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Cost Efficiency of the ASEAN Banking Market

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Abstract: Efficiency is an important determinant for sustainability of modern business. The efficiency of the banking market is more governing especially in the developing countries because the role of the banking system is to support national development especially the economic growth. This study is to provide a general level of cost efficiency of the ASEAN banking market. The study applies a parametric methodology known as the Stochastic Frontier Analysis (SFA). In short, the study infer that the cost efficiency of the ASEAN banking is 71%. Further, 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%, Phillippines is 67% and finally Vietnam 69%. The study unveiled that Singapore and Thailand banking markets are on average the most efficient. However, Singapore is the most efficient banking market although the trend is downward.

Key words: Cost efficiency, SFA, ASEAN, bank, Malaysia

INTRODUCTION

Banks are regarded as the most important components of the financial system due to their role in the economy. In the intermediary process, banks have the capability to bridge the different interest between depositors and borrowers in terms of liquidity or time preference of money. Banks are also very important in providing payment services. In the macro perspective level, banks are important sources of financing for economic development.

The importance of banks in the economy makes their position essential to the performance of economic activities. It means how the banks perform will influence and determine all aspects of economic activities in the country. When banks fail in providing services to the economy, the economic players will face difficulties and this will deteriorate all economic sectors. Concern of financial panic caused by bank failure is always a matter of disruption to communities. That is why, knowledge of whether a bank is efficient or not is essential in creating a stable banking system as well as a stable economic condition.

Over the last 10 years, the banking industry in the Association of the Southeast Asian Nations (ASEAN) has become increasingly connected and liberalized in the sense of cross border ownership, acquisition and operation. This progressive process of financial integration such as cross border ownership has enhanced competition. It emphasized the importance of efficiency in all aspects of banking business. The diffussion of innovation in the delivery services such as the Automated Teller Machines (ATM), internet banking, mobile banking and other innovative processes is widely spreading.

The importance of efficiency is related to the impact that an efficient financial system has on of the national competitiveness. The financial sector affects the allocation of financial resources, helping to find an optimum of resources allocation that reducing unnecessary waste. To enhance the contribution, financial institutions such as banks must be efficient too. Efficient banking system also enhance the implementation of the macroeconomic policies and pushing economic growth and welfare.

Problem of research: Efficiency is an important element for sustainability of modern business. This argument is also valid for the banking industry as efficiency is related to various aspects such as management and environment where the banks operate. Berger and DeYoung (1997) mentioned that managerial decision and problem loan interlinked to cost efficiency of banking firm. The sources of efficiency is complicated and it is summarised by Berger and Mester (1997) as within a black box. Fries and Taci (2005) reiterated the role political regime on bank efficiency. Further, efficiency can indicate the weakness of management quality and be an early signal of bank failure. A study by Podpeira and Podpeira conclude that bank cost inefficiency is an early warning of the bank problem. By applying a cost efficiency measure in the Cox proportional hazards model they conclude that cost efficiency can serve for an early warning tool to identify the managerial problems in commercial banks.

The banking system is essential part for financial development. For example in Indonesia, the banking system provides 85% of total financing and 81% in the Philippines (De Gregorio and Guidotti, 1995). This situation implied that an efficient banking system will help to provide cheaper credit and services to boost national income and wealth. It also encourages depositors to make more deposits and helps to speed up the financial deepening of the country. Faster process of capital deepening is regarded as a necessary condition for stable economic progress.

However, efficiency is still a big issue in Asian banking especially in Southeast Asia. Quoteding from Mohanty and Turner (2010):

> "...the high cost nature of Asia's banking system. The operating costs of banks in many Asian economies are not only high but have also tended to rise in recent years. For instance, operating costs were 3-5% of total assets in Indonesia, the Philippines and Thailand in 2007 substantially higher than more developed financial centres, both within the region (around 1% in Singapore and Hong Kong) and outside"

In short, the problem of the research can be formulated as what is the universal point of cost efficiency of the ASEAN banking market?

Empirical works: The pioneer of the application of SFA on bank efficiency study in ASEAN is Tahir. The study, discuss on the issue of efficiency and competition in banking, its relationship between market structure and bank performance of individual banks in five ASEAN countries (Malaysia, Singapore, Thailand, Indonesia and the Philippines) over 1991-1995 period.

Karim (2001) investigated bank efficiency in five countries member of the ASEAN. The finding shows the ASEAN banking is on the stage of increasing returns to scale production process. The optimum scale is up to USD 3 billion lower thereafter. On the cost efficiency, the Thai banks being the most efficient then followed by the Singaporean banks, the Malaysia banks, the Indonesia banks and finally the Philippine banks.

Rezvanian and Mehdian (2002) apply a multi product approach to investigate the cost and production efficiency of the commercial banks in Singapore. The linear programming results inefficiency score is 43%. This figure indicates that the Singaporean banks in the sample could have reduced costs by 43% had they all been operating at full efficiency.

Dacanay (2007) examines the Philippines banking from 1992-2004 to their calculate the profit and cost efficiency. How the liberalization, Asian financial crisis and mergers impacted to the banking industry efficiency. The study found that profit efficiency slowly lower from 92% in 1992 to just only 84% in 2004. For the cost efficiency are around 89-88% from 1992-1998. The Asian crisis is significant as efficiency reduced by 1%.

Shen *et al.* (2009) found that the cost efficiency of the Asian banking is 59% with a negative trend in the midst of positive technical progress and improvement of the economies of scale. In short, efficiency scores of the banking firms from India, Singapore, Malaysia and Hong Kong SAR are having the most efficient banking system in Asia.

According to Margono *et al.* (2010), the cost efficiency of the Indonesian banking is 79.7% before crisis and reduced to only 53.4% after the crisis. From technological, banking industry enjoy benefits in term of cost reduction by 2.98% and jump by 6.40% after crisis.

MATERIALS AND METHODS

The study applies a parametric method to calculate the efficiency score. It known as the Stochastic Frontier Analysis (SFA). According to Ferrier and Lovell (1990), the stochastic approach can estimate the inefficiency score as introduced by Coelli *et al.* (1998) and Aigner *et al.* (1977). Battese and Coelli (1995) introduced panel data for technical inefficiency using the SFA. The cost function model follows (Coelli, 1996; Molyneux *et al.*, 1996) and is presented as:

$$TC = TC(Q_i, P_i) + \varepsilon_i \quad (1)$$

Where:
TC = Real total cost
Q_i = Vector of outputs
P_i = Input price vector

In the SFA cost efficiency model:

$$Y_i = x_i\beta + (V_i + U_i) \quad (2)$$

Where:
Y_i = Logarithm of the total cost of production of the ith firm
x_i = k×1 vector of input prices and output of the ith firm
β = Vector of unknown parameters

Referring to Molyneux *et al.* (1996), the study assumes that the error of the cost function is:

$$e = V_i + U_i \quad (3)$$

Where:
V_i = Random variables which are assumed to be independent and identically distributed (iid) $N(0, \sigma_V^2)$
U_i = Non-negative random variables which are assumed to account for the cost of inefficiency

Table 1: The total expenses, total output, prices

Variables	Definition	Mean	SD	Min.	Max.
LTC	Log total cost	11.52	1.75	7.39	15.48
lq1	Log total loans	13.72	1.91	8.05	18.29
lq2	Log other earning assets	13.16	1.87	8.45	18.07
lp1 (r)	Log price of funds	-3.19	0.59	-5.25	-0.93
lp3 (w)	Log price of other expenses	-4.51	0.65	-7.91	-2.86

Inputs for estimation model

These V_i and U_i variables are assumed to be iid $|N(0, \sigma_U^2)|$. In non-technical word, the v is error and u is inefficiency. That means v as error is normally distributed and u as efficiency score is distributed as half-normal or one-sided positive disturbance. In this study, the cobb-douglas cost of production frontier is estimated using the following approach:

$$\ln(C_i/W_i) = \beta_0 + \beta_1 \ln(Q_i) + \beta_2 \ln(R_i/W_i) + (V_i + U_i) \quad (4)$$

Where:

C_i, Q_i, R_i and W_i = Cost, output, capital price and labour price, respectively

V_i and U_i = Assumed normal and half-normally distributed, respectively

Three approaches are employed; Model I SFA is assuming efficiency that follows normal-half normal distribution. Model II SFA is assuming the efficiency that follows normal-exponential distribution. Model III SFA Panel Time Invarian that efficiency distribution follows truncated distribution). We, then compares the results to select the best one.

Input and output of the cost function: In this study, the intermediation approach is adopted. The reason is ASEAN banking market is relatively simple in operation. Their main business is mostly lending and deposit taking. Under this treatment, the outputs are specified as total loans (Q1) and other earning assets (Q2).

To estimate the efficiency score, the SFA requires inputs and output specification. This study also includes input prices; interest, labor and other price for physical capital. However, while the bank-level data includes interest rate expenses, personnel expenses and other overheads (other operating expenses), not all banks in the sample publish the data on depreciation. To simplify, the study follows by Coelli (1996) that applies the ratio of total other expenses to total fixed assets to a proxy measure for fixed asset input. The inputs for the model is presented in Table 1.

RESULTS AND DISCUSSION

The study applies three SFA Models to estimate the cost efficiency frontier and are estimated using maximum likelihood techniques. The Model I shows parameter estimates of the translog (transformation logarithmic) function where efficiency follows a half-normal distribution. In the Model II, efficiency is assumed to follow an exponential normal distribution. The Model III estimates the cost efficiency using a panel model that follow truncated-normal distribution.

Table 2: Empirical results of the cost efficiency (SFA)

Variables	Model I (normal)	Model II (exponential)	Model III (panel)
LLOAN	0.65163460***	0.66925288***	0.6124612***
LOEA	0.42801835***	0.41569451***	0.3385052***
LRW	0.53204978***	0.59125839***	0.4549716***

***Significant at 1%; estimation results

Underlying assumption of the study is that all banks have same production structure. There are 1356 bank observations for 2003-2012 from Brunei, Cambodia, Laos, Myanmar, Indonesia, Malaysia, Singapore, Thailand, Philippines and Vietnam. Table 2 exhibit presents the SFA Models for estimating the cost efficiency for 1356 banks from ten countries for the period of 2003-2012. The model is similar to Coelli (1996).

From Table 2, the parameter estimates of output quantities (loan and other earning assets) and input price are all positive and significantly different from zero across all specifications. Referring to the cost function rule that output and price must be positive, the results show both price and output are positive and significant. This suggests that the cost function is theoretically a valid cost function.

The test is done to see the robustness of the models. Table 3 and 4 show that the LLR is 25.55 for Model I SFA half-normal model, 59.05 for Model II SFA Exponential Model and 12.44 for Model III SFA panel time invariant model. To test if the model is statistically different from zero, likelihood statistics is used. Likelihood is a measure of how likely an event is. The Logarithmic values of the likelihood function (LLR) is a criterion of statistical properties of an econometric model estimated through the maximum likelihood technique. The likelihood-ratio test uses Chi-bar distribution. The Likelihood-Ratio (LR) test compares whether an estimated variance component is different from zero or not.

Under Chi-squared distribution table and assuming 1% significance, df (2), the Chi-squared table is 37.57. From Table 3, it can be seen that Wald-Chi is -661, -755.14 and -275.29 for Model I, Model II and Model III, respectively. The result rejects the null hypothesis meaning at least one coefficient is different from zero. The Chi2 is 1866928 for Model I SFA assuming normal distribution, 2328023 for the Model II SFA assuming exponential distribution and 9951 for Model III SFA panel time variant decay model. Comparing the Log likelihood value with the Chi-square table (df = 21%) = 10.6, all

Table 3: Model fit comparison using SFA

Distribution	Model I (normal/half-normal)	Model II (normal/exponential)	Model III (panel truncated)
Observations	1356	1356	1356
Log likelihood	-661.04	-755.14	-257.29
Chi-squared	1866928.1	2328023.3	15680.3
Prob.>Chi2	0.0000	0.0000	0.0000
AIC	1332.0796	1520.285	564.59968
Likelihood-ratio test	Chibar2 (01) = 0.0	Chibar2 (01) = 190.23	Chibar2 (01) = 1.4
of sigma_u = 0	Prob.≥Chibar2 = 1.000	Prob.≥Chibar2 = 0.000	Prob.≥Chibar2 = 1.000
Convergence	Yes	Yes	No

Table 4: Summary of efficiency scores from SFA Model

Countries	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Total
BN (Brunei)	0.641	0.699	0.694	0.650	0.538	0.489	0.519	0.527	0.457	NA	0.5790
ID (Indonesia)	0.658	0.710	0.685	0.666	0.700	0.688	0.693	0.714	0.742	0.763	0.7040
KH (Cambodia)	0.605	0.661	0.557	0.633	0.670	0.577	0.522	0.567	0.647	0.726	0.6000
LA (Laos)	0.477	0.592	0.767	0.775	0.492	0.536	0.623	0.729	0.694	0.639	0.6170
MM (Myanmar)	NA	0.038	0.711	0.739	0.629	0.386	0.370	0.350	0.627	NA	0.4810
MY (Malaysia)	0.618	0.618	0.603	0.458	0.404	0.466	0.598	0.639	0.697	0.787	0.6300
PH (Philippines)	0.644	0.658	0.626	0.623	0.681	0.694	0.693	0.679	0.696	0.731	0.6740
SG (Singapore)	0.919	0.842	0.808	0.719	0.724	0.705	0.816	0.821	0.777	0.816	0.7950
TH (Thailand)	0.734	0.758	0.749	0.708	0.741	0.797	0.813	0.845	0.857	0.860	0.7860
VN (Vietnam)	0.729	0.688	0.713	0.725	0.759	0.603	0.732	0.707	0.629	0.632	0.6880
Total	0.676	0.696	0.686	0.669	0.693	0.662	0.701	0.713	0.717	0.753	0.7099

model are significant. This means that the efficiency effect (u) is not zero. From this perspective it can be concluded that Model II is eligible to be used as the cost efficiency estimator for ASEAN banking under investigation.

This study also tests the efficiency effect in the error. To do this test, the study compares likelihood-ratio by using F-bar test. It is an adaptation of the traditional F-test for ANOVA. This approach is proposed by Silvapulle *et al.* (2002) and embedded in the STATA Software. The generalized log likelihood test is done by comparing inefficiency term (μ) with the OLS (ordinary least square) residuals. When $\mu = 0$ and $\sigma = 0$, the SFA is a Linear Regression Model with normally distributed errors. Coelli *et al.* (2005) noted that the presence of an ineficiency term would negatively skew the residuals from an OLS regression. The results show that Chi-bar p-value for Model I and Model III are 100%. The p-values for Model II is 0.001. The results confirm that Model II is viable and eligible for efficiency score.

The other assessment is consistency to economic theory. Referring to Table 3, all models shows that prices (lrw) and output (lqi) are consistent with economic theory because all have positive coefficients. In every cost or production model, price and output are not allowed to be negative. If the model produces a negative coefficient it cannot be used for further study. It is because, under economics principles, price and output are never negative.

Next is to prove whether each variable can influence the total cost. To do this, it needs to compare the coefficient estimate of the total loans (q1), the other productive assets (q2) and prices (p) for three models. For Model II SFA exponential, the coefficient for the total loan (lq1) is 0.652. It means, on average, a 1% increase in the amount of loans will increase costs by about 0.652%. In micro-economics terms, the marginal cost is 65% for loans. For the other productive asset (lq2), the coefficient is 0.42 meaning that any 1% increase on the other productive assets (lq1) will increase 0.42% of total cost. In micro-economics terms, the marginal cost is 42% for other productive assets. When both variables (lq1 and lq2) are compared it can be said that loan origination is more expensive than producing other productive assets.

For the price of inputs, it can be seen that the coefficient is 0.59. This means that any increase of a 1% interest rate will increase the total cost by 0.59%. Please note that price is the ratio between interest and other price. An increase by 1% will increase 0.59% of the total cost.

Efficiency scores of ASEAN banking: Table 4 presents the efficiency score estimated using Model II SFA. To simplify the efficiency scores, We converts inefficiency score to get scores between 1 and 0. The most efficient will have unity meaning 100% efficient. When the score is zero, denotes 0% efficient. This study applies a formula which divide 1 (theoretically efficient) with efficiency score from Model II. The results are summarized in Table 4.

Figure 1 presents the efficiency score from Model II. The mean for cost efficiency is 71%3 or inefficiency is around 29%. It means, there is a 29% opportunity for improvement. The standard deviation is 20% meaning that the efficiency score standard deviation is around 20% of the mean value 71% indicating the degree of variability. The minimum efficiency score is 1% and the maximum efficiency score is 99%. The data is not normally distributed as the Jarque-Bera statistics is 4388.

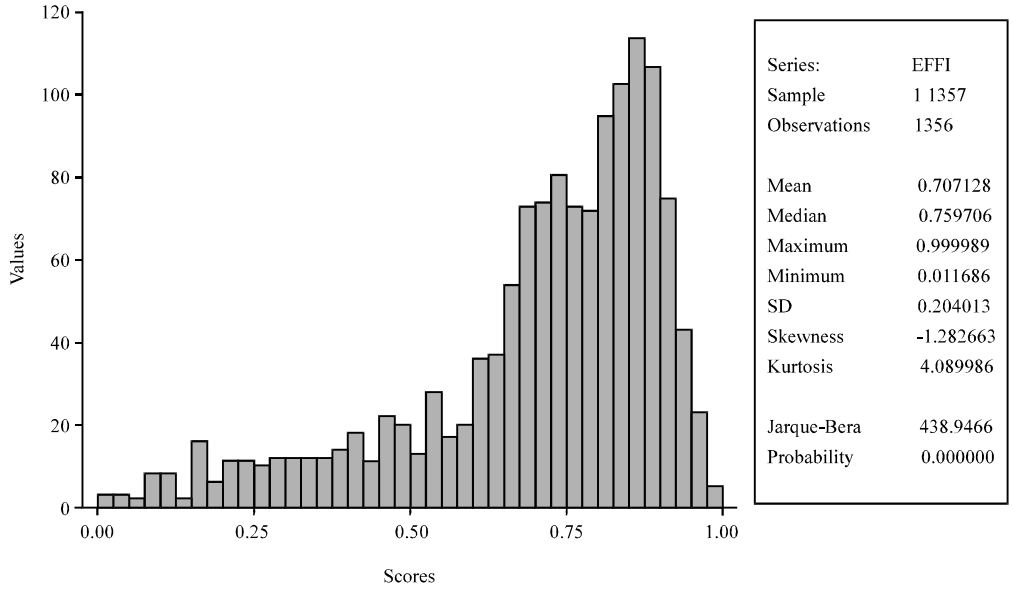

Fig. 1: Description and distribution of efficiency

From Table 4, we see that in 2003, the most efficient banking system is Singapore where the efficiency scores are 92%. The least efficient is Laos that only achieves 48%. The efficiency score for Malaysia is 61% and Indonesia is 66%. On average, the efficiency score for 2003 is 67.6%. There is no observation from Myanmar in this year. In 2004, the average efficiency is 70%. Singapore is still the most efficient banking market where the average efficiency score is 92%. The second most efficient banking markets is Thailand. The least efficient is Myanmar.

In 2005, Singapore is still the most efficient banking market as the average efficiency score is 81%. Thailand and Vietnam are still the second most efficient banks. In 2006, the most efficient banking is still Singapore with an efficiency score of 90%. Thaialnd and Vietnam are still the second most efficient although the score tends to decrease. In 2007, average efficiency is 70%. A significant change on the efficiency score happened when Thailand supersede Singapore's position as the most efficient banking system. Vietnam is the second and Singapore is third. Malaysia is the least efficient. In 2007 as the global crisis started hitting developed economies, countries like Singapore were most impacted. In 2008, Singapore became less efficienct than Thailand. Thailand is the most efficient with a score of 80%. Indonesia the third most efficient banking system.

In 2009, Singapore regained its position as the most efficient banking system. The efficiency score also increased compared to previous year. Thailand is the second most efficient banking system. Singapore, Vietnam, Thailand and Indonesia enjoy improvement in their cost efficiency score. In 2010, Thailand supercedes Singapore again and Myanmar is the least efficient banking system. In 2012, Singapore, Thailand and Indonesia are among the most efficient market.

If the efficiency score from 2003 is compared with that of 2012, it can be seen that on average, improvement has been made especially Thailand, Philipines, Malaysia and Indonesia. However, Singapore efficiency scores tend to be worsening. Other nations tend to be stagnant. In general, Thailand, Malaysia and Indonesia are improving their cost efficiency score and their trend is positive. Singapore and Vietneam are in opposite direction and Philipines is no improvement from time to time. Figure 2 depicts the efficiency score.

Further investigation as shown in Table 5 indicates that Brunei banking system is on average 58% and maximum achievement is 69% and a minimum 26%. Indonesian banking in the sample, during the period, can achieve a maximum efficiency score of 96.7% and the minimum is 9%. The efficiency range is 96.5% with coefficient variation of 13%. Cambodia can achieve maximum efficiency score at 88% and minimum 4%. Laos can achieve maximum efficiency score 72% and a minimum 3%. Myanmar banks average efficiency is 48% with maximum efficiency 82%. Malaysian banks can achieve maximum efficiency of 95.7% and minimum efficiency of 59.4%. The average efficiency is 63% and the range is 36.4% with Coefficient Variance (CV) of 6%.

Singapore bank can achieve a maximum efficiency score of 97.2% and the minimum is 0.074%. The efficiency

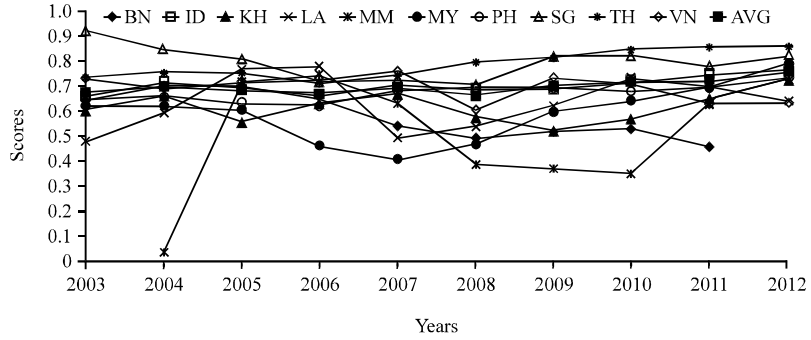

Fig. 2: Plots of efficiency score; SFA efficiency score

Table 5: Descriptives statistics of efficiency scores by country

Country	Mean	Max.	Min.	CV	SD
BN	0.579	0.684	0.257	0.298	0.137
ID	0.704	0.967	0.088	0.175	0.134
KH	0.600	0.879	0.037	0.418	0.194
LA	0.617	0.723	0.024	0.335	0.166
MM	0.481	0.818	0.012	0.614	0.312
MY	0.630	0.950	0.040	0.600	0.282
PH	0.674	0.987	0.049	0.265	0.189
SG	0.795	1.000	0.074	0.421	0.299
TH	0.786	0.972	0.015	0.175	0.143
VN	0.688	0.916	0.117	0.179	0.126
All	0.710	1.000	0.012	0.289	0.204

range is 92.2% with coefficient variation of 42.1%. Thailand bank can achieve maximum efficiency of 97.2% and the minimum is 1.5%. The range is 95.7% with coefficient variation 17.5%. The maximum efficiency score for banks from the Philippines is 98.7% and the minimum score is 4.9%. Range is 93.8% with coefficient variation 26.5%. Maximum efficiency reached by banks from Vietnam is 91.6% and the lowest is 11.7%. The range between the most efficient to the least is 90% and the coefficient variation is only 17.9.%. Laos, Cambodia and Bruneis are among the least efficient. In summary it can be stated that the most efficient bank is from Singapore and the least is from Brunei. The least variability in the bank cost efficiency is Brunei.

CONCLUSION

The study investigate the efficiency level of ASEAN banking market that covers 1356 bank observations from ten countries. It is assumed that the input and output relationship in the banking firm follows the intermediation approach. Three estimation techniques is used to estimate cost efficiency which SFA follows half-normal (Model I), SFA follows normal exponential (Model II) and the SFA panel approach (Model III). Based on the statistical consideration it can be decided that the estimation of the efficiency following normal exponential (Model II) is the best technique for cost efficiency in ASEAN banking market.

The general level of 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%, the Phillippines is 67% and finally Vietnam is around 69%. The study unveiled that the Singapore banking market is on average, the most cost efficient although the trend is on diminishing. Singapore banks' efficiency is deteriorating. The Myanmar banking market is the least cost efficient market. The variability in the efficiency may create a negative impact on the market when the ASEAN single market on banking service is applicable.

IMPLICATIONS

The findings implied that there are severe inequality in the efficiency condition among banking markets. The free market for banking services under ASEAN Single Market may produce two possible impacts. In one situation, it may drive existed local banks out of the market due to losing their market. In other side, it can make local banks more efficient. Looking at the characteristics of banking industry that is mostly capital and knowledge intensive, the first result may be more viable than the later.

RECOMMENDATIONS

It is clear that the cost efficiency level of the banking firm in ASEAN is widespread. The situation can create uneven of the level of playing field when banking market integration takes place in the coming years. The next agenda is to investigate the determinant of the cost efficiency as suggested by Berger and Mester (1997), especially to look at the non financial aspects that is feasible and achievable for improvement. Future studies on banking integration should provide benefits ASEAN economic integration especially on trade on financial services.

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