2 = Labour (personnel expense), w1 = Price of Deposits (total interest expenses/deposits), w2 = Price of Labour (personnel expense/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 other interest income/loans), and r2 = Price of income (other operating income/income).

Econometrics Specification using Dynamic Panel Data

Bank efficiency determinants in the selected Asian Islamic banks are examined by employing dynamic panel data approach in GMM procedure. This method is introduced by Arellano & Bond (1991) by deriving one-step and two-step GMM estimators. Robust VCE estimator is provided for one step model standard error to have a robust result, while Windmeijer (2005) introduced worked out a bias-corrected (WC) robust estimator for VCEs of two-step GMM estimator. However, they found a seriously biased of robust two-step VCE (Stata Press, 2015). Therefore, this research employ dynamic panel data with one-step and robust VCE estimator. No autocorrelation is required for Arellano-Bond estimator that will be reported in AR (artests) value.

The past performances could explain the current inefficiency as one part of it. For instance, the inefficiency level of Islamic banks in 2015 might be caused by the inefficiency level 2014 as its previous year explain valuable information for the coming year. Producing financing by the Islamic banks through term deposits acceptance may perform well in a long term of financial institutions with better strategies in long-run. Typically, their previous performance and historical decisions stand as the current performance reflections and as the determinants of efficiency study this should be considered. Therefore, banks' efficiency

determinants as having dynamic behavior will be considered with a lagged of efficiency score. The advantages of employing GMM model are the model variations of cross-sectional and time series could be acknowledged by its dynamic panel, the bias of cross-country regression could be avoided and the panel model in which having low number of years with large number of cross-sections relatively is a useful method for the model (Al-Gasaymeh, 2016). Cost, revenue and profit efficiency are regressed to find the determinants of bank efficiency by determining the bank specifics and macroeconomics in the econometric model that specified as follows:

$$EFF_{i,t} = \beta_0 + \beta_1 EFF_{i,t-1} + \beta_2 LLPNIR_{i,t} + \beta_3 NPF_{i,t} + \beta_4 ROAA_{i,t} + \beta_5 CIR_{i,t} + \beta_6 NETf\ in\ TA_{i,t} + \beta_7 Size_{i,t} + \beta_8 EquityTA_{i,t} + \beta_9 GDPPC_{i,t} + \beta_{10} Inflation_{i,t} + \varepsilon_{i,t} \quad (\text{Eq. 4})$$

Where $EFF_{i,t}$ is measurements of cost efficiency (Eq. 1), revenue efficiency (Eq. 2) and profit efficiency (Eq. 3), are estimated from DEA, $EFF_{i,t-1}$ is past efficiencies (lagged dependent variable), $LLPNIR_{i,t}$ as credit risk measurement, $NPF_{i,t}$ as non-performing financing, $ROAA_{i,t}$ as profitability measurement, $CIR_{i,t}$ as efficiency measurement based on bank specifics, $NETf\ in\ TA_{i,t}$ as financing intensity measurement, $Size_{i,t}$ as bank size a logarithm of total assets, $EquityTA_{i,t}$ as bank's capitalization measurement, $GDPPC_{i,t}$ GDP per capita measurement and $Inflation_{i,t}$ as inflation measurement of the country. Additionally, $i = 1 \dots 16$; as the cross sections contains of 16 Islamic banks, t is time as $t = 2011 \dots 2015$. Table 4 describes the efficiency scores obtained from DEA along with the bank specifics and macroeconomics variables as the determinants.

Table 4
Descriptive statistics of the variables used in GMM model

<i>Variables</i>	<i>Min</i>	<i>Max</i>	<i>Mean</i>	<i>Std. Dev</i>
Dependent variables				
Cost efficiency	0.3390	1.0000	0.7450	0.1716
Revenue efficiency	0.0027	1.0000	0.5888	0.1569
Profit efficiency	0.1663	1.0000	0.5871	0.2410
Independent variables				
LLPNIR	-9.0060	52.0310	13.0465	10.9483
NPF	0.2010	15.3240	2.7707	2.4389
ROAA	0.0150	21.3850	1.4437	2.6401
CIR	21.2020	96.6470	55.3803	19.6872
NetfinTA	0.0740	125.6960	63.5243	18.4323
Size	3.6101	6.8533	4.6639	0.6905
EquityTA	3.9490	75.0790	12.3214	14.4728
GDPPC	2.9031	4.0365	3.6003	0.4530
Inflation	-0.7544	1.2932	0.4810	0.5240

4. RESULTS AND DISCUSSIONS

In this section, we will discuss about the analysis results of cost, revenue and profit efficiency in the Islamic banks of Asian countries employing DEA method as well as the determinants that might determine the bank efficiencies. First of all, the rule of thumb will be tested regarding the selection variables of inputs

and outputs as it has been applied by Sufian *et al.* (2013), Kamarudin *et al.* (2014), Kamarudin *et al.* (2017). There are 16 banks as DMUs total number which is greater compare to the minimum required. The minimum required represents from the total number of inputs and outputs variables (2 inputs x 2 outputs @ 3[2 inputs + 2 outputs]). Complying to the rule of thumb, the variables selection are valid and reliable measurement of DMUs efficiencies are allowed.

Earlier in the studies, Bauer *et al.* (1998) and DeYoung & Hasan (1998) suggested more flexible construction of a frontier annually in a specific of each year rather than a frontier estimation of a single multiyear for the banks in the sample. Then after, Isik & Hassan (2002) and Sufian & Noor (2009) employed this suggestion in their research. Therefore, five separate frontiers (2011-2015) constructed in this research. Employing panel data has its principal advantage that in a certain time period the bank could be observed more than once (Isik & Hassan, 2002). Since the business environment of the banks change continuously, an efficient bank in a certain period may be inefficient in another period, hence this issue becomes critical (Sufian & Noor, 2009).

Efficiency of the Asian Islamic banks

Trends of Islamic banks in the Asian countries during 2011 to 2015 is revealed in Figure 1. Cost efficiency reach its peak during 2013, but then declined on 2014 and slowly inclined on 2015. Revenue efficiency touched the weakest inefficient on 2012 and increasing slowly after year by year, while 2013 is the peak point of profit efficiency.

The mean efficiency scores of Asian Islamic banks are revealed in Table 5 which divided in each panel; Panel A (2011), Panel B (2012), Panel C (2013), Panel D (2014), Panel E (2015) and Panel F (all years). During the whole years, the mean efficiency score of cost, revenue and profit efficiency are 74.5%, 58.88% and 58.71% respectively. Briefly, it is found to be inefficient in the Asian Islamic banks. These inefficiencies caused of same outputs cannot be produced since the inputs are not fully used (cost

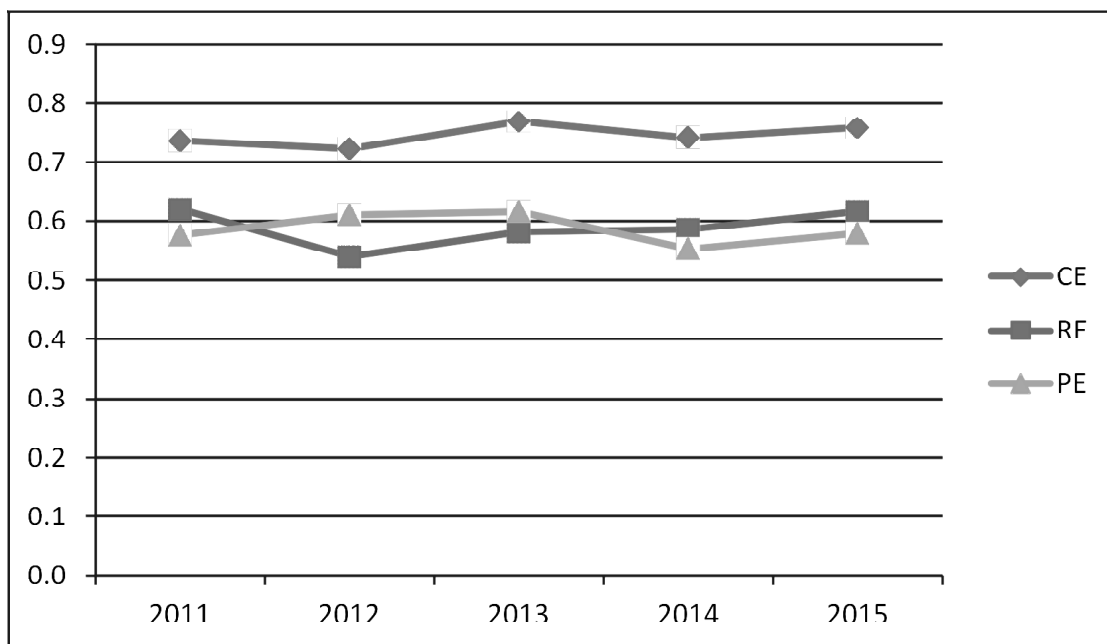


Figure 1: Cost efficiency, Revenue Efficiency and Profit efficiency trends of Asian Islamic banks 2011-2015

inefficiency), through using the same amount of inputs cannot produce outputs (revenue inefficiency) and when the bank fails to minimize the cost to the fullest point as well as fail in revenue maximization, it is found to be slacked (profit inefficiency). The level of cost inefficiency, revenue inefficiency and profit efficiency are 25.5%, 41.12% and 41.29% respectively.

In term of cost efficiency, the Asian Islamic banks could only utilized the resources (inputs) for 74.5% to produce the same outputs level averagely, while wasting the remaining 25.5%. The revenue could only be generated for 58.88% in the Asian Islamic banks averagely in term of revenue efficiency. Initially, the generating was expected to be high at first. In the other words, there were loss of revenue for 41.12% which is expected to receive more revenues on that amount with the same resources amount to be given or producing 41.12% of the given outputs with the same inputs level. Additionally, Asian Islamic banks have earned the profit for 58.71% only, it is meaning to say that the opportunity to make the profit for 41.29% more on the same input levels have been lost. The lower revenue efficiency compare to cost efficiency indicates to higher revenue inefficiency rather than cost inefficiency and the result suggests that revenue inefficiency is found to be as the biggest contributor to the higher level of profit inefficiency.

Table 5
Descriptive statistics of efficiency score of Asian Islamic banks

<i>Efficiency</i>	<i>Min</i>	<i>Max</i>	<i>Mean</i>	<i>Std. Dev</i>
<i>Panel A: Asian Islamic Banks 2011</i>				
Cost Efficiency	0.4064	1.0000	0.7357	0.1893
Revenue Efficiency	0.3363	1.0000	0.6196	0.2059
Profit Efficiency	0.1791	1.0000	0.5765	0.2644
<i>Panel B: Asian Islamic Banks 2012</i>				
Cost Efficiency	0.4382	1.0000	0.7220	0.1737
Revenue Efficiency	0.0027	0.8361	0.5405	0.1891
Profit Efficiency	0.1663	1.0000	0.6104	0.2832
<i>Panel C: Asian Islamic Banks 2013</i>				
Cost Efficiency	0.4577	1.0000	0.7683	0.1955
Revenue Efficiency	0.3588	1.0000	0.5818	0.1595
Profit Efficiency	0.2030	1.0000	0.6159	0.2802
<i>Panel D: Asian Islamic Banks 2014</i>				
Cost Efficiency	0.5107	1.0000	0.7408	0.1472
Revenue Efficiency	0.3209	0.7583	0.5860	0.1067
Profit Efficiency	0.2516	1.0000	0.5533	0.1948
<i>Panel E: Asian Islamic Banks 2015</i>				
Cost Efficiency	0.3390	1.0000	0.7582	0.1668
Revenue Efficiency	0.3571	0.8387	0.6161	0.1017
Profit Efficiency	0.3378	1.0000	0.5796	0.1906
<i>Panel F: Asian Islamic Banks all years</i>				
Cost Efficiency	0.3390	1.0000	0.7450	0.1716
Revenue Efficiency	0.0027	1.0000	0.5888	0.1569
Profit Efficiency	0.1663	1.0000	0.5871	0.2410

Determinants of Asian Islamic banks efficiency

Dynamic panel data with GMM procedure is being employed to find the determinants of bank efficiency in the Islamic banks of selected Asian countries during 2011-2015 period and the results is presented in Table 6. The explanatory variables consist of seven bank specifics variables (loan loss provision to net interest income, non-performing financing, return on average assets, cost to income ratio, net financing to total assets, bank size as a proxy of logarithm of total assets and equity to total assets) and two macroeconomics variables (GDP per capita and inflation). Three models will be examined to find the determinants of cost efficiency (Model 1), revenue efficiency (Model 2) and profit efficiency (Model 3).

Table 6
Dynamic Cost Efficiency, Revenue Efficiency and Profit Efficiency of Asian Islamic Banks

<i>Dependent Var</i>	<i>Model 1</i>	<i>Model 2</i>	<i>Model 3</i>
(DEP)	CE	RE	PE
Lag of DEP	0.2262 ** (0.1029)	0.1504 ** (0.0733)	0.5209 ** (0.2350)
LLPNIR	-0.0011 * (0.0006)	-0.000023 (0.0003)	-0.0044 *** (0.0017)
NPF	0.0064 * (0.0034)	-0.0017 (0.0016)	0.0192 *** (0.0074)
ROAA	-0.0639*** (0.0231)	0.0150 (0.0183)	-0.1370 (0.1101)
CIR	-0.0025 * (0.0015)	-0.0004 (0.0006)	-0.0078 * (0.0042)
Netloansta	0.0079 *** (0.0008)	0.0090 *** (0.0006)	0.01653 *** (0.0028)
Size	0.4256 (0.2952)	-0.0812 (0.0711)	0.4082 * (0.2451)
Equityta	0.0178 ** (0.0089)	0.0080 *** (0.0022)	0.0275 ** (0.0135)
GDPPC	-2.5886 *** (0.9437)	0.1474 (0.2501)	-5.1009 *** (1.6398)
Inflation	0.0409 *** (0.0092)	0.0105 ** (0.0051)	0.1111 ** (0.0525)
Constant	7.3757 *** (2.1152)	-0.2662 (0.6672)	15.7690 *** (5.0809)
No. of Obs	80	80	80
No. of banks	16	16	16
Instruments	16	16	16
AR(1)	0.2551	0.2891	0.1592
AR(2)	0.2529	0.2444	0.3818

Notes: Dependent variables are efficiency scores of Asian Islamic banks. The models are estimated by dynamic one-step GMM estimator (Arellano and Bond, 1991) with robust standard errors are in parentheses. A robust version of the Sargan test however is not available in Stata after specifying vce (robust) that represents the robust standard error. The *p* value of AR(1), AR(2) are also reported; *, **, *** indicates significance at the 10%, 5% and 1% levels

Firstly, loan loss provision to net interest revenue (LLPNIR) as a proxy of credit risk has negative impact and statistically significant at 10% level for cost efficiency and 1% level for profit efficiency in the Islamic banks of Asian countries. It reveals the relationship between provisions of profit and loss account and its income of interest during the same period. As suggested by Resti (1997) and Kwan & Eisenbeis (1997) it requires higher expense to maintain the screening and monitoring good credit. The lower the bad loan is, the better efficiency may have by Asian Islamic banks. Risk management will be costly in which additional deposits and labour of inputs are required to produce outputs on the same level. Credit risk management has become the main problem in the banking industry recently thus Islamic banks should be focusing more on this issue. If the Asian Islamic banks could maintain the loans as lower as possible, probably higher cost efficiency are needed, but will be paid off with higher profit as well.

Secondly, non-performing financing (NPF) as another proxy of bad loans has positive impact and statistically significant at 10% level for cost efficiency and 1% level for profit efficiency. Instead of actively taking a high risk in order to receive higher return, passively taking the high risk may increase the cost as it takes time to classify the financing during the granting process (Kwan & Eisenbeis, 1997). As the Asian Islamic banks are reducing the high risk (taking the role to perform as low risk banking), it becomes costly yet there is still possibility to receive higher profit.

Return on average assets (ROAA) as a proxy of profitability has negative impact and statistically significant at 1% level on cost efficiency. It agrees the study of Rahman & Rosman (2013), but it is surprisingly as many previous studies found a positive impact of profitability to efficiency. This result suggests that the lower the profitability is, the higher cost efficiency will be. The Asian Islamic banks supposed to operate on cost minimization but happened to operate in cost maximization that leads to less profitable.

As an efficiency ratio based on bank internal performance, cost to income ratio (CIR) has negative and statistically significant at 10% level for both cost efficiency and profit efficiency. This result agrees the study of Havidz & Setiawan (2015b) that the usage of cost (expenses) to generate income will decrease the efficiency. When the operating expense increase, it will reduce the operating income hence lower CIR will lead to higher efficiency score. The lower cost to generate income of Islamic banking activities may have higher cost efficiency as it operates on cost minimization and could achieve higher profit efficiency.

As expected, financing (loans) intensity proxy, namely Net financing to total assets (Netfinta) has positive impact and statistically significant at 1% level in all models; cost efficiency, revenue efficiency and profit efficiency. The Asian Islamic banks tend to have higher efficiency with higher net financing to total assets. This indicates to financing activity of Asian Islamic banks how much they could offer the financing for reasonable reasons and become more productive in order to gain more market shares from the financing activities. If the sequence of financing activities are productive, then the Asian Islamic banks will gain higher cost efficiency, revenue efficiency as well as profit efficiency. This result agrees with Sufian & Noor (2009).

Bank size which proxy by logarithm of total assets has positive impact and statistically significant at 10% level for profit efficiency. The higher the total assets of Asian Islamic banks may have higher efficiency since the banks have larger scale economies hence the management could convert the inputs to outputs more efficient. The result supported by Sufian & Noor (2009), Rahman & Rosman (2013) and Rosman *et al.* (2014).

Equity to total assets (Equityta) as a proxy of Bank capitalization has positive impact and statistically significant at 5% level for cost efficiency and profit efficiency, while 1% level for revenue efficiency. Bank's equity may be utilized for the unexpected future losses as the cushion. The higher the capital is, the better efficiency could be achieved by the Asian Islamic banks and this research result agreed the previous studies of Rahman & Rosman (2013) and Rosman *et al.* (2014).

As from the macroeconomics factor side, GDP per capita (GPDPC) has negative impact and statistically significant at 1% level for both cost efficiency and profit efficiency, while inflation has positive impact and statistically significant at 1% level for cost efficiency and 5% level for revenue efficiency profit efficiency. This result agrees the study of Al-Gasaymeh (2016). The higher value of GDPPC may lower the bank efficiency as the coefficient value indicates -2.5886 and -5.1009. The better economic conditions of Asian countries lead to spending more cost (cost maximization) and receive lower profit (profit minimization) in return as the inputs and outputs might not be utilized efficiently. In addition, higher inflation levels drive the Asian country into having better efficiency as the consumers of Islamic banks have expected the inflation to be happening in the future.

5. CONCLUSIONS

The current research investigates the Islamic banks in the selected Asian countries, those are; Indonesia, Malaysia, Bangladesh and Pakistan during 2011-2015 period. The measurement of efficiency employs non-parametric approach Data Envelopment Analysis (DEA) by adopting VRS frontier type to measure the cost efficiency, revenue efficiency and profit efficiency. Once obtaining the efficiency scores, the results will be regressed to find the determinants of efficiency by applying dynamic panel data with GMM procedure. There are seven bank specifics and two macroeconomics variables as its explanatory variables.

The mean efficiency scores of the Islamic banks in the Asian countries are found to be 74.5% for cost efficiency, 58.88% for revenue efficiency and 58.71% for profit efficiency. On the other words, the Asian Islamic banks could not perform fully efficiency in all efficiency types. Cost inefficiency was found due to same outputs cannot be produced since the inputs are not fully used, by wasting 25.5% amount of inputs or resources. Revenue inefficiency was due to failure of using the same amount of inputs to produce outputs hence they lost the revenue for 41.12%. Profit inefficiency was due to the slack when failure of cost minimization and revenue maximization exist hence they lost the profit for 41.29%. Furthermore, revenue inefficiency is found to be as the biggest contributor to the higher level of profit inefficiency rather than cost inefficiency.

This research proved that bank specifics and macroeconomics factors could determine bank efficiency (cost efficiency, revenue efficiency and profit efficiency) in the selected Asian Islamic banks. Net financing to total assets, capitalization (equity to total assets) and inflation have positive impact and statistically significant to the three efficiency models, namely; cost efficiency, revenue efficiency and profit efficiency. Loan loss provisions to net interest income (LLPNIR) as a proxy of credit risk, cost to income ratio (CIR) and GDP per capita (GDPPC) have negative impact and statistically significant to cost efficiency and profit efficiency. Non-performing financing (NPF) has positive impact and statistically significant cost efficiency and profit efficiency, while profitability (ROAA) has negative impact and statistically significant to cost efficiency and bank's size as a proxy of logarithm total assets has positive impact and statistically significant to profit efficiency.

The empirical findings of this research suggests that decision makers and regulators should review periodically the bank efficiency in term of cost efficiency, revenue efficiency and profit efficiency as these become crucial efficiency measurements since there are limited studies in the Islamic banking area. This should be done since Islamic banks need to compete with the conventional counterparts. Bank managers could also be guided by the results of this research to have clear and better understanding in finding the factors that might determine bank efficiency. Thus, the Islamic banks especially in the Asian countries could have better stability in long term.

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