The Efficiency and Inefficiency of the Banking Sectors: Evidence From Selected ASEAN Banking (Kecekapan dan Ketidakcekapan Sektor Perbankan: Bukti daripada Perbankan ASEAN Terpilih)

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Submission date: 19-Sep-2019 08:02AM (UTC+0700)
Submission ID: 1175457619
File name: mongidjeko_511-10mongid.pdf (760.08K)
Word count: 9734
Character count: 51262

Jurnal Ekonomi Malaysia 51(1) 2017 119 - 132
http://dx.doi.org/10.17576/JEM-2017-5001-10

The Efficiency and Inefficiency of the Banking Sectors: Evidence From Selected ASEAN Banking

(Kecekapan dan Ketidakcekapan Sektor Perbankan: Bukti daripada Perbankan ASEAN Terpilih)

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ABSTRACT

This paper examines the cost efficiency of banks operating in selected countries of the Association of Southeast Asian Nations (ASEAN). We calculate the cost efficiency base on accounting efficiency and economic efficiency using Stochastic Frontier Analysis (SFA) and then classify it as efficient and not. Further, bank specific and economic variables are combined to determine the cost efficiency and the efficiency category (efficiency dummy) using linear regression and logistic regression. The results show that bank efficiency determined by asset size, dummy of economic crisis, interest rate gap, economic growth, inflation, capital, earning assets and loan losses provision. Only capital, earning asset and loan loss provision are consistent for accounting and economic efficiencies. For economic variable, economic growth and inflation rate are only significant in the accounting efficiency. The result implied that ASEAN banking should continue to consolidate the asset size and the authority should create high economic growth and a low inflation environment to make their banking industry more efficient.

Keywords: Cost efficiency; ASEAN; SFA; economic variable

ABSTRAK

Kertas ini mengkaji kecekapan kos bank-bank yang beroperasi di negara ASEAN. Kecekapan kos asas perakaunan dan keberkesanan ekonomi telah dikira dengan menggunakan kaedah analisis perbatasan stokastik (SFA) dan mengelaskan bank kepada dua kategori iaitu cekap dan tidak cekap. Kaedah regresi linear dan regresi logistik telah digunakan untuk menganggarkan kecekapan kos dan kategori kecekapan. Hasil kajian menunjukkan bahawa kecekapan bank dipengaruhi oleh saiz aset, dami krisis ekonomi, aset berpendapatan, jurang kadar faedah, pertumbuhan ekonomi, inflasi, modal, aset pendapatan dan peruntukan kerugian pinjaman. Hanya modal, aset berpendapatan dan peruntukan kerugian pinjaman adalah konsisten pada kecekapan kos asas perakaunan dan keberkesanan ekonomi. Bagi pemboleh ubah ekonomi iaitu pertumbuhan ekonomi dan kadar inflasi hanya signifikan dalam pempengaruhi kecekapan perakaunan. Hasil kajian ini menunjukkan bahawa perbankan ASEAN perlu memperbesarkan saiz dan pihak berkuasa perlu mewujudkan suasana pertumbuhan ekonomi yang tinggi serta persekitaran inflasi yang rendah untuk menjadikan industri perbankan lebih cekap.

Kata kunci: Kecekapan kos; ASEAN; SFA; pemboleh ubah ekonomi

INTRODUCTION

No one will challenge the contribution of the banking sector to the economy, especially in its role for saving and lending function that facilitate the economic growth (Levine1997). The role of the banking system in promoting economic growth as financial intermediary requires banking system operates efficiently by maintaining low transaction cost in saving and lending business. Efficient banking system means, as an intermediary, banking industry can provide service financing at lower costs. Stiglitz (2016) mentioned that the banking industry has transformed the economy of a nation into capitalist economy v[illegible]bank's credit.

In conventional banking, interest rates play an important role in bank operations. The major business of the commercial banks is by receiving deposits and granting the loans to business sectors. When the interest rate increases, the cost of fund of liabilities side also increases. To compensate it, the interest rate of the loan is also increased. Be[illegible]e 1990s, the interest rate was kept low for deposits, creating less volatility in the spread between a bank's deposits and liabilities. After the deregulation on interest rate, it increases and make the borrowing cost higher and at the same time, it can also make bank's profit also increase.

Efficiency is a very important concept in economics on how the resource allocation is performed. In simple, the efficiency is the ratio between the amount of resources and costs that must be sacrificed to achieve the result of an activity and mostly measured by comparing the input to output. In other words, the efficiency of the optimized

results is achieved with the use of limited resources. Increased efficiency exist when the existing output can be produced by a lower cost.

The objective of this paper is to investigate the determinant of bank cost efficiency in ASEAN-5 banking market. The study covers Malaysia, Indonesia, Philippines, Thailand and Singapore. These countries were chosen as their economic system are close to capitalist, economically prosperous and at the middle-income group. The definition of the efficiency is cost efficiency using accounting concept. Referring to Berger and Mester (1997) the best methodology to study cost efficiency is using economic efficiency. It's the choice of the estimation technique. They argue that the parametric techniques such as Stochastic Frontier Analysis (SFA) provides results more useful than a non-parametric technique such as Data Envelopment Analysis (DEA) because they are based on economic optimization rather than technical optimization.

The characteristic of the ASEAN economy is having a relatively higher inflation rate. As inflation rate is an important macroeconomic performance, central banks in the region are very active to make inflation rate lower. Inflation is also viewed as an indicator of business risk. The high inflation rate means high business risk. If inflation rises, banks must spend more to compensate depositors. The impact on bank cost efficiency depends on the ability of the bank to exploit interest rate dynamics in the market. The inflation rate is expected to have a negative impact on bank cost efficiency measured using cost to income ratio. When the inflation rate is higher, deposit rate is also higher and at the same time, banks are not willing to increase lending rates as it is too risky. In general, higher inflation implies lower interest margins.

The contributions of this paper are in support on the integration of ASEAN banks under the ASEAN Banking Integration Framework (ABIF). It will also provide insights and inputs in effort to develop Qualified ASEAN Banks (QAB) framework. It also adds the empirical works on efficiency, which is relatively less available, compared to other regional bloc such as European Economic Community. Referring to Bos et al. (2009), heterogeneity of the economic conditions influence both banks' optimal costs and profits and their ability to be efficient. In this study, we combine accounting based efficiency and economic efficiency. Unfortunately, most of papers on bank efficiency are focused on accounting or economic efficiency measures only (Mongid 2015; Tahir, Mongid and Haron 2015; Karim, Chan and Hassan 2010; Karim 2001; Bos et al. 2009; Fries and Taci 2005; Shen, Lhiao and Weyman-Jones 2009). This paper tries to move forward by combining accounting and economic efficiency using ASEAN Banking. Further, we treat efficiency scores to generate efficiency category of the bank so we get efficiency variable as categorical variable (dummy).

This paper attempt to investigate the determinant of bank efficiency. Are there any consistencies when the efficiency measurements differ? As efficiency is a necessary condition for efficient financial system, this paper elaborates the bank characteristic and macroeconomic environment factors and their influence on bank cost efficiencies. As it is international comparison, the paper also look on the contribution of the country of origin bank cost efficiency categories.

This study is the first effort to combine accounting and economic efficiency and their category in one paper. Further, by treating efficiency score into a dichotomous variable, the study provides a different insight compared to the traditional approach. The result should provide a better managerial and policy implication than the traditional approach.

LITERATURE REVIEW

We are aware that banking efficiency is very important for financial development. Efficient banking system can provide the loan with a better rate because the spread is small. Higher net interest margins usually imply lower banking sector efficiency because banks are in a less pressure to gain efficiency due to their ability to get higher profit amidst various economic constraints. That is why banks operating in a country that have a higher net interest margin (NIM) tend to be less efficient. This condition has a negative impact on financial developments measured by loan to GDP ratio. Further, these will make investments and economic activity lower compared to its potential. Liebeg and Schwaiger (2009) study on the benefits of lower cost of financial intermediation to the economy especially on a business loan.

Lang and Welzel (1996) study 7 German cooperative banks was done using the intermediation approach to calculate the cost efficiency by means of transformation logarithm (Translog) cost function. They found that cost efficiency was linked to size class of bank indicating the existence of economies of scale benefits. However, in general, they also found that all class sizes deviated from its optimal level. Further, all banks enjoy growth of total factor productivity, although big banks tend to enjoy less than the smaller banks.

Karim (2001) studies on the cost efficiency of ASEAN banking found strong evidences that it is a divergence. By using a stochastic cost frontier approach, the paper investigates whether there are significant differences in bank efficiency across selected countries in the ASEAN region (Indonesia, Malaysia, the Philippines, and Thailand). The results indicate that there are significant differences. The results also show that, on average, the ASEAN banks enjoy increasing returns to scale. Unfortunately, the economies of scale are not supported, but asset sizes, is matter for bank cost efficiency.

Olson and Zoubi (2011) study on bank's efficiency using both of accounting-based and economic-based measures of banks from ten Middle East and North Africa (MENA) countries. They regress an according variables to explain the cost and profit efficiency. They show that most of the banks in this region are smaller than the optimal size and they find a positive relation between the efficiency and the total assets of a bank. Efficiency also relates to capital strength (EQAS). On risk, the risk taking sides, credit risk (LOAS) is significant and positive to efficiency as long as the problem loan is manageable. The operating costs efficiency such as efficiency (INEF), overhead cost (OVER) and non interest bearing asset (NIBA) are negatively significant on efficiency, indicating the contribution of management for efficiency. Concentration (CONC) is positive to both profit and cost efficiency. In comparison, they found that MENA banks are slightly less cost efficient and European banks are more efficient. Almost all banks in the MENA region are below optimal size. However, in terms of profit (ROA), they are higher than European banks. The study covers the period 2000-2008. The economic and social conditions in the MENA regions support or fits in quite life where less competition and captive market make the bank's management less incentive to innovate and working beyond the current condition as explained by Berger and Hannan (1998).

Berger and Mester (1997) argue that a bank's failure risk depends on the level of its equity capital since it provides a cushion against portfolio losses and financial distress. Under market discipline framework, the low capitalised bank also reduces the market reputation, so the bank has to pay a higher interest for its borrowings the market as it is viewed as risky. That is why equity to total assets (ETA) ratio is viewed as risk preference as higher ratio means the bank takes less risk preference (leveraging). There are two possible outcomes of bank capital position on efficiency. On one side, higher capital means higher creditworthiness. Highest credit worthiness means banks can borrow the fund at cheaper price and it increases efficiency. In other side, the higher capital ratio means banks have to hold less risky assets that will generate income.

The size of the bank is also an important factor for efficiency. Under the macroeconomic framework, a theoretically larger bank could enjoy economies of scale and economies of scope that make them enjoy lower average cost. When banks can produce outputs at lower cost due to the size factor, it is efficient because of economies of scale. When banks can produce outputs at lower average cost due to joint cost advantage, the efficiency is from economies of scope. Karim (2001) states larger banks tend to be more cost efficient. Impact of size efficiency is clear. Size is positive to efficiency. Athanasoglou, Delis and Staikouras (2006) report the positive influence of a bank's asset on profitability and efficiency. Akhavein, Berger and Humphrey (1997) reported that mergers improve and benefit profit efficiency. However, it is not benefiting to the cost efficiency.

External factors are factors that are beyond the control of the bank, which is linked with economic and environmental conditions that affect the bank's operations and performance. A country with higher economic growth has better economic activities than lower one. Economic growth is basically a reflection how economic activities available. Higher economic growth also means that national income increase and it is distributed among society. Banks operate in the country with higher economic growth can enjoy lower cost of doing business as banks can easily find prospective debtors with less cost. In short, we can say that economic growth has a positive impact on bank cost efficiency. However, during economic upturn, banks tend to invest more to enjoy market expansion. It increases cost, but not income. In these possibilities, banks will experience higher cost, but less income. For example, Newer empirical studies by Miencha et al. (2015) and Zeitun (2012) found a direct positive relationship. In contra Athanasoglou, Delis and Staikouras, (2006) showed that real GDP per capita fluctuations did not have a significant impact banks' profitability.

According to Berger and De Young (1997), the operating cost of bank is also influenced by non-performing loans. A large proportion of problem loans may be due to "bad management". These non-performing loans will hit efficient banks who do not practice adequate loan underwriting and monitoring and hence will have higher losses due to non-performing loans. Problem loans may also be caused by short-run cost savings on the initial credit evaluation and loan monitoring (skimping hypothesis). Bank with high loan ratio tends to have better operating cost.

This would produce a short-term benefit (higher cost efficiencies artificially) than a bank, which spends adequate resources to ensure its loans are of higher quality. On the other hand, when credit risk is an event, banks experience lower efficiency because banks spend more resources to recover it. The problem loans make the asset less productive. Banks lose the income because the assets become tacit. Problem loans give two impacts on banks, which are cost increases and income decrease.

Gardener et al. (2011) provide an empirical efficiency analysis of five selected ASEAN banking institutions, including Indonesia, Malaysia, the Philippines, Thailand, and Vietnam for the period of 1998 to 2004. The authors estimate the technical and cost efficiencies using DEA. The results indicate that efficiency has significantly declined over the period 1998–2004 indicating that the post-1997 crisis restructuring had a negative influence on bank performance. Foreign banks appear to be more efficient than the domestic counterparts. In addition, state-owned banks exhibited greater efficiency than their local private sector peers. Among country-level factors, national

banking development shows a strong and positive link with bank efficiency.

Tahir et al. (2012) examined the determinants of cost inefficiency of banks operating in six member countries of the Association of Southeast Asian Nations (ASEAN): Indonesia, Malaysia, Singapore, Thailand, the Philippines, and Vietnam. They apply the SFA (Translog) and then regress the estimated cost inefficiencies on a set of bank specific variables and environmental variables using a Tobit regression analysis. They found that bank specific variables such as size, capital, personal expenses, loan and economic growth are important determinant of bank cost inefficiencies in ASEAN banking. The result support by Barth et al, (2013) on the importance of capital on the banking efficiency.

Sufian (2009), Sufian (2010), Sufian and Habibullah (2010) applied DEA methodology on Malaysian and Thailand banking after economic crisis found that efficiency is related to managerial preference behavior and economic conditions. Internally, it is also related to loans intensity, the bank busines strategy. Wong and Deng (2016) examined bank efficiency in ASEAN and they found that Malaysian banks are more efficient than other three ASEAN countries. Large-sized banks in ASEAN are less cost efficient and government banks improved their efficiency.

Mghaieth and Mehdi (2014) study the scores of cost and profit efficiency of 16 countries before, during and after the 2008 financial crisis. On the evolution of efficiency scores, the sample has a medium level of cost efficiency of 82.13%. Cost efficiency is determined by log assets but the capital adequacy ratio (EQAS) and ROAA are not determinants of cost efficiency. Cost efficiency measured using an operating cost ratio. For Islamic banking, Beck, Demirgüç-Kunt and Merrouche (2013) shows that non loan earning asset is positive to cost inefficiency (CIR) indicating less optimal return than loan origination.

Mongid (2015) studied the cost efficiency of ASEAN banking using a parametric methodology known as the Stochastic Frontier Analysis (SFA). In short, the study infers that the cost efficiency of the ASEAN banking is 71%. The cost efficiency score for Brunei is 58%, Indonesia is 70%, Cambodia is 60%, Laos is 62%, Myanmar is 48%, Malaysia is 63%, Singapore is 80%, Thailand is 79%, Philippines is 67% and finally Vietnam 69%. The study unveiled that Singapore is, on average, the most efficient. However, the Singapore bank efficiency trend is downward. The findings confirmed Dietsch and Lozano-Vivas (2000), Chortareas, Girardone and Ventouri (2013) that cost efficiency is country specific.

Referring to previous studies, there are three streams in the study on efficiency; accounting, non parametric (DEA) and parametric (SFA). Most papers studying ASEAN banking apply single approach (Karim, 2001, Gardener et al. (2011), Sufian (2009) and Tahir et al. (2012). This paper combines accounting, SFA and efficiency category to provide better insights on the ASEAN banking as it provides a comprehensive views of efficiency from various perspectives of efficiency measurement. From writers' knowledge, this extension is not yet available, especially in ASEAN literature. It means this paper is not merely focused on the determinant of efficiencies, but also focused on the efficiency groups.

METHODOLOGY

Evaluating bank cost efficiency is a complex process that involves assessing interaction between the environment where banks operate, internal bank condition and external activities. Currently, the primary method of evaluating internal performance of banking firm is by analyzing accounting data. Financial ratios usually provide a broader understanding of the bank's financial condition since they are constructed from accounting data derived from the bank's balance sheet and financial statement. Besides that, economic efficiency gets its popularity as it focuses on how resources are allocated within an entity.

The study combines both micro and macroeconomic aspects that influence the cost efficiency of banking firm. We are aware that banking firm is very specific in nature. Both bank-specific and macroeconomic or external variables are expected to have a role to play, with real GDP growth and bank size being the most important determinants according to the economic industry theory. This study is to find a link between bank-specific factors and the macroeconomic environment on cost efficiency. The finding is useful for academic knowledge and policy assessment, especially in the light of ASEAN banking integration framework.

MEASUREMENT

The concept of efficiency in this study is straightforward. We try to apply cost efficiency concept into two groups: accounting efficiency and economic efficiency. From these two concepts, we treat them further based on efficiency level and efficiency category. These concepts and measurement are presented in Table 1.

For economic efficiency, it is estimated using SFA, the efficiency derived from component U_{it} which is follow half normal distribution. As this paper discusses the cost efficiency, the result for U_{it} is always positive. For error component, V_{it}, it is assumed to be independently $N(0; \sigma.v)$.

MODEL

The study cvers 46 large banks from 2005-20012. For the estimation, we use 352 observations from five ASEAN

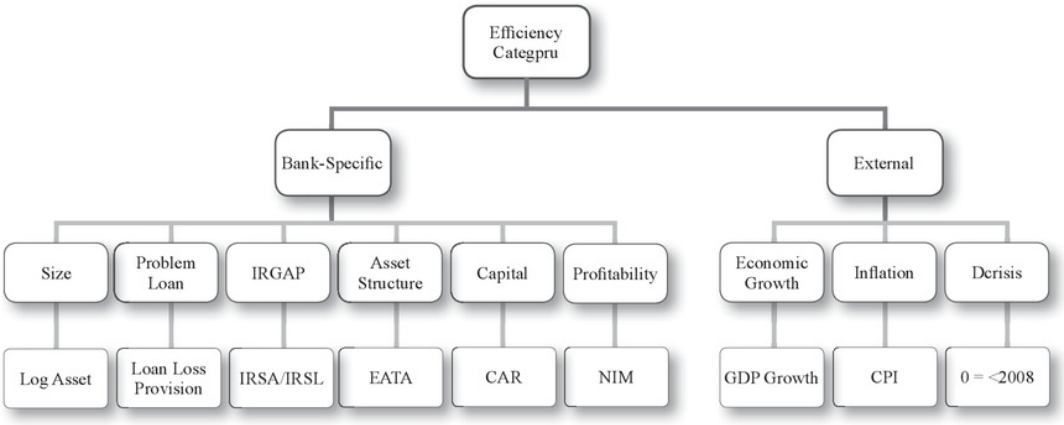

FIGURE 1. Research Framework

country members. There are 88 observation banks from Malaysia, 80 observations banks from Indonesia, 72 sample banks of the Philippines, Singapore 24 sample banks and finally from Thailand we have 88 sample banks. In total 352 samples are collected. 57% of sample banks are from the 2008 to 2012 and the rest is from 2004-2007.

To examine the determinant of bank efficiency (EFC) in ASEAN Banking, we use two types of regression. The first is a linear panel regression for Model 1 and Model 2. The second is a logistic regression for Model 3 and Model 4. We use panel regression as the models are failed to the Breusch-Pagan test and the White-heteroscedasticity test as the Chi-Square is more than 100. It means a pooled regression is rejected. The approaches are a linear relationship between a response variable, efficiency (y) and the predictor variable (x), x_i, $i = 1, 2, \ldots, n$. The baseline model can be written as follow:

$$Y_{it} = \beta_0 + \beta_1 x_{it} + \beta_2 x_{it} + \ldots + \beta_i x_{it} + \varepsilon_{it} \quad (1)$$

Where i: bank, t: time and $\beta_0, \beta_1 \ldots \beta_n$ are regression coefficients and ε is the error due to variability in the observed responses. In our study, the model can be formulated as follows:

$$\begin{aligned} EFC_{it} = {} & \alpha + \beta_1 SIZE_{it} + \beta_2 DCRISIS_{it} \\ & + \beta_3 IRGAP_{it} + \beta_4 ECGR_{it} + \beta_5 CPI_{it} \\ & + \beta_6 NIM_{it} + \beta_7 CAR_{it} + \beta_8 EATA_{it} \\ & + \beta_9 LLRGL_{it} + \varepsilon_{it} \end{aligned} \quad (2)$$

The EFC is efficiency score. The model assumes the efficiency score is related to bank specific and economic condition of the country of origin and fixed effect model is the appropriate. Using Hausman test, we find that Chi-square is 33.94 and significant at 1% suggesting the use of fixed effect model. When efficiency is in categorical (dummy variable), then the logistic model is presented as follows:

$$\text{Logistic } (E(Yi[Xi]) = \text{Log}_{it}(p_i) = Ln\left(\frac{p_i}{1-p_i}\right) = \beta.Xi \quad (3)$$

$$\text{Pi} = \frac{\exp(B_o + B_1 x_1 + \ldots + B_k x_k)}{1 + \exp(B_o + B_1 x_1 + \ldots + B_k x_k)} \quad (4)$$

To assess the ability of the model to explain bank efficiency (EFC), we apply both panel linear regression

TABLE 1. The Measurement of Efficiency Concept

No.	Concept	Measurement	Result	Modeling
1	Accounting Efficiency	Total Operating Expenses / Total Operating Income	CIR Efficiency	Model 1
2	Economic Efficiency	$TC_{it} = x_{it}\beta + (V_{it} + U_{it})$	SFA Efficiency	Model 2
3	Accounting Efficiency Category	CIR <= Mean Value = 1 CIR > Mean Value = 0	CIR Dummy	Model 3
4	Economic Efficiency Category	SFA >= Mean Value = 1 SFA < Mean Value = 0	SFA Dummy	Model 4

Note: TC = Total Expenses, CIR = Total Cost/Total Income, SFA=Economic Efficiency Score

and logistic regression fit test such as Chi-Square, Log likelihood, z-test, and R-Squared. Log likelihood ratio is similar to F-distribution and it is used to test the capability of the model to explain the variability of the EFC. To test the overall model or to measure the goodness of fit, the Chi-squared distribution will be used. The use of a Chi-squared test is more appropriate because the F-tests are not suitable for logistic and other binary models because these models consider likelihood or probabilities.

To assess the capacity of the individual variable, we use z-test. To measure the correlation coefficient of the model, Pseudo R^2 is used for logistic regression. Traditional R^2 is only appropriate for the linear regression model. In this study, we follow Morgan and Teachman (1988) and STATA Manual for Logistic Regression written by Long and Freese (2006). The criterion of success in the traditional R^2 estimation is the degree to which the error of the variance is minimized while the logistic model uses the criterion of maximum likelihood. Evaluation is also carried out to assess the ability of the model to classify the result.

HYPOTHESIS

The null hypothesis is tested by uing the following formula. Ho = $\beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = \beta_7 = \beta_8 = \beta_9 = 0$. The alternative hypothesis is Ha = *at* least one of the coefficients has linear relations with efficiency. The comparison between Chi-squared value and Log-likelihood ratio will determine whether the model is useful or not. When the absolute value of Log-likelihood is larger than the Chi-squared value, we reject Ho and accept Ha. The Chi-square value is derived from the Log likelihood ratio. All previous studies used the t-test, R^2, Chi-Square test and classification results for evaluating the success of logistic model. We teste the normality using a Wilkinson normality test (Stata:1997).

There are two types of variables in this study. The first is the data were derived from individual bank balance sheet and income statement. These data are to measure the individual bank characteristics. The second type is data from economic condition where the bank is operating. Data were collected from the Bankscope Database for bank-specific data and for economic growth and inflation; data are collected from the Asia Regional Information Center (ARIC), Asian Development Bank website. These variables and their definition are presented in Table 2.

For efficiency category, we follow Table 1. It uses data from CIR and the score of the SFA efficiency. The CIR is popular as it does not require various distribution assumptions to calculate as compared to the SFA methodology. For the SFA efficiency, we use a frontier methodology to calculate it. However, for this study, we manage it further by classifying the bank into two groups based on the CIR value and SFA efficiency. We set the cut off at the mean value.

It means banks with CIR and SFA Efficiency more or less the cut-off value (the mean) is classified into the efficiency group (1). The rest of the bank sample will be classified into inefficient group (0). This dummy (1, 0) is then regressed using logistic regression to identify the determinant of the cost efficiency category of ASEAN banking.

The data combine time series and cross sectional known as pooling or panel data. It combines a cross-section observation with a time series dimension. In the modeling, we apply pooled regression. However, the Breuch-Pagan test confirms that pooled regression is not valid. The Hausman test confirms that fixed effect is appropriate method. The observations are strongly balance panel.

We expect the following results. The bank-specific characteristics such as size is positive (+) to efficiency due to economies of scale, capital adequacy CAR is

TABLE 2. Variables, Definition and Sources of Data

No.	Variable	Definition	Sources of Data	Measurement	Hypothesis
1	EFC	CIR, SFA Efficiency, Efficiency Category (1,0)	Bank Level	Score/Dummy	
2	DCRISIS	Dummy Crisis, 2008<=1, 0	Country Level	Percentage	Negative/ Negative
3	ECGR	Economic Growth	Country Level	Percentage	Positive
4	CPI	Consumer price Index / Inflation Rate	Country Level	Percentage	Negative
5	LASSET	Logarithm of Asset Size	Bank Level	Logarithm	Positive
6	LLRGL	Loan Loss Provision / Total Loan	Bank Level	Percentage	Negative
7	NIM	(Interest Income-Interest expenses) / Productive assets	Bank Level	Percentage	Positive
8	CAR	Capital Adequacy Ratio (Equity/RWA)	Bank Level	Percentage	Positive
9	EATA	Earning Assets / Total Assets	Bank Level	Percentage	Positive
10	IRGAP	Interest sensitive Asset/ Interest sensitive Liabilities	Bank Level	Percentage	Positive/ Negative

Note: All data is in the percentage value

positive (+) as higher capital provide cushion against risks, Asset Composition (EATA) is positive (+) as good composition increase earning and reduce cost and loan loss provisions (LLRGL) is negative (–) as it increase cost of managing problem loan. For macroeconomic/ external variables, we expect GDP / Economic Growth is positive (+) to efficiency as bank has less efforts to produce loan when economy is growing. Inflation is expected (CPI) to have negative (–) on efficiency as it increases cost of funds. For interest rate risk (IRGAP, we expect none as it can be positive or negative depending on the market condition. For crisis (Dcrisis), it can be positive or negative depending on the various factors such as monetary policy, open economic condition and government budget. The summary of the hypothesis is presented in Table 2.

RESULTS AND DISCUSSION

In this study, we calculate efficiency using Stochastic Frontier Analysis (SFA), the following inputs are used. LTCT is a_summing up of total expenses and loan loss reserve. LDEPOSIT is total deposits in the bank. LEARNAS is total earning asset that consists of loan and other productive assets such placements. Interbank is total interbank assets. LCAP is the total capital of the bank excluded current profit. All variables are converted into logarithm to fulfill the frontier software requirement. The statistics of the variables are presented in Table 3.

The result of the descriptive statistics is summarized in Table 4. This table explains all variables for this study. The efficiency score based on SFA is 74%, meaning on average bank sample achieves 74% cost efficiency. The highest is Singapore (84%), Malaysia (78%), Indonesia (77%), Thailand (69%) On average, it leaves 26% rooms for improvement. When the efficiency score is converted into the efficiency category, 56% is efficient. It is slightly lower than efficiency category based on accounting efficiency (CIR efficiency) that reached 61%. From the result, we also find that 96% of bank from Malaysia is classified as efficient. The lowest is the Philippines, which only has 24% of the sample as efficient. Indonesia is 51% in efficient group.

Asset size is measured using the log of total assets. Total asset is in the US dollar denomination. We find that

TABLE 3. Statistics of SFA Input Variables

No	Variable	Obs	Mean	Std. Dev.	Min	Max
1	LTC	352	13.11	10.48	10.39	15.64
2	LDEPOSIT	352	16.15	10.74	13.69	18.83
3	LEARNAS	352	16.20	10.64	14.01	19.10
4	LINTERBANK	352	12.97	1.93	3.07	17.02
5	LCAP	352	13.95	1.06	9.96	16.79

Note: Data is in logarithm

TABLE 4. Descriptive Statistics (In Percentage)

No.	Variable	N	Mean	SD	Min	Max	Normality
	Dependent						
1	CIR	352	54	18	29.8	268	Not
2	SFA	352	74	11	16	100	Not
3	CIR-Dummy	352	61	49	0	100	-
4	SFA-Dummy	352	56	50	0	100	-
	Independent						
1	LASSET	352	16.35	10.80	14.20	19.18	Not
2	DCRISIS	352	0.50	0.49	0.00	1.00	-
3	IRGAP	352	106.92	30.98	31.56	317.56	Not
4	EGRW	352	4.98	2.70	-2.33	14.47	Not
5	CPI	352	142.76	35.63	102.80	239.35	Not
6	NIM	352	3.95	1.60	0.67	11.04	Not
7	CAR	352	16.12	4.07	1.48	37.40	Not
8	EATA	352	86.04	63.54	58.26	99.52	Not
9	LLRGL	352	4.92	3.39	0.06	23.85	Not

Note: Bank Specific data is from Bankscope, Economic Data is from Asian Development Bank (ADB)

the mean value is 16.35 (USD 23.2 million) and the data is not normally distributed. Interest rate gap (IRGAP) has a mean value of 107 meaning that ASEAN banking in average is very conservative in taking the interest rate's position. However, if we look at individual bank, we find that the range is almost 270%, meaning there is a bank that ta excessive risk. The data are not normally distributed. Net interest rate margin (NIM) is a measure of profitability. The mean value is 3,95%, meaning on average the margin is 4%. The distribution is relatively low (35%) meaning that the margin is relatively close to 4%. The minimum NIM is 0.67% and the maximum is 11%. The data are not normally distributed.

For capital variable, we use the capital adequacy ratio (CAR). It is basically regulatory capital imposed by regulators. According to international rule, at least the CAR must not be lower than 8%. The mean for CAR is 16%. We noticed that the variability is very low as it is regulatory imposed. The minimum data is 1.5%, ning this bank is categorized as problem bank. The data are not normally distributed.

Asset composition of the bank is measured using earning asset to total asset (EATA). Earning assets compose of loan, securities and other placement such as interbank lending. A higher ratio is better as it reflects that most of the assets are productive. The mean value is 86%, meaning non-earning asset is less than 15%. New business model of banks makes the fixed asset holding become less usual as banks prefer to rent from other companies. The lowest is 58% and the highest is 99%. Data is not normally distributed. For the loan quality of the banks, we use loan loss reserve. Ideally, we should use non-performing loan (NPL) as it can indicate the quality of the asset. However, the data on the NPL is not available. Even if it is available, the treatment of past due loan among jurisdiction is also no similarity. On average the provisions are 5% of loans. The highest is 24%. Data is not normally distributed.

For macroeconomic variable, we use economic growth (EGRW) and an inflation rate (CPI). The highest CPI is Indonesia means that on average, consumer price index in Indonesia is the highest. The Philippines is the second highest. The lowest is Singapore. CPI is an indicator of economic s ility. For economic growth, the mean value is 5%. We find that the Indonesia, on average, the highest in term of economic growth during the period. Again, the Philippines is the second highest in term of the inflation rate. Basically, there are two nations with high economic growth and inflation rate and the other side is low inflation and lower economic growth.

Table 5 reports four regressio utputs. For efficiency based on CIR efficiency, the Chi-Squared 51.88 and significant at 1% with R-Squared 28.36 It means the model can explain 28% of the variabili in CIR Efficiency. For SFA Efficiency, we find that Chi-Squared is 213 and nificant at 1%. The R-Squared is 68.63% implies the ability of the model to explain 69% of the variability of the SFA Efficiency. However, the heteroscedasticity is persistent when it is estimated using pooled regression. As consequences, these efficiency models were estimated using panel regression with fixed effect. We convert efficiency scores into the efficiency category, the CIR efficiency dummy and SFA efficiency dummy. For logistic regression, for CIR dummy model, we get Chi-Squared 24.76 and significant at 1%. The Chi-Bar statistics is 84.96 and significant 1%. The log likelihood is –115.39. For SFA efficiency dummy model, we get Chi-squared is 11.10 but not significant. Log likelihood is –42.13. In general, we can conclude that all four models are eligible for further use. The result is presented in Table 5.

For variable asset size (LASSET), we find that the coefficient is -4.62 for Model 1 meaning that any percentage increase in the size of the asset, the bank will be 5 percent more efficient. With t-value (z statistic)

TABLE 5. The Determinants for Bank Efficiency

Variable	Model 1 Panel Regression CIR Level	Model 2 Panel Regression SFA Level	Model 3 Logistic Regression CIR Category	Model 4 Logistic Regression SFA Category
LASSET	-4.62***	-2.26***	2.25***	-2.45**
DCRISIS	.511	1.79**	.494	-.421
IRGAP	5.1	-1.19	-.468	3.88
EGRW	-.674*	-.075	.111	.119
CPI	.045*	.023	-.0395**	-.00045
NIM	-.632	-1.27***	1.08**	.236
CAR	-.957***	.381***	.107	.0717
EATA	.267	-.123**	.018	-.345*
LLRGL	.904**	-2.93***	-.133	-6.26**
Constant	110***	132***	-37.3**	91.6**
Insig			2.31***	2.19*

Note: indicate significance at * p<.05; ** p<.01; *** p<.001

–3.86, the asset is significant at 1%, meaning that size is matter for bank efficiency. For Model 2, the size is negative and significant meaning the big bank tends to be economically less efficient. For model 3, the result shows that big banks tend to have higher probability to be in the efficient group. In contrast, Model 4 shows that size reduce the probability to be efficient. The finding is in contrast to previous studies such as Wheelock and Wilson (2009) for the US banking produce the positive result. According to Berger and Mester (1997), larger banks have shown a slightly higher efficiency than smaller ones when cost efficiency is considered. The finding is also in line with economics theory that stated the economies of scale benefited from the size effect are always significant in economic studies. Berger and Hannan (1998) found similar conclusion. However, negative impact of size on economic efficiency (Model 2) is in line to Wong and Deng (2016) that apply similar methodology on ASEAN banking. This result supports Tahir et al. (2012) that size is negative to the economic efficiency.

We include the Global Financial Crisis/GFC (DCRISIS) in our modeling. Recent studies on banking efficiency include the GFC to see the impact of global financial crisis. It may not be very relevant to ASEAN economy, except Singapore, on the impact of global financial crisis as ASEAN is not in the center of the crisis. However, countries like Singapore and Malaysia in which their economy relies on export, any disruption in the global economy will impact the economy as whole. The Dummy for crisis is positive and significant only when the efficiency is estimated using SFA (Model 2). The result indicating the GFC is positive to the ASEAN banking firms as it makes allocate the resources better. The GFC is significant at 5%.

The explanation is quite straight forward. During a global crisis, the global fund managers avoid the US and Euro area to invest their funds. The cheap money entered the emerging economy and the ASEAN is part of the emerging economy. Cheap funds help the ASEAN banking to tap cheap fund and at the same time they can use the fund to finance their lending at regular price. The excess liquidity in the global market is also the result of the US government program to buy tacit assets of the US banks known as TARP. There are about USD 18 trillion for the TARP program. The result opposites to Ovi, Perera and Colombage (2014) who study market power of ASEAN banking that conclude that the global financial crisis (GFC) has a negative impact on credit risk and revenue diversification among big banks. Spulbăr and Niţoi (2014) study bank cost efficiency in eastern and south Europe by applying economic efficiency estimated using SFA. They found that the financial crisis (GFC) has significantly deteriorated efficiency of the banking systems of the transition countries. It is not the case for ASEAN Banking.

Bank efficiency also relates to managerial characterized such as lower risk appetite and the expectations of profitability. Further, it is also related to innovation in pricing deposits. However, ASEAN banking business model is at the traditional deposit-taking and loan-making stage and it remains the most efficient activity of the banks. Interest rate gap (IRGAP) is positive but not significant for Model 1. It means higher interest rate risk reduces efficiency. In addition, other models are not significant either. In general, ASEAN banking is very conservative in managing interest rate as it is less harmful than liquidity risk. In general ASEAN banking holds more interest rate sensitive asset (IRSA) than interest rate sensitive liabilities (IRSL). On average, there is around 1.06 meaning IRSA is 6% higher than IRSL. It is very low risk. This figure means when the interest rate decrease banks will have a negative impact on their margin. Unfortunately, the central bank policy in ASEAN, during the study, lower interest rate to respond the global financial crisis. The impact is banks incur higher interest expenses and at the same time earn less. This makes the accounting cost efficiency decrease.

We expect that macroeconomic variables such as economic growth and inflation are significant to efficiency. Our finding shows that economic growth (EGRW) is negative and significant for Model 1 (CIR Level) indicating a positive impact of economic growth on accounting efficiency. Further, the results for Model 2 is negative for SFA efficiency models but not significant. The rests are not significant either. Please note CIR is an inefficiency measure that implies higher ratio is worse than lower one. The result, however, provides the explanation that when the economy is growing, bank will be able to do business much easier than when the economy is on the recession. This is very rational as during the expansive time, business is expanding that means demand for loan will increase. In the economy with bank based financial system, the role of banking is more significant than the capital market. However, from economic efficiency perspectives, the situation is different. Model 2 shows that economic growth is negative to efficiency. It is in line to a recent study by Spulbar and Nitoi (2014) shown a higher Gross Domestic Product growth rate (GDP) is negative to cost efficiency. When economy is growing, resources allocation is less controlled and it can increase inefficiency.

For the inflation rate (CPI), the result is positive and significant at 10% in the Model 1 (CIR efficiency level). It is in line with the expectation that increase the CPI increase inefficiency. For Model 2, the CPI is not significant. Model 3, the coefficient is negative and significant at 5%. It means when a bank operating in the high inflation country, any one point increase on CPI, there will be 4% increase in the probability to be in inefficient group. The results confirm that banks should consider the inflation rate trend in managing their business as it is related to more interest rates risk than operating efficiency. Inflation is also important for cost of banking operation. A bank operating in the high inflation rate pays high interest expenses as the cost of borrowing is in the nominal term. When the inflation rate is high, for the

central bank, the only policy available is by increasing the discount rate policy. As inflation is unfavorable economic condition, Yildirim and Philippatos (2006) indicate that it affects the demand of banking service and increase the cost.

The impact of interest rate policy is that the deposit rate increases, it also implies the cost of banking operation also increase. At the same time, banks tend to be cautious to increase interest on loan as it can fire banks back when the increased rate causes lowering credit quality. The net impact of higher inflation is lowering the efficiency. For Model 1 and Model 2, CPI is not significant.

A bank that can maintain the net interest margin (NIM) should be more efficient. In another way, banks that have the capability to operate efficiently will enjoy higher NIM. Our result shows that NIM is negative but not significant in Model 1. It means highe M increases the operating efficiency. In contrast, NIM is negative and significant to the effici y base on SFA Level (Model 2). The result indicates that a bank with high M tends to have lower efficiency due to "quite life" hypothesis as introduced by Berger and Hannan (1998). When the efficiency is measured by accounting efficiency (CIR) Dummy, as presented in Model 3, NIM is positive and significant to efficiency. As under accounting efficiency concept, high NIM refer to high interest income, high NIM makes a bank fall to efficient category. For Model 4, NIM is positive but not significant.

The result is as expected when efficiency is accounting efficiency as the ability to maintain the high NIM means banks can maintain the cost of funds and income from lending. That implied the high NIM is positive to efficiency. However, when referring to economic efficiency (Model 2), high NIM creates moral hazard that restrain the management to allocate resources efficiency. Further, high NIM is not a sufficient condition as non interest rate expenses such as personal expenses, loan loss provision and overhead cost is also dominant to change higher NIM into inefficient banks.

For the Capital Adequacy Ratio (CAR), the coefficient is negative for model 1 (CIR Level) indicating owning higher CAR, a ban nds to be more efficient. In Model 2 (SFA Level), the coefficient is positive and significant, indicating the positiv npact of capital strength to the economic efficiency. Model 3 and Model 4 positive but not significant. The result support Tahir, et al. (2012) and Barth, et al. (2013). In contrast, the result contradicts to Mghaieth and Mehdi (2014). The reason is market reputation. Bank with high CAR is highly reputable and it can borrow from the market at lower rates. Pessarossi and Weill (2013) used samples fro hina banking market provide a similar result that capital adequacy is positive and significant for bank efficiency. The result of SFA efficiency (Model 2) supports the CAR as a transformation policy tool to improve accounting as well as economic efficiency. The finding is in line to Olson and Zoubi (2011)

The asset composition is also important for bank efficiency. The impact of the total earning assets to total assets ratio (EATA) is positive but not significant in model 1. It means higher earning asset ratio reduces efficiency as these asset types require higher cost to originate and maintain the quality. In Model 2 (SFA Level), it is negative and significant indicating the possible resource misallocation when bank focuses on income generating assets but neglects cost of doing business. There are two possible explanations for this finding: higher overhead cost or higher problem loan. We suspect that ASEAN banks are changing their business model in which they reduce the ownership of fixed assets to support their business. Model 4, the coefficient is negative and significant. Th esult is consistent. It means a higher ratio reduces bank efficiency. This finding is similar to Beck et al. (2013) on Islamic bank but the ratio is non-loan earning assets. Further, This result is also in line with Ovi et al. (2014) on the impact of revenue diversification.

The coefficient for LLRGL is .904 and significant at 5% for Model 1. It means any increase in LLRG will make the bank inefficient. In Model 2, the LLRG is -2.93 and significant at 1%. It implies a high LLRGL ratio reduce bank efficiency. In model 4, it is negative and significant. In general, LLRGL reduce bank efficiency. It means higher LLR har red the efficiency of the banking firm. There are two impacts of the problem loan on the bank efficiency. The first is when the problem loan increase, the cost of the bank also increases because the bank must provide loan loss provision and other expenses to manage it. At the same time when problem loan increases, the income from the loan diminishes. The total impact is lowering income and increasing cost and lowering bank efficiency.

In relation to the performance of Model 3 and Model 4 in clarifying the category, it is very good as it can correctly classify 75% and 94%. The results mean the misclassification is only 25% and 6%. For the international study, the performance is regarded as very good because efficiency is a very complicated indicator of business as it is a result of various factors that may be immeasurable such as culture and political condition. From the model above, we can conclude that banks should improve their internal management as well as external environment, especially monetary policy that can influence the cost of banking operation.

The second interest of the paper is to investigate whether cost efficiency category is a country specific or not. We estimate the efficiency category (CIR and SFA) with the dummy of the country using linear regression. It provides information, whether the country of origin is matter for bank efficiency. As we have five countries of origins, we then estimate the Efficiency (EFC) with a dummy of Indonesia, Malaysia, Thailand and Singapore, Philippines. We exclude the Philippines in the modeling as it will be the constant. See Table 6 for the results.

TABLE 6. Impact of Country of Origin on Efficiency

No.	Variable	CIR Efficiency (Model 3)	SFA Efficiency (Model 4)
1	Indonesia	-5.2	8.1***
2	Malaysia	-17***	8.7***
3	Thailand	.16	-.22
4	Singapore	-11**	15***
	Constant	81***	69***

Note: Indicate significance at * p<.05; ** p<.01; *** p<.001

The result shows that Likelihood ratios is significant at 1% and pseudo R-Squared is between 15% and 20%, meaning the model concludes the country specific is a problem. As expected, the efficiency category is significant for all countries dummy of origin except for Thailand. The difference is only on the sign. Indonesia is negative 5.5 meaning that on average Indonesia's bank is 55.8%. It is similar to Singapore and Malaysia's banks. Further, the result confirms that banks of these two countries will be efficient as they will be less than 50%. It means, in general, Indonesia, Thailand and the Philippines banking are not efficient. In Malaysia and Singapore, the coefficient is negative, meaning their banks are in efficient group.

When efficiency is measured using SFA efficiency, we find Indonesia, Malaysia and Singapore are more efficient compared to the benchmarked (69, the Philippines). In short, we can conclude that country of origin is a matter for an efficiency ly both in accounting based efficiency and economic efficiency. This finding is in line with Chortareas et al. (2013) for European banking in term of country economic conditions such as economic freedom contribute to the efficiency. Previously, Dietsch & Lozano-Vivas (2000) conclude similarly that environment where the banks operate determine their efficiency score.

CONCLUSION

This study unveiled that efficiency country specific. Efficiency is mostly related to the size of the bank. It supports the significance of the economies of scale theory. This means banks with large-scale opera ns tend to be a cost-efficient bank. Dummy for crisis is positive and significant for economic efficiency, indicating the positive impact of the crisis on bank management. Economic growth improves accounting efficiency. Inflation rate (CPI) is only significant when efficiency is measured ng accounting (CIR). Profitability, as measured using net interest margin (NIM) is negative and significant underlying the negative effect of hi interest margin to create "quiet life" that undermine bank efficiency in the long run. The interest rate margin is also positive to efficiency category. The capital is also important factor for efficiency. Higher capitalized bank tends to more efficient as it can manage the operation better in terms of liquidity and op onal management. Credit risk, as measured by the loan loss reserve ratio, is negative and significant. For economic variables, inflation rate is negative and economic growth is positive and significant. The implication of this research is the ASEAN banks are still less optimal in the size and to have a better efficiency, consolidation is still necessary. As efficiency is country specific, this finding implies that the ASEAN Banking Integration Framework (ABIF) should accommodate the country specific condition to prevent the unequal treatment when setting up ASEAN bank criteria.

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The List of Bank Sample

Number	Bank	Country
1	Bank Mandiri (Persero) Tbk	ID
2	Bank Central Asia	ID
3	Bank Negara Indonesia (Persero) - Bank BNI	ID
4	PT Bank CIMB Niaga Tbk	ID
5	Bank Danamon Indonesia Tbk	ID
6	Bank Pan Indonesia Tbk PT-Panin Bank	ID
7	Bank Permata Tbk	ID
8	Bank Internasional Indonesia Tbk	ID
9	Bank Tabungan Negara (Persero)	ID
10	Bank Mega TBK	ID
11	Malayan Banking Berhad - Maybank	MY
12	Public Bank Berhad	MY
13	CIMB Bank Berhad	MY
14	Hong Leong Bank Berhad	MY
15	RHB Bank Berhad	MY
16	AmBank (M) Berhad	MY
17	HSBC Bank Malaysia Berhad	MY
18	United Overseas Bank (Malaysia) Bhd.	MY
19	Standard Chartered Bank Malaysia Berhad	MY
20	Affin Bank	MY
21	Alliance Bank Malaysia Berhad	MY
22	BDO Unibank Inc	PH
23	Metropolitan Bank & Trust Company	PH
24	Bank of The Philippine Islands	PH
25	Rizal Commercial Banking Corp.	PH
26	Philippine National Bank	PH
27	Union Bank of the Philippines	PH
28	China Banking Corporation - Chinabank	PH
29	Security Bank Corporation	PH
30	Allied Banking Corporation	PH
31	Oversea-Chinese Banking Corporation Limited OCBC	SG
32	United Overseas Bank Limited UOB	SG
33	Bank of Singapore Limited	SG
34	Bangkok Bank Public Company Limited	TH
35	Krung Thai Bank Public Company Limited	TH
36	Siam Commercial Bank Public Company Limited	TH
37	Kasikornbank Public Company Limited	TH
38	Bank of Ayudhya Public Company Ltd.	TH
39	Thanachart Capital Public Company Limited	TH
40	TMB Bank Public Company Limited	TH
41	United Overseas Bank (Thai) PCL	TH
42	Tisco Bank Public Company Limited	TH
43	Kiatnakin Bank Public Company Limited	TH
44	CIMB Thai Bank Public Company Limited	TH

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